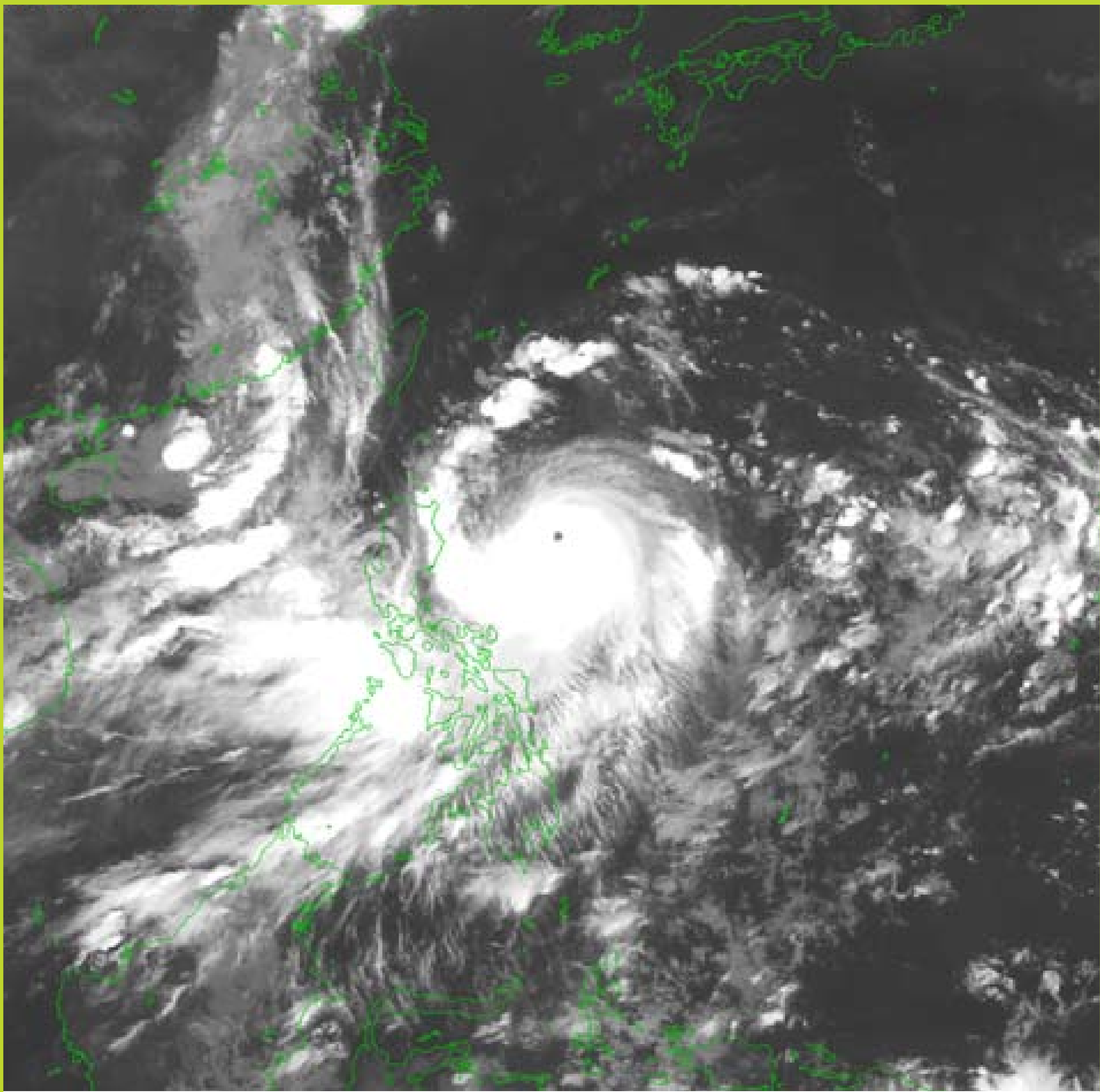
ESCAP/WMO

Typhoon Committee Annual Review



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Toraji
Man-Yi
Usagi
Pabuk
Wutip
Sepat
Fitow
Danas
Nari
Wipha
Francisco
Lekima
Krosa
Haiyan
Podul
Lingling
Kajiki
Faxai
Peipah
Tapah
Mitag
Hagibis

ESCAP/WMO Typhoon Committee

UNITED NATIONS Economic and Social Commission for Asia and the Pacific

World Meteorological Organization

2007

On the Cover:

MTSAT-1R VS imagery of SEPAT (0708) at 00UTC, 16 August 2007.*(By courtesy of Japan Meteorological Agency)*

The headquarters of the Typhoon Committee Secretariat.

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ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (ESCAP)

The Economic and Social Commission for Asia and the Pacific (ESCAP) aims to initiate and participate in measures for concerted action towards the development of Asia and the Pacific, including the social aspects of such development, with a view to raising the level of economic activity and standards of living and maintaining and strengthening the economic relations of countries and territories in the region, both among themselves and with other countries in the world.
The Commission also:

- provides substantive services, secretariats and documentation for the Commission and its subsidiary bodies;
- undertakes studies, investigations and other activities within the Commission's terms of reference;
- provides advisory services to Governments at their request;
- contributes to the planning and organization of programmes of technical cooperation and acts as executing agency for those regional projects decentralized to it.

WORLD METEOROLOGICAL ORGANIZATION (WMO)

The World Meteorological Organization (WMO), a specialized agency of the United Nations, serves:

- to facilitate international cooperation in the establishment of networks of stations and centres to provide meteorological and hydrological services and observations;
- to promote the establishment and maintenance of systems for rapid exchange of meteorological and related information;
- to promote standardization of meteorological and related observations and ensure the uniform publication of observations and statistics;
- to further the application of meteorology to aviation, shipping, water problems, agriculture and other human activities;
- to promote activities in operational hydrology and to further close cooperation between Meteorological and Hydrological Services;
- to encourage research and training in meteorology and, as appropriate, in related fields.

ESCAP/WMO TYPHOON COMMITTEE (TC)

Under the auspices of ESCAP and WMO, the Typhoon Committee was constituted with a view to promoting and coordinating efforts for minimizing tropical cyclone damage in the ESCAP region. The incipient stage of the Typhoon Committee dated back to 1964 when the United Nations Economic Commission for Asia and the Far East (ECAFE)1 at its twentieth session recommended that the Secretariat, in cooperation with WMO, should study the practical means of initiating a joint programme of investigations of tropical cyclones in the ECAFE region. Accordingly, a meeting of the Working Group of Experts on Typhoon was organized by ECAFE and WMO with financial assistance from the United Nations Development Programme (UNDP) in Manila in December 1965. Noting the extensive damage caused by tropical cyclones in the region, the meeting recommended that a Preparatory Mission on Typhoons be organized to visit the countries in the ECAFE region and neighbouring countries affected by tropical cyclones, in order to formulate an action programme to mitigate tropical cyclone damage. It also recommended that a second meeting of experts be convened to examine the report of the Mission.
Consequently, the ECAFE/WMO Preparatory Mission on Typhoons was organized during the period from December 1966 to February 1967, with financial assistance from UNDP. Broadly, the report of the Mission provided recommendations to improve meteorological observing networks, telecommunication facilities, tropical cyclone forecasting and arrangements for warnings. It also described requirements for the improvement or establishment of new pilot flood forecasting and warning systems on a key river basin in each of the countries visited. The establishment of a Regional Typhoon Centre was also dealt with in the report.
The second meeting of the Working Group of Experts on Typhoon was held in Bangkok in October 1967 and the meeting endorsed the report of the Preparatory Mission and reiterated the need for early action to mitigate tropical cyclone damage as a means of speeding economic development in the region. It also re-affirmed that national as well as joint efforts were necessary to combat effectively the detrimental effect of tropical cyclones. Accordingly, the meeting recommended that a Typhoon Committee with a Regional Typhoon Centre as its executive body be established under the auspices of ECAFE in cooperation with WMO; and the ECAFE and WMO secretariats were requested to draft jointly the statute and rules of procedure of the proposed

1 ECAFE was changed to ESCAP (Economic and Social Commission for Asia and the Pacific) in 1974

Typhoon Committee and to convene an ad hoc meeting of government representatives to consider and finalize the drafts.

The ad hoc meeting on the statute of the Typhoon Committee was held in Bangkok from 29 February to 2 March 1968. The meeting, besides finalizing and adopting the statute and rules of procedure of the Typhoon Committee, recommended that the statute of the Typhoon Committee be submitted to the twenty-fourth session of ECAFE and the appropriate body of WMO for consideration. It also recommended that ECAFE and WMO should provide a small staff to undertake the preparatory work required for the implementation of the programme recommended by the Mission.

At its twenty-fourth session in April 1968, ECAFE endorsed the establishment of the Typhoon Committee in accordance with the statute as adopted by the ad hoc meeting. In a parallel action, the WMO Executive Committee, at its twentieth session in 1968, endorsed the establishment of the Typhoon Committee.

The inaugural session of the Typhoon Committee was convened in Bangkok in December 1968.

The functions of the Committee are to:

- review regularly the progress made in the various fields of tropical cyclone damage prevention;
- recommend to the participating Government plans and measures for the improvement of meteorological and hydrological facilities needed for tropical cyclone damage prevention;
- recommend to the participating Government plans and measures for the improvement of community preparedness and disaster prevention;
- promote the establishment of programmes and facilities for training personnel from countries of the region in tropical cyclone forecasting and warning, flood hydrology and control within the region and arrange for training outside the region, as necessary; promote, prepare and submit to participating Governments and other interested organizations plans for coordination of research programmes and activities concerning tropical cyclones;
- consider, upon request, possible sources of financial and technical support for such plans and programmes;
- prepare and submit, at the request and on behalf of the participating Governments, requests for technical, financial and other assistance offered under the UNDP and by other organizations and contributors.

In carrying out these functions, the Typhoon Committee maintains and implements action programmes under the five components, namely meteorology, hydrology, disaster prevention and preparedness, training, and research with contributions and cooperation from its Members and assistance by the UNDP, ESCAP, WMO and other agencies.

The Typhoon Committee is currently composed of 14 Members: Cambodia, China, Democratic People's Republic of Korea (DPRK), Hong Kong-China, Japan, Lao PDR, Macau-China, Malaysia, the Philippines, Republic of Korea, Singapore, Thailand, Viet Nam and the United States of America.

TYPHOON COMMITTEE (2007)

Chairman : **Dr. Fong Soi Kun** (Macao, China)

Typhoon Committee Secretariat

Secretary	:	Mr. Olavo Rasquinho
Meteorologist	:	Mr. Derek Leong
Hydrologist	:	Mr. Liu Jinping
Administrative Staff	:	Ms. Denise Lau
		Ms. Lisa Kou

ESCAP/WMO TYPHOON COMMITTEE ANNUAL REVIEW 2007

Chief Editor

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(Typhoon Committee Secretariat)

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Foreword

The ESCAP/WMO Typhoon Committee has been established for more than four decades and enters its forty-first year of existence jointly sponsored by the United Nations Economic and Social Commission for Asia and Pacific (ESCAP) and the World Meteorological Organization (WMO), and has made excellent progress in various aspects through close co-operation among Members.

The ESCAP/WMO Typhoon Committee Annual Review (TCAR) in its twenty-fourth issue, almost a quarter of a century, is already a legacy publication in the field of meteorology, hydrology, disaster prevention and preparedness, training and research from Members in Asia/Pacific area.

Considering the colossal social and economic impacts of the global warming/climate change, I am therefore very pleased at the work in different Working Groups of the Typhoon Committee which took working on the impacts of the climate change especially in regard to the activity of tropical cyclones and in suggesting appropriate actions.

Macao, China is the smallest Member, in terms of land area and population, among its fourteen Members but is big in aspirations. Since becoming Member in 1992, Macauo, China has worked together with all Members and already hosted three annual sessions in sixteen years of time-span; this shows the absolute will to cooperate with Members of Typhoon Committee to achieve a win-win situation. Furthermore, 13 February 2007 was a remarkable date for Macao, China as it got the confidence of Members of Typhoon Committee to relocate the Secretariat from Manila to Macao and contribute financial support for its operation.

Here, I wish to take the opportunity to place on record on behalf of the ESCAP/WMO Typhoon Committee my appreciation and thanks of the efforts of Macao, China through the years. I would also like to urge Members to forge stronger and closer links in the protection of lives and property.

It has been my great honor to serve as Chairman of the ESCAP/WMO Typhoon Committee for 2007-2008. I wish to extend my sincere appreciation and thanks to all Members for their support and confidence.

On behalf of the Typhoon Committee, I wish to express my sincere thanks to Dr. Olavo Valente Francisco Rasquinho, Secretary of the Typhoon Committee, for the service of the Chief Editor and for undertaking the preparation of the first issue in a format in line with the seven Key Result Areas adopted by Typhoon Committee. Expressions of gratitude are also due to the National Editors for their co-operation in bringing forth an excellent Review.

Dr. Fong Soi Kun
Chairman
Typhoon Committee
(2007-2008)

Introduction

The Typhoon Committee Annual Review (TCAR) has been published since 1985. From 1985 to 1994, the Royal Observatory of Hong Kong provided a chief editor for the preparation and publication of the annual review. In 1995, the Typhoon Committee Secretariat (TCS) took over the task of the publication of TCAR. The Typhoon Committee, in its 39th Session held in Manila, Philippines, from 4 to 9 December 2006, appointed the Typhoon Committee Secretary as the Chief Editor.

Chapter 1 provides an overview of the activities of the Typhoon Committee in 2007. It contains detailed information of its Members' respective national programmes and activities related to meteorology, hydrology, disaster prevention and preparedness, training and research, as well as the achievements of ESCAP and WMO related to water resources management and disaster prevention and preparedness. It also includes the technical and administrative support provided by TCS and its activities undertaken in 2007.

Chapter 2 includes a summary of the **24** tropical cyclones with tropical storm intensity or higher, in 2007. A new method of assigning Asian names to tropical cyclones in the Western North Pacific and South China Sea was implemented on 1 January 2000. Each tropical cyclone is identified by a four-digit code assigned by the Japan Meteorological Agency (JMA). In accordance with the WMO Guide to Marine Meteorological Sciences (WMO-No. 471) and WMO Manual on Marine Meteorological Services (WMO-No. 558), the intensity of a tropical cyclone is classified following the table below.

This chapter also includes the narrative accounts of tropical cyclones in 2007 based on post analyses submitted by Members. Each report includes an account of the movement and intensity change of the tropical cyclone. The extent of damage caused by the tropical cyclone is documented as accurately as possible utilizing available data supplied by the national editors.

Sustained winds as referred to are wind speeds averaged over a period of 10 minutes. The velocity unit of kilometers per hour (kph) is used for wind speed as well as speed of movement of tropical cyclones and other weather systems. The SI unit of hectoPascal (hPa) is used for atmospheric pressure. Reference times used in this Chapter are primarily in Coordinated Universal Time (UTC). Whenever possible, station names and numbers contained in WMO Weather Reporting-Observing Stations (WMO-No. 9, Volume A) are used for geographical references. Composite tracks and satellite images of the tropical cyclones are provided as well. Are also provided 00 UTC Sea Level Synoptic Analysis Charts on the day, a day before and a day after peak intensity was attained and upper air charts referring to the day when maximum strength was reached.

Chapter 3 consists of **8** contributed papers, which were presented at the 40th TC session by ESCAP, Republic of Korea, China, Japan, and Hong Kong. Chapter 4, the final chapter, provides the 2007 activities of the WMO Tropical Cyclone Programme.

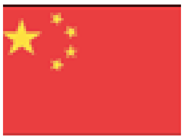
The TCAR has been published through the joint support of ESCAP and WMO. It would have not been made possible without the contributions of the National Editors of Members of the Typhoon Committee.

Special thanks to TCS staff Mr. Leong Kai Hong (Derek), meteorologist, Mr. Liu Jinping, hydrologist and Ms. Denise Lau, senior administrative secretary for assisting in the editorial work and layout.

Chief Editor
November 2007, Macao

CLASSIFICATION	MAXIMUM SUSTAINED WINDS		
	Mps	*Knots*	*Kph*
(a) Tropical Depression	up to 17.2	Up to 34	up to 62
(b) Tropical Storm	17.2 - 24.4	34 – 47	62 – 88
(c) Severe Tropical Storm	24.5 - 32.6	48 – 63	89 – 117
(d) Typhoon	32.7 or more	64 or more	118 or more

1.1 Meteorology



People's Republic of China,

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives

a. Hardware and/or Software Progress

● Satellite Observation System

The new geostationary satellite FY-2D was launched on Dec. 8, 2006. It consists of a twin satellite observation system with FY-2C. The observation coverage of the two satellites expands from 26.5˚E to165˚E and the overlap region is at about 101.5˚. The figure below gives the observation coverage of the FY-2C & FY-2D. During the flooding season of the year, according to the demands for making TCs' analysis, the NSMC switched on the multi-temporal twin satellite observational-mode i.e. producing 96 pictures (once quarter an hour) everyday from the FY-2C and FY-2D satellites. Through the higher temporal resolution satellite data, the characteristic of TCs can be better derived, such as TC occurrences, developments and evolutions. The central meteorological office and each local meteorological bureau along the coastline highly commended the value of the twin satellite data in monitoring and forecasting TCs in the flood-prone season.

FY-1D was launched on May 15, 2002 and it has a 10-Channels radiometer. It is now operating over the designed lifetime and still in a healthy operation, it plays an important role in the typhoon monitoring. Its horizontal resolution at the nadir is 1.1km, and can provide more high space resolution images for typhoon monitoring. This facilitates the study on the fine structure of typhoon cloud, especially the mid and lower level cloud around the typhoon eyes. In the typhoon monitoring in 2007, FY-1D satellite data were used in estimating and precisely locating cloud systems, in making structure analysis, and in modifying the location and strength of typhoons based on the geostationary meteorological satellites. At the same time, other foreign polar orbiting meteorological satellites such as NOAA series (NOAA-16, NOAA-17, NOAA-18) and EOS series TERRA and AQUA of the USA are also used in daily typhoon monitoring,

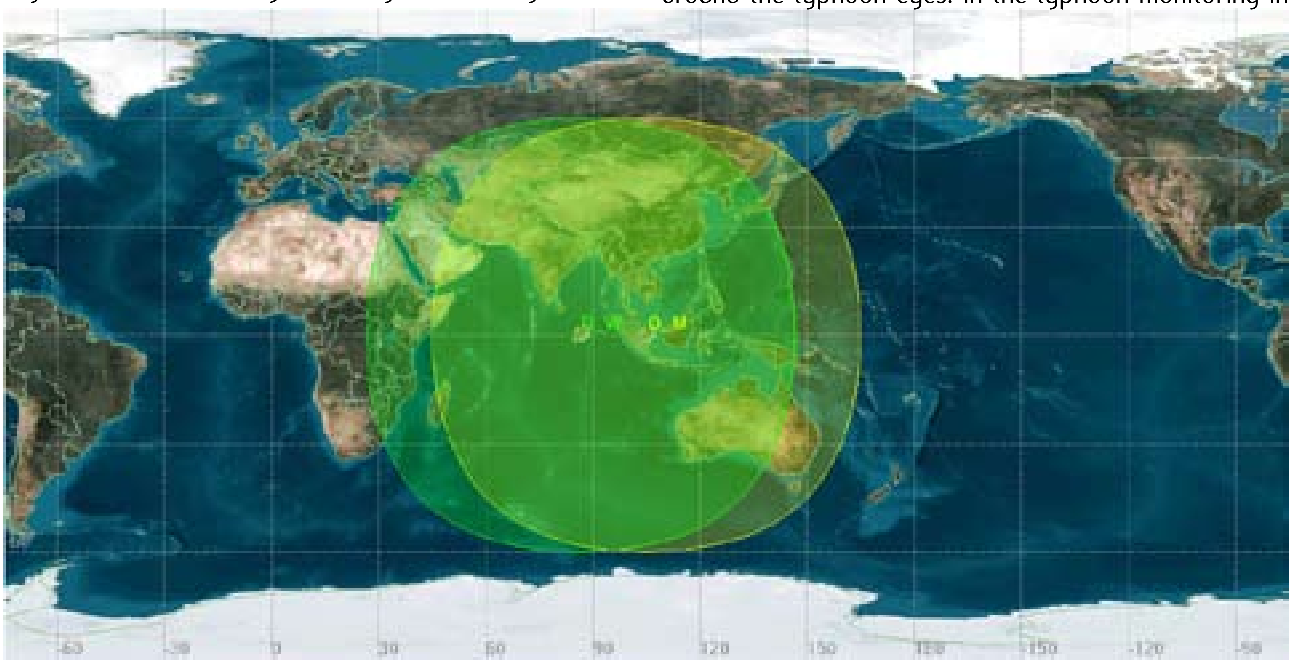


Fig. 2.1 The observation coverage of the FY-2C & FY-2D

such that polar orbital meteorological satellites provide continuous monitoring imagery of typhoons and they

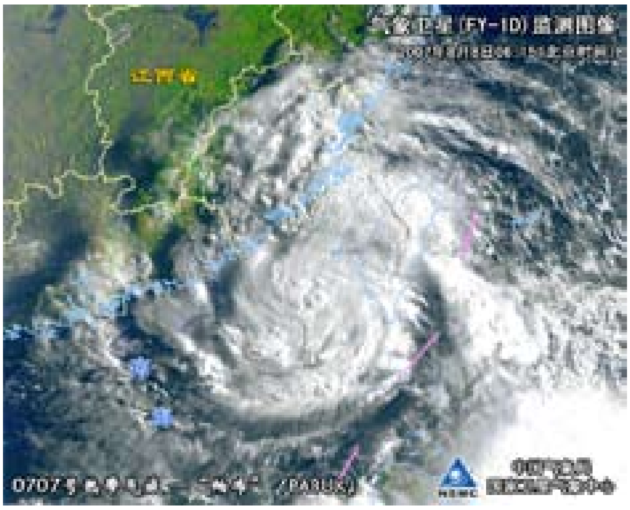


Fig. 2.2 A monitoring image of PABUK taken by FY-1D

become the important supplements to the geostationary meteorological satellites for making typhoon analysis

Up to October 14, 2007, the National Satellite Meteorological Center (NSMC) has monitored and analyzed 19 Tropical Cyclones (TCs) with the meteorological satellites. The tasks not only include TC center locating, strength estimation, track monitoring, structure analysis, but also cover analysis on the distribution of the gale region, the heaviest rainfall area, etc. NSMC releases the real-time results of the TCs' analysis, such as TCs' locations, intensity, tracks, comprehensive analysis reports and multiple relevant data & products on the website. The web site is http://dear.cma.gov.cn.

In 2007, TCs were formed later than other years, but there are many strong TCs influencing China after August. Not only 'Pabuk', 'Wutip','Sepat', but also 'Wipha', 'Lekima' and 'Krosa', binging about serious impacts to the Chinese mainland. NSMC actively attended the emergency services of TCs organized by the China Meteorological Administration (CMA) and carried out 24-hour continuous satellite monitoring and analysis of TCs which were approaching to land and causing potential severe damages. NSMC attended dozens of weather consultation teleconferences focusing on TCs, which were organized by CMA. During these TC weather discussion meetings, NSMC presented satellite TC observations, the atmospheric status from the remote sensing, physical quantity distributions, etc., and it provided advisory opinions about the possible change of the future weather. In the meantime, NSMC put forward 13 satellite monitoring reports on tropical cyclones to provide key satellite features for the decision-making and forecasters. In the TC services of this year, NSMC gave much attention to public serves. Based on the illustrative & vivid satellite data, NSMC produced 3-D satellite cloud imageries, TC cross-section charts, etc. These products are made available to the meteorological TV programs on a regular basis, so as to enable the viewers to better understand the motions and the possible impacts of TCs.

● RADAR Observation System

According to the latest plan, 158 new generation Doppler weather radars -- CINRAD will constitute the China New Generation Doppler Radars Network . 118 CINRAD radars have already deployed in China and used in observing hail rainstorm and typhoon monitoring. It has provided encouraging contribution to the disastrous weather prevention & mitigation in a large number of provinces.

So far, 14 typhoons have affected China, i.e. super typhoons "Sepat", "Wipha", "Krosa", especially the Chinese southeast foreland, causing great impacts.

In Southeast China, the radar at Zhoushan, Zhejiang province, and radars located at Fuzhou ,Xiamen, Jianyang in Fujian province were successfully used to monitor "Sepat", "Wipha", "Krosa" and contributed to accurate forecasts. They have made due contribution to prevention and mitigation of disastrous weather events.

Up to end of this year, about 125 CINRAD radars will be setup in mainland, and 10 or so CINRAD radars will be built in next year.

● Upper air sounding observation

In order to strengthen the monitoring of the super typhoons "Sepat", "Wipha", "Krosa", CMA intensified the upper-air observations during the alert period of the 3 approaching super typhoons .26 upper-air stations of 9 provinces, during the landing period of "Sepat", 40 upper-air stations in13 provinces intensified their observations for "Wipha", 15 upper-air sounding stations in 6 provinces increased their observations for "Krosa".

● Surface Observation

About 2134 AWSs operated by CMA has become operational by now.

The other surface observations include:

- weather radar
- in-situ meteorological observations

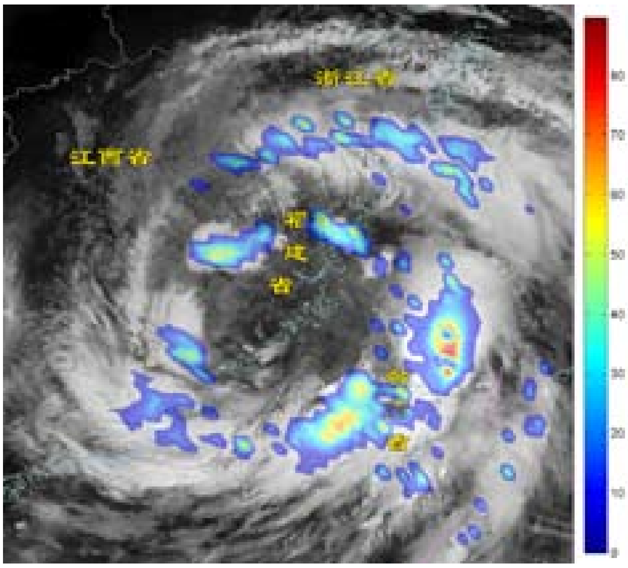


Fig. 2.3 precipitation retrieval products for tropical cyclone

b. Implications to Operational Progress

Based on the monitoring requirements when typhoon is over the ocean, NSMC developed the precipitation retrieval products of tropical cyclones by combining the precipitation from the infrared & microwave channels and provided more precise precipitation estimation over the ocean. In making the landing TC analyses and forecasts in 2007, the satellite precipitation products discovered the distribution pattern of typhoon rainfall and provided the useful information about typhoon-induced heavy rainfall & disasters. This strongly supported TC analysis & forecasting operations and thus made social contributions.

c. Communication with users, other Members, and/or other components

CMA's satellite-based broadcasting system PCVSAT was running in a stable manner in 2007. There was a new remote station, Dhaka PCVSAT reception-only station, installed outside China in the year. Currently, PCVSAT system totally has exceeded 2500 remote stations, and its average daily broadcasting data volume is over 2.8 GB, including surface observations, upper-air observations, aircraft observations, weather radar data & products, satellite data & products, as well as NWP products generated by numerical weather and climate models.

At RTH Beijing, the upgrading for GTS links made good progress in 2007. Beijing-Pyongyang link was upgraded from 75Bauds ASYNC circuit to 64kbps IP link in April, 2007. The GTS links to Offenbach, Tokyo, Moscow and New Delhi was upgraded from FR VPN to MPLS VPN in July, 2007, and the port speed for Beijing side was increased from 256 kbps to 2 Mbps. And, a new link, Beijing-EUMETSAT link, was also established over MPLS VPN in July, 2007 to exchange satellite data, including the observations and products of FY-2C, METEOSAT 7, METEOSAT 9, GOES 11 and 12, between CMA and EUMETSAT on real-time basis.

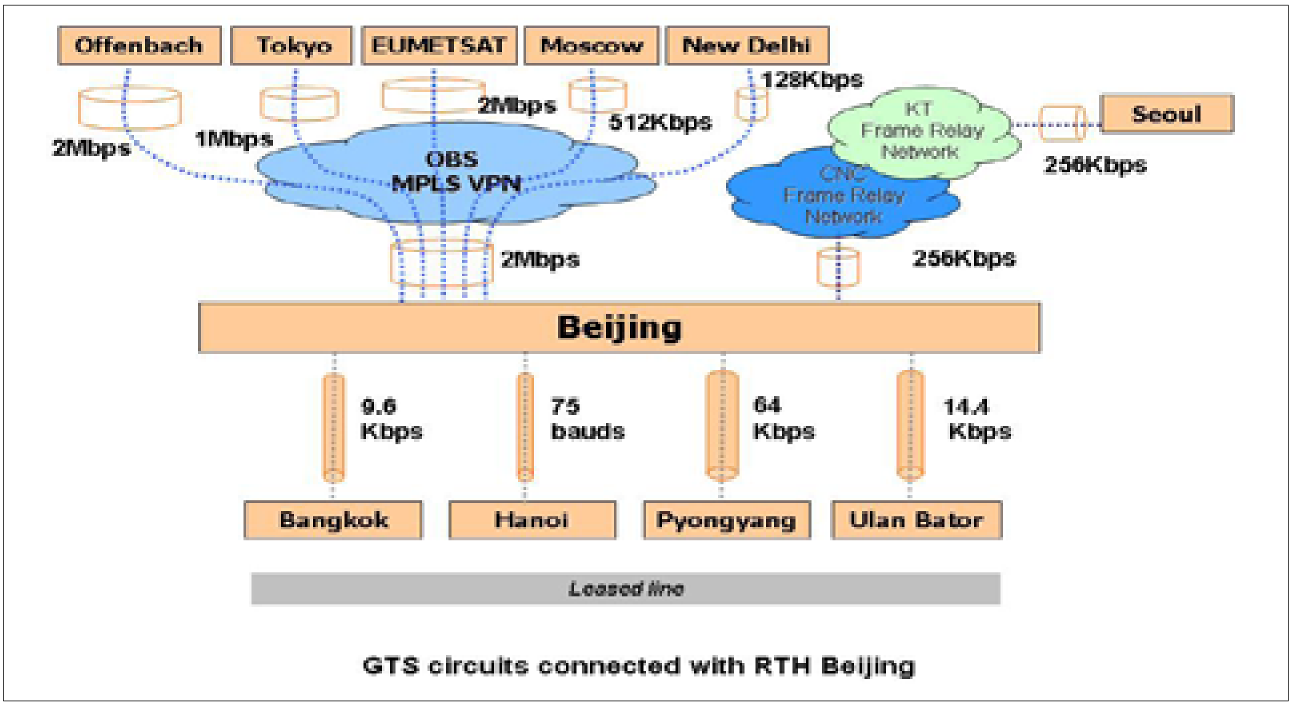


Fig. 2.4 GTS circuits connected with RTH Beijing

CMA's Internet system was built in 1997. Nowadays it has established internet access to two different ISPs, which access internet through firewall with a bi-routing 100M-Bandwidth link. As the network-based platform provides the available meteorological information, the internet system offers WWW, E-mail and DNS services. Meanwhile, internet system also provides network access and data exchange service from the meteorological information service website, such as the official website of CMA (www.cma.gov.cn), international communications systems and for other international meteorological services, e.g. WIS.

d. Training Progress

The education & training infrastructure was improved, like new meeting halls, case study training rooms as well as other training facilities. Distance education & training platforms and the Internet based education training environment were also implemented. The preparation of training materials & course wares were continued, which were used and distributed in the training courses of both residence and distance events through multiple channels.

The typhoon forecast, warning, disaster prevention & mitigation were also applied to the international training seminars in CMA.

e. Research Progress

The researches on tropical cyclone mainly focused on the following aspects in the past year: tropical cyclone structure, intensity and its changes, precipitation mechanism, prediction techniques and tropical cyclone climatic characteristics, etc.

■ TC Structure

More attention was paid on the mesoscale wave activities in typhoon in order to better understand TC structures and their changes. Using the barotropic shallow water equations and baroclinic disturbance equations in the cylindrical coordinates, 2 kinds of vortex Rossby Wave (VRW) in a typhoon are separated. One (barotropic VRW) is generated with the second order radial horizontal shear of tangential base flow or the radial change of vertical vorticity in it. If a second order vertical shear in the tangential base flow is allowed for, the expression could be found for phase speed of second VRW (baroclinic VRW) in a typhoon. If wind speed of the tangential base flow experiences linear shear only, no VRW occurs at all, except the internal inertia gravity wave.

A numerical study shows that the mesoscale waves in typhoon possess the mixed features of inertia gravity waves and vortex Rossby waves. The mesoscale waves show the features of strong convergence, divergence and ageostrophic wind. And the maximum perturbation occurs near the maximum wind radius in typhoon. The formation of polygonal eye wall in typhoon is possibly related to the mesoscale waves.

In addition, based on the f-plane shallow water model, the interaction between the fast inertia gravity wave (FAGW) and balance vortex was studied. Results indicate that the vortex could intensify and the wind distribution of the vortex would become asymmetric when the FAGW is transmitted into the vortex area. However, the vortex would recover after the FAGW leaves.

■ Intensity and Intensity Change

Generally, tropical cyclones will decrease while some of them could intensify greatly when they are approaching to the land. Statistical analysis on the TC in the northern South China Sea from 1960-2002 has been made. It is found that there are 6.7 TCs on annual average and 4.9 of them may experience sudden intensity change. About 3% of the total strengthens abruptly, 72% decreases rapidly and 25% tend to intensify and decay suddenly. Typhoon Saomai (2006) intensified remarkably when it approached to the coastal zone of China. Resent studies indicate that its sudden intensification is closely related to the entrainment of vorticity belt into its circulation from the remnant of typhoon Bopha (2006), which was next to Saomai. In addition, Numerical experiment results showed that the sudden intensification of Saomai also was associated with the sea surface temperature (SST) change, Saomai would increase its minimum sea level pressure by 17hPa if the SST were reduced by 2 degrees Celsius.

Intensification of northwardly typhoons is closely related to its extratropical transition (ET) process. The baroclinic potential energy can be converted into TC kinetic energy due to the interaction between TC and baroclinic systems. This is the way to intensify TC depression during its ET process. Typhoon Winnie 1997 underwent transformation and re-intensification process and caused a large scale heavy rainfall after its landfall. Mesoscale numerical model MM5v3 was used to testify and compare the effects of different troughs on Winnie ET process. The results indicate that ET process is sensitive to the intensity of upper trough, which throws its effects in terms of temperature advection, vorticity advection and upper divergence associated with the upper trough.

The stronger the upper trough is, the faster the TC re-intensifies. Besides, the PV analysis of simulations results show that Winnie ET and re-intensification is related to the interactions of TC circulation with lower layer front and PV downward transportation from upper troposphere.

■ TC precipitation

The mechanism of TC periphery rainfall brought more attention in the past year. Based on intensive surface observation data, remotely sensed data and new-generation Doppler weather radar products, the heavy rainstorm process induced by the inverted trough of typhoon Haitang on July 22, 2005 was studied. The results indicate that the rainstorm is related to interaction between the northwardly inverted trough of typhoon Haitang and weak cold wave. Abundant heat and water vapor are transported by southeasterly jet on the eastern side of the inverted trough. Severe convection likely occurs on its left frontage area.

An analysis was made to investigate the structure features of the extensive heavy rainfall left by typhoon Matsa, after its landfall in mainland China in August 2005, based on a wide range of observational results, including surface intensive observation data, TBB data from China's FY-2 satellite, and NCEP $1°\times1°$ reanalysis data. Results show that Matsa rainbands, extending as far as 2000 km northwardly from the typhoon center, have the features of noticeable wave train distribution and long distance propagation with 500-1000 km in wavelength and 12-24 h in time period. The wave structure of Matsa rainbands is closely associated with the corresponding wave variation of the ambient 3-D atmospheric structures, including disturbance vorticity, divergence field, vertical motion field, water vapor flux divergence field, etc. Moreover, both observational facts and theoretical analysis show that the northward extending typhoon rainbands are associated with the mixed effects of atmospheric inertia wave and internal gravity wave. It's found that only under proper atmospheric stratification and vertical wave number of gravity wave, can a typhoon stimulate such a wave reach such a distance, and lead to extending wavy rainbands.

■ TC forecasting

The technique of ensemble prediction still was a research focus in the past year. Ensemble Kalman Filter (EnKF) data assimilation was applied to tropical cyclone track prediction by using MM5 model. Various parameterization schemes were used to design 9 groups of model configurations, 45-,60- and 75-minute forecasts were conducted for each situation. With the "mirror imaging method", 18 different initial conditions were obtained to provide the initial ensemble numbers. The initial fields were also obtained from different models. For example, using three numerical models, 16 different initial fields were produced. Based on the comparison of the results of numerical experiments on 9 TC cases in 2004, seven cases were selected as initial ensemble members for TC track forecast in the South China Sea or nearby areas. Besides, there were two main sources for estimating uncertainty in Numerical Weather Prediction (NWP), i.e., initial value-related uncertainty and model-related uncertainty. A 20-member mesoscale ensemble forecasting system including these two kinds of uncertainty was identified to simulate tropical cyclone Danny (1997). It was found the ensemble approach was the best compared with all 20 members after 12-h integration time.

In addition, TC intensity forecasting method was studied too. Using genetic algorithm and artificial neural network, an experiment for establishing a forecasting model was implemented to predict TC intensity based on TC data over the South China Sea area in July and August respectively from 1960 to 2001. The method of genetic algorithm combining with artificial neural network was compared with the Climatology and Persistence (CLIPER) method. It was found that the former was better than the latter.

■ TC climatic feature

The climatically characteristics of wind vectors on 100 hPa and 850 hPa level and the relationship between the tropical easterly current on the 100 hPa level and tropical cyclone frequency were analyzed using NCEP/NCAR reanalysis data and the tropical cyclone data from JTWC (Joint Typhoon Warning Center) over the Arabian Sea, the Bay of Bengal and the South China Sea during the period 1958-1998. The result showed a high positive correlation between tropical easterly current and the TC frequency over the Arabian Sea and the Bay of Bengal. However, the TC frequency in the South China Sea was closely related to the intensity change of meridional wind at 100hPa level.

■ An improved cumulus parameterization scheme for typhoon numerical prediction

As cumulus parameterization defines the sub-grid scale convective activities in a numerical model and it is crucial for typhoon numerical prediction. In a study, according to three typical typhoons made landfall at East China in 2006, 15 numerical experiments were implemented with three most popular cumulus parameterization schemes, namely, Kain-Fritsch, Betts-Miller and Grell, to evaluate their performance. It was concluded that Kain-Fritsch scheme was more stable and appreciable in heavy rainfall and track prediction. While admitting its advantages, it was also noted that Kain-Fritsch scheme was necessary to be improved in the case of weak environmental forcing. Particularly, the parameterization of convective parcel's temperature perturbation with environmental vertical velocity in convective triggering function was not so robust, which may be applicable only when the prerequisite of moisture transportation was satisfied. To alleviate this deficiency, spatial temperature anomaly as well as the effect of moisture advection were taken into account in determine convective parcel's temperature perturbation, where the contribution from boundary layer heat and moisture flux was treated explicitly. Contrast with the original scheme, this technique could eliminate the convective instability more effectively for the rainfall simulation.

■ Sheared-Super-Helicity and its application in rainfall prediction

Based on the vertical super-vorticity equation, the conception of Sheared-Super-Helicity is proposed, which means the interaction between vertical wind shear and mesoscale coupled vortex, or in other words, the tussling between vertical wind shear induced horizontal vortex tube and horizontal nonuniform vertical vorticity. Preliminary case studies show that the new idea of Sheared-Super-Helicity is valuable in nowcasting on supercell-induced deep convection and heavy rainfall.

■ Generation and merging of the meso-vortices in a landfall tropical depression

A heavy rain event resulting from the interaction between a landed tropical depression (TD) and its adjacent mesoscale vortices was studied. Generation and merging processes of these mesoscale vortices around the TD were examined through observations and numerical simulations. The large-scale environment was quite favorable for convection to be organized. A diagnosis of the potential vorticity (PV) equation showed strong interaction between the TD and the newly-generated vortices. A newly-generated vortex finally replaced the TD due to horizontal PV advection. The PV advection and diabatic heating terms became primary sources of PV for the mesoscale vortices generation and development of the east. These newly-generated mesoscale vortices moved cyclonically and approached to each other under the effect of the cyclonic circulation associated with the remnants of the TD. Due to PV advection, two vortices finally merged and the weakened TD began to reintensify, which directly causes the heavy rain.

■ Prognostics for quantitative precipitation forecast of landfall typhoon

Through case study of Talim (2005), several parameters were compared on their prognostic capability in rainfall distribution and variation, including vorticity, potential vorticity, helicity, and so on. A synthetic parameter wa proposed, which was found to be better than any single one in diagnosing rain distribution and enhancement with a lead time of 1-5 hours.

■ Vertical wind shear and inner core asymmetric convection of typhoon

Based on a high-resolution numerical simulation of Typhoon Rananim (2004), the shear-induced vortex tilt and storm-relative asymmetric winds were examined to investigate how vertical shear impacted the asymmetric convection in the inner core region. It was found that the inner core vertical shear was non-unidirectional, and induces a non-unidirectional vortex tilt. The distribution of asymmetric convection was inconsistent with the typical downshear-left pattern for considering a deep layer shear. Qualitative agreement was found between the divergence pattern and the storm-relative flow with convergence (divergence) generally connected with asymmetric inflow (outflow) in the eyewall. In conclusion, the collocation between the inflow-induced lower-level convergence in the boundary layer and in the lower troposphere and mid-level divergence led to shallow updrafts in eyewall, while the deep and strong upward motion in the eyewall was in conjunction with the corresponding collocation between the net convergence associated with the strong asymmetric flow in the mid troposphere and the inflow near 400 hPa and the divergence in the outflow layer.

■ Climatic variation of tropical cyclone activity

The interannual, interdecadal and intercential variation of typhoon affecting East China during AD1450 - AD1949 was analyzed and 50-yr trend analyses were performed on the frequency and intensity of typhoons making landfall in China, as well as the precipitation and high winds brought by typhoons to China.

f. Other Cooperative/Strategic Plan Progress

Nil

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee)

a. Hardware and/or Software Progress

◆ IBM HP Computer System

CMA imported IBM CLUSTER 1600 parallel computer system in July 2004. It consists of 376 nodes, 3152 CPUs, 8224GB memory, 8 I/O nodes and 128TB capacity of disks. Its theoretic peak performance can reach 21 TFLOPS, and serves as the platform of running 7*24 short-term climate forecast, ensemble forecast and some other high-resolution regional weather forecast models.

Fig. 2.5 IBM HP Computer System

b. Implications to Operational Progress

CMA is building a new satellite-based broadcasting system, DVB-S system, for replacing the current PCVSAT system. The new system has run in parallel with PCVSAT since April, 2006. It supports the services of priorities-based data broadcasting, which disseminates warning messages and information to users with highest priority, and multimedia program broadcasting. Comparing with the current PCVSAT system, the new system has the main advantages in terms of higher data transmission rates and lower costs for remote stations due to standard DVB technology.

At present, the total broadcasting rate for the new system is 8.5 Mbps, and the daily broadcasting data volume is over 25GB, including the traffic of FY satellite observations and products at 30 minutes intervals. Currently, it has a hub station installed at National Meteorological Information Center and about 350 receiving stations deployed at all provincial centers and city level centers. And its services will be extended to all level stations gradually.

c. Interaction with users, other Members, and/or other components

d. Training Progress

● Training Course on Application of the New-generation Doppler Weather Radar

From October 2006 to September 2007, China Meteorological Administration Training Centre (CMATC) has held 4 training courses on application of the new-generation Doppler weather radar and 2 seminars on application of the subject with about 300 participants. The training mainly included the principles of the new-generation Doppler weather radar, locating the typhoon center with the Radar, estimation of wind intensity, the echo characteristics of the radar in convective weather and the cases studies, estimation of typhoon precipitation as well as warnings of the severe convective weather related to typhoon spiral rain band, etc.

● Training Course on Application of Meteorological Satellite Data

From January 6 to 16, 2007, CMATC held one training course on application of meteorological satellite data with 86 participants. The main training content covered the basic principles of meteorological satellites and satellite imagery interpretation, making weather forecast with satellite data, the production and application of SST data, the production and application of TOVS data, location and intensity estimation of Typhoon with satellite images, the interaction of typhoon and the mid-latitude weather system, methods of estimating precipitation with satellite data, analysis and application of water vapor images, etc.

◆ Advanced Training Course for Senior Forecasters

From October to December, 2006, CMATC held one Advanced Training Course for Senior Forecasters, 37 forecasters took part in the training. They studied the radar detection and warning of severe convective weather, analysis of satellite image, estimation of typhoon precipitation, forecasts of torrential rains and severe convective weather systems, calculation of severe convection parameters, forecast of tropical cyclones, the small systems of torrential rains and severe convective weather, the echo characteristics of the Radar in convective weather and the case studies, etc.

● Training Course for Fresh Forecasters

From September to December, 2006, CMATC held a Training Course for Fresh Forecasters with 38 participants. The training contents included locating the center of Typhoon by use of Radar echo and satellite image, estimating the intensity of winds, analysis of satellite image, estimating typhoon precipitation, the interaction of typhoon and the mid-latitude weather system, forecasting torrential rains and severe convective weather, forecasting tropical cyclones, the small systems of torrential rains and severe convective weather, the echo characteristics of the radar in convective weather and case studies, etc.

● The Training Course on Typhoon Forecasting Techniques

From August 11 to 15, Shanghai Typhoon Institute held a Training Course on Typhoon Forecasting Techniques for army meteorologists. More than 10 army meteorologists attended this training course. The training included the forecast of typhoon track and intensity, typhoon climate and short-range climate prediction, typhoon numerical forecast, typhoon data, marine meteorology, typhoon monitoring and forecasting techniques, the landfall process of typhoon, etc.

● The Training Course in Typhoon Season

On July 23, 2007, China Southern Airlines Shantou Company held one training course focusing on the typhoon season. Engineers of Shantou Air Control Agency and Weather Stations illustrated the typhoon weather features and track changing situations and other related themes such as the safety precautions against typhoon. Participants of the training are staffs of the Airlines.

e. Research Progress

● An improved vortex initialization scheme for GRAPES-TCM

The original vortex relocation technique of GRAPES-TCM encounters difficulty in the case of strong storm prediction for the deficiency in upgrading the intensity of the initial vortex. An improved vortex initialization scheme was proposed for picking up the TC vortex from the prediction at a previous time, which represents better the observed one in terms of intensity, scale and asymmetry. This vortex was then assimilated into the model with 3-DVAR to ensure the harmony between vortex and environmental field. Integrations for typhoons making landfall on East China in 2006 showed positive performance as compared to the old vortex initialization technique.

● An improved BDA scheme for STI-TCM

Treated in Shanghai Typhoon Numerical Model symmetrically, the structure of bogus vortex in BDA may be quite different with the real situation in some occasions. Thus a new bogus vortex scheme was designed to improve the depiction of the initial vortex. In this new scheme, a model constrained vortex from model integration was used to replace the original statistical vortex defined by symmetric sea level pressure. While performing the new scheme, the NCAR-AFWA method, which proved to be more efficient than its counterpart in GFDL model in keeping consistency among vortex variables, was used to pick up the original vortex from the background field. Case study on typhoon numbered 0701 showed the improvement of the new scheme, by which the average track prediction errors were 120 km/24h, 161 km/48h and 148 km/60h respectively, better than the original BDA scheme with 160 km/24h, 213 km/48h and 212km/60h. This study also showed the particular role of asymmetric vortex in typhoon initialization.

● Operational experiments on bogus vortex and satellite data assimilation

Operational experiments on vortex initialization were conducted with satellite-derived and bogus vortex data and 3DVAR technique based on the understanding of the observational error of Satellite-derived wind, QuikSCAT sea wind and AMSU-retrieved temperature. Statistics on a number of simulations identified particular effects of various types of datasets. Experiment for typhoons making landfall on East China in 2006 showed the benefit of joint assimilation of satellite datasets and bogus vortex, as compared with that of BDA.

- **An ensemble prediction system for typhoon tracks**

An ensemble prediction system was set up for typhoon track prediction based on GRAPES-TCM model. 21 prediction members constituted the system. Each of the members had a horizontal resolution of 0.5 degree, in which the Breeding Method was employed for initial perturbation. In addition, vortex relocation and bogus vortex were also implemented during the quasi-operational experiments. Presently, 0-72h prediction on typhoon track's probability was made twice a day on 00UTC and 12 UTC.

- **Evaluation on the performance of typhoon numerical model in QPF**

The performance of GRAPES-TCM in Quantitative Precipitation Forecast (QPF) was evaluated for cases making landfall on East China in 2006. The results were also compared with those of Shanghai Regional Numerical Prediction Model and TRaP (Tropical Rainfall Potential Technique). It showed that GRAPES-TCM could represent generally well the coverage of rainfall and outperformed the other two methods, due mainly to the consistency between the vortex structure and environmental field with the updated relocation technique.

- **An updated model output statistical tropical cyclone intensity prediction scheme for the western North Pacific**

An updated model output statistical tropical cyclone intensity prediction scheme for the western North Pacific (MSTIP) was developed based on samples stronger than 17.2m/s from 1996 to 2002. All the samples were divided into 3 sub-groups according to the initial position: the region near the coast of East China (ECR), the South China Sea region (SCR), and the far ocean region (FOR). Regression equations were developed respectively for each region, with major predictors different for different regions. 5 versions of MSTIP were developed using different operational model output. Independent test and operational experiment in 2006 showed that the version based on T213 model operating at National Meteorological Center and the one based on GFS had positive skills.

- **An updated consensus scheme for tropical cyclone track forecast**

The consensus scheme for typhoon track prediction was updated by replacing 3 statistical sub-methods with 3 numerical prediction models, Shanghai Typhoon model, GRAPES-TCM, and the Typhoon model operating at National Meteorological Center. The forecast leading time was extended from 48 hour to 72 hour. Mean errors of the updated scheme for 2006 were 74.8, 116.9, 158.9, 208.3, 239.1, and 311km for 12, 24, 36, 48, 60, and 72 h forecast, respectively. It was put into operation in May 2007.

Operational system

No changes in the operational system

Research and development on TC track prediction

1) A new vortex initialization scheme was developed and used in the new experimental TC track prediction system based on the SSI data assimilation system. The mean track errors are greatly reduced. The differences between the operational system and the new TC track prediction system are as table 1.

Table 1. The difference between the operational system and the experimental system

	Dada assimilation	Vortex initialization
Operation TC System	OI	BOGUS vortex
New TC System	SSI	New vortex scheme

The results from the operational system and the new experimental system for 2007 are shown as figure 1.

2) The TC track numerical ensemble prediction system was developed and put into real time running in July 2007
The TC track numerical ensemble prediction system was developed based on the global medium range numerical ensemble prediction system and the BOGUS vortex technique used in the operation TC track prediction system in 2006 and put into real time run in 2007. The ensemble tracks and the strike probability (shown as figure 2 and figure 3) are provided to the forecasting office in NMC.

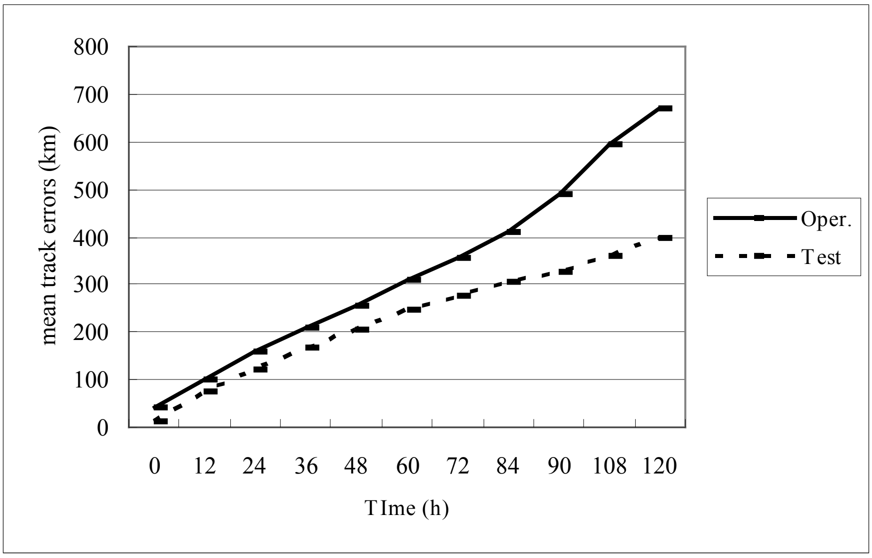
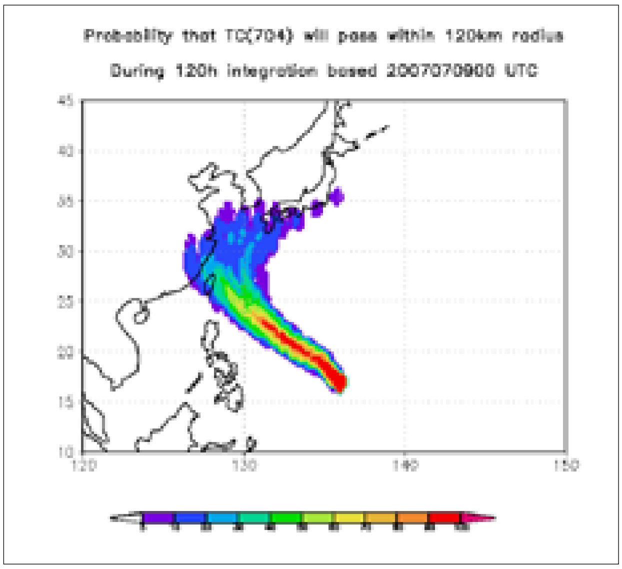


Fig. 1 mean track errors from the operation system and the experimental system for 2007



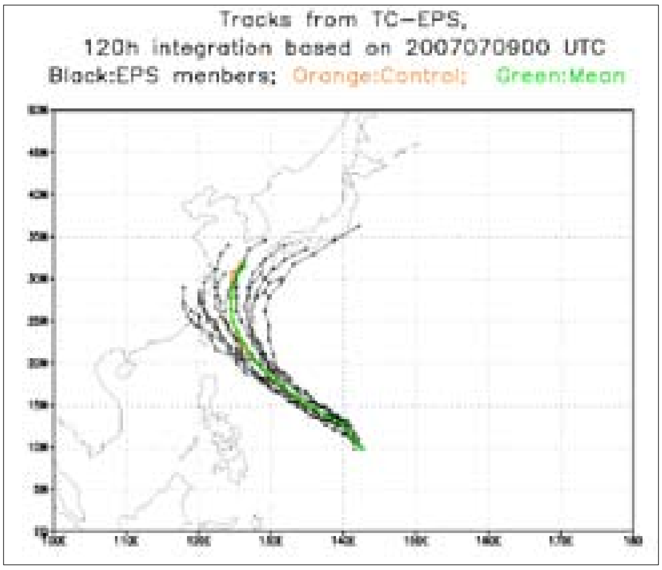


Fig. 2 Ensemble tracks from the TC track EPS

Fig. 3 Strike probability with 120h

◆ Field experiments for landfall typhoon

Special field experiments were conducted with two landfall typhoons, Sepat (2007) and Wipha (2007), by using GPS sonde, mobile wind profiler, sonic anemometer/thermometer, and AWSs. Real time data were provided consecutively to weather forecast centers during each experiment. The collected data were processed and analyzed.

f. Other Cooperative/Strategic Plan Progress

Nil.

3. Opportunities for Further Enhancement of Regional Cooperation

Nil.

In Hong Kong

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives

a. Hardware and/or Software Progress

Nil.

b. Implications to Operational Progress

Nil.

c. Interaction with users, other Members, and/or other components

The WMO RA II Pilot Project on the Provision of City-Specific Numerical Weather Prediction (NWP) Products to Developing Countries via the Internet, approved by the Thirteenth Session of the RA II in 2004, was in good progress. As of 30 September 2007, 18 RA II Members, of which 4 are Typhoon Committee Members, had participated in the project. Currently, three NWP centres from Japan, Republic of Korea and Hong Kong, China had been providing forecast products for a total of 160 cities, including 33 cities of the 4 Typhoon Committee Members. Besides graphical format, forecast products in text format are also available to facilitate post-processing by participants.

Based on the findings of a joint research project between HKO and the Japan Meteorological Agency (JMA) on the utilization and verification of JMA's Ensemble Prediction System (EPS) tropical cyclone track data, a number of forecasting tools were developed and put into operational trials in 2007, including: (i) EPS-based strike probability maps fine-tuned using the latest tropical cyclone fixes (Figure 2); and (ii) ensemble mean of JMA EPS tropical cyclone intensity forecasts calibrated using an artificial neural network (Figure 3).

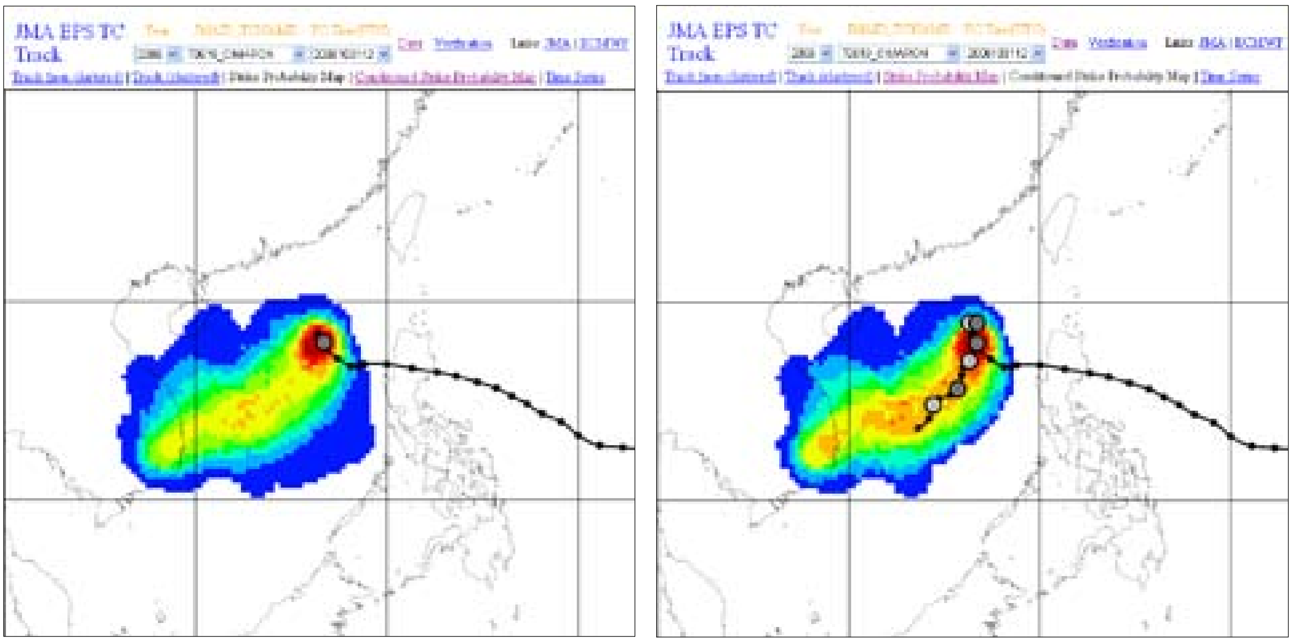
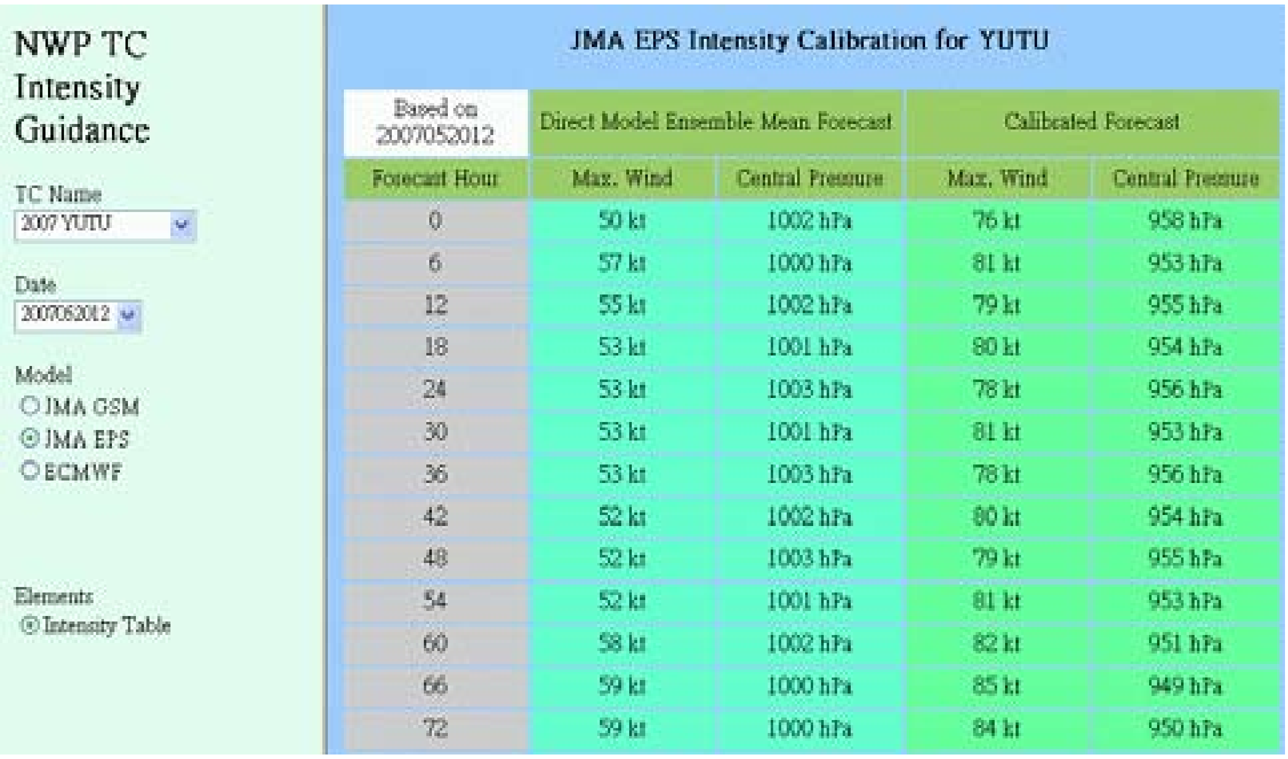


Figure 2 Left panel – the strike probability map of Typhoon Cimaron (0619) derived from JMA EPS data (initial time: 12 UTC, 31 October 2006). Right panel – the same map fine-tuned with the latest fixes. The most probable movement of Cimaron stands out more clearly on the fine-tuned map. The black lines with circles and dots denote the track of Cimaron.



JMA EPS Intensity Calibration for YUTU

Based on 2007052012	Direct Model Ensemble Mean Forecast		Calibrated Forecast	
Forecast Hour	Max. Wind	Central Pressure	Max. Wind	Central Pressure
0	50 kt	1002 hPa	76 kt	958 hPa
6	57 kt	1000 hPa	81 kt	953 hPa
12	55 kt	1002 hPa	79 kt	955 hPa
18	53 kt	1001 hPa	80 kt	954 hPa
24	53 kt	1003 hPa	78 kt	956 hPa
30	53 kt	1001 hPa	81 kt	953 hPa
36	53 kt	1003 hPa	78 kt	956 hPa
42	52 kt	1002 hPa	80 kt	954 hPa
48	52 kt	1003 hPa	79 kt	955 hPa
54	52 kt	1001 hPa	81 kt	953 hPa
60	58 kt	1002 hPa	82 kt	951 hPa
66	59 kt	1000 hPa	85 kt	949 hPa
72	59 kt	1000 hPa	84 kt	950 hPa

Figure 3 . Intensity forecast of Typhoon Yutu (0702) calibrated using an artificial neural network.

Mr. C.Y. Lam, the Director of HKO, and Professor Johnny Chan of the City University of Hong Kong, co-chaired the Sixth WMO International Workshop on Tropical Cyclone (IWTC-VI) convened in San José, Costa Rica in November 2006. Apart from making a number of recommendations on various aspects of tropical cyclones, a consensus statement on tropical cyclones and climate change was formulated and released at the end of the Workshop (http://www.wmo.int/pages/prog/arep/tmrp/documents/iwtc_statement.pdf).

d. Training Progress

Nil.

e.Research Progress

A study on the recent decline of typhoon activities in the South China Sea was carried out and the main results were presented in the International Conference on Climate Change held in Hong Kong in May 2007.

f. Other Cooperative/Strategic Plan Progress

The Expanded Best Track (EBT) data for 2006 in respect of Hong Kong-China was compiled and sent to the Regional Specialized Meteorological Center (RSMC), Tokyo in March 2007.

2. Progress in Member's Important, High-Priority Goals and Objectives

a. Hardware and/or Software Progress

A suite of new tropical cyclone forecasting tools was launched in 2007 to support operational forecast activities:

(i) time-series of strike probability based on European Centre for Medium Range Weather Forecast (ECMWF) and JMA EPS tropical cyclone tracks – strike probabilities for the tropical cyclone centres to be within 120 nm (the conventional distance threshold) and other thresholds varying from 60 to 300 nm are provided;

(ii) probability of strong/gale winds based on ECMWF EPS – derived from climatological probability isopleths for occurrence of strong and gale force winds, coupled with the uncertainties in position and intensity as indicated by EPS members; and

(iii) tropical cyclone intensity forecasts from ECMWF – deterministic and EPS ensemble mean forecasts derived from the full resolution datasets of ECMWF T799 deterministic and T399 EPS models.

To prepare for the cessation of High Resolution Image Data

(HiRID) broadcast from JMA's Multi-functional Transport Satellite-1R (MTSAT-1R) in March 2008, a new ground reception system was installed in early 2007 to receive MTSAT data in both High Rate Information Transmission (HRIT) and Low Rate Information Transmission (LRIT) formats. The new system was put into operation in August 2007 for monitoring the development and movement of tropical cyclones over the western North Pacific and the South China Sea.

An automatic windshear alerting algorithm, using data from the infrared Doppler LIght Detection And Ranging (LIDAR) system, provided windshear alerts to HKO's Windshear and Turbulence Warning System at the Hong Kong International Airport (HKIA) under non-rainy condition, including rain-free areas between the rainbands of tropical cyclones. An additional LIDAR was installed at HKIA in October 2006 as a backup and for enhancing windshear detection over the most used arrival runway. HKO's achievements in windshear alerting services won the championship in the "Specialized Service" category of the Civil Service Outstanding Service Award Scheme 2007 of the Hong Kong Government in September 2007.

A decision-support system comprising the next-generation Meteorological Information Dissemination System (MINDS2), a Meteorological Information Display and Analysis System (MIDAS) and an Integrated Weather Monitoring Panel (IWMP) have been progressively put into operation since early 2007. MINDS2 supports the operations of the forecasting office and provided user-friendly features for the preparation and dissemination of weather forecasts, reports and warnings to the public, relevant government bureaux/departments, and special clients. A workflow engine is incorporated in MINDS2 to provide decision support functions to forecasters during inclement weather conditions. The MIDAS provides an integrated facility for visualizing meteorological data and NWP products while the IWMP monitors the warning status and provides real-time alarms to alert forecasters when pre-set conditions are met.

b. Implications to Operational Progress

Nil.

c. Interaction with Users, other Members, and/or other Components

Nil.

d. Training Progress

Two HKO officers attended the "7th Typhoon Committee Roving Seminar" held in Manila, Philippines on 5 - 8 September 2007. The themes of the seminar were on radar and satellite analysis techniques, as well as interaction of tropical cyclones with monsoon systems.

e. Research Progress

The following tropical cyclone related research projects were undertaken in 2007:

(a) A joint research project between HKO and the Physics Department of the Chinese University of Hong Kong to develop a prediction scheme for tropical cyclone intensity forecast.

(b) Computation of turbulence intensity profiles in the vicinity of the HKIA using LIDAR and mini-SODAR data with applications to tropical cyclone cases.

(c) Large eddy simulation of turbulence intensity at HKIA, including application to a tropical cyclone episode with the largest number of turbulence reports from the pilots at HKIA.

(d) A research project for generating probability maps for severe turbulence over HKIA under the influence of tropical cyclones was carried out.

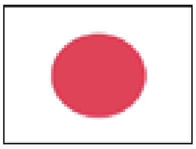
A list of tropical cyclone related reports or papers published during the year is given in Appendix I.

f. Other Co-operative/Strategic Plan Progress

Under the Typhoon Committee Research Fellowship Scheme, Mr. Nguyen Dang-Quang of the Viet Nam National Center for Hydro-Meteorological Forecasting began a two-month attachment to HKO in mid-September 2007 to study the use of ensemble prediction system data in tropical cyclone track forecasting.

3. Opportunities for further Enhancement of Regional Co-operation

Nil.



In Japan

1. Progress in Members' Regional Cooperation and Selected Strategic Plan Goals and Objectives

a. Hardware and/or Software Progress

a.1 Observation

(a) Satellite observation

The Multi-functional Transport Satellite-1R (MTSAT-1R) has been operating in geostationary orbit at 140 degrees East since 28 June 2005, while the Multi-functional Transport Satellite-2 (MTSAT-2), launched on 18 February 2006, has been on standby in orbit at 145 degrees East since 4 September 2006. In the event that MTSAT-1R fails to collect imagery for a certain period, MTSAT-2 will take over the operational role until the former recovers functionality. The meteorological payload of MTSAT-2 will become operational from around 2010, at which point it will succeed MTSAT-1R as the operational satellite.

High Rate Information Transmission (HRIT), High Resolution Imager Data (HiRID, compatible with S-VISSR), Low Rate Information Transmission (LRIT) and WEFAX imagery are disseminated from MTSAT as direct broadcasting services. HiRID and WEFAX dissemination are scheduled for continuation until 12 March 2008 for S-VISSR/WEFAX users in transition to HRIT/LRIT.

The Japan Meteorological Agency (JMA) presents the latest information on the MTSAT series on its website at http://www.jma.go.jp/jma/jma-eng/satellite/index.html.

(b) Surface observation

JMA operates 20 weather radars equipped with processing systems. Half these radars are remotely controlled from the Agency's headquarters, while the others are administered from District Observatories. Various products (such as CAPPIs* at 15 vertical levels, echo tops and composite low-level CAPPIs calibrated with rain gauge data) are provided and disseminated to local observatories via JMA's network.

In March 2007, JMA upgraded two units to Doppler radars, meaning that it currently operates four such radars.

JMA's synoptic observation system consists of about 150 synoptic stations. The current setup enables automated data quality control and housekeeping self-diagnosis. As of the end of 2007, 68 unmanned synoptic stations out of about 150 are equipped with present-weather sensors (visibility sensors) as well as other conventional sensors.

* Products utilizing a Constant Altitude Plane Position Indicator

(c) Upper-air observation

Rawinsonde observations are routinely made at 00 and 12 UTC through 18 upper-air stations, and JMA also makes observations at 06 and 18 UTC if there is a typhoon within 300 km of the Japanese mainland. JMA operates the wind profiler network (WINDAS), which consists of 31 wind profilers and makes upper-wind observation every ten minutes up to a height of six or seven km in summer and three or four km in winter.

(d) Oceanographic observation

JMA performs oceanographic and marine meteorological observation in the seas adjacent to Japan and in the western North Pacific using five research vessels (the Ryofu Maru, Keifu Maru, Kofu Maru, Chofu Maru and Seifu Maru). In 2007, JMA carried out five cruises for marine meteorological observation in the typhoon genesis area of the western North Pacific. During June and July 2007, the Chofu Maru and Seifu Maru took part in a field experiment by JMA's Meteorological Research Institute (MRI) on the Baiu Front to observe the storms associated with this front over the sea west of Kyushu and the Sea of Japan. Observational data from this experiment will be used in the improvement of a high-resolution numerical prediction model.

a.2 Telecommunications circuits

In June 2007, the Beijing-Tokyo and New Delhi-Tokyo GTS circuits were improved from frame relay to MPLS (Multi-protocol Label Switching) technique. The new access line from Tokyo to both circuits is 1 Mbps. In September, the Khabarovsk-Tokyo GTS circuit was also improved from 14.4 kbps (analogue) to 64 kbps (digital).

a.3 Global numerical weather prediction model

(a) Assimilation of WV CSR from MTSAT-1R in the JMA

global 4D-VAR system

On 7 June 2007, JMA began operational use of clear-sky radiances of the water vapor channel (WV CSRs) from MTSAT-1R in its global four-dimensional variational data assimilation system (4D-VAR). WV CSRs are generated by averaging the radiances of cloud-free pixels in 16 x 16 pixel areas (60 km x 60 km at nadir). WV CSRs contain information on middle- and upper-tropospheric humidity.

Several quality control procedures are applied to WV CSR data before assimilation in 4D-VAR. The data are thinned to 2.0 degrees spatially and every one hour temporally. In the procedure, data with a low percentage of clear pixels, a large standard deviation of brightness temperature or a large departure (observation minus first guess) are eliminated. Bias correction is conducted using a variational bias correction scheme in the 4D-VAR system.

Observing System Experiments were carried out to evaluate the impact of WV CSRs on both analysis and forecast quality for August 2006 and January 2007. Assimilation of WV CSRs slightly reduced dry biases of the first guess and analysis with respect to the radiosondes of the mid-troposphere in the Tropics and the Southern Hemisphere. In the boreal summer experiment, the assimilation of WV CSRs also reduced the root mean square errors (RMSEs) of forecasts with respect to analysis for 500 hPa of geopotential height in the Tropics and the Northern Hemisphere. The cold temperature biases at 850 hPa in global areas were also improved, and typhoon track forecast errors were clearly reduced (Figure 1). In the boreal winter experiment, the assimilation reduced the RMSEs for 500 hPa of geopotential height and 850 hPa of zonal wind velocity in the Tropics.

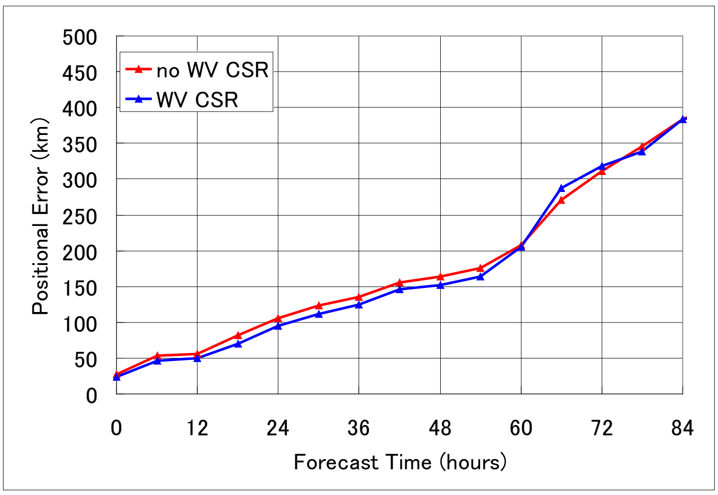


Figure 1: Typhoon track forecast errors of the run with WV CSR (blue line) and without (red line) in August 2006.

(b) Introduction of a new version of the third-generation MRI-III wave model

On 30 May 2007, JMA began operating the new version of the third-generation global wave model (MRI-III). The new model is run with surface winds predicted by JMA's Global Spectral Model (GSM). The resolution of the model is 0.5 degrees x 0.5 degrees in latitude and longitude, with 25 frequencies and 36 directions of wave spectrum component. In this model, a swell dissipation term is newly introduced to improve the representation of swell. The model's predictions show a closer correspondence to actual observations than the previous model (Figure 2), especially in the oceans of the Southern Hemisphere.

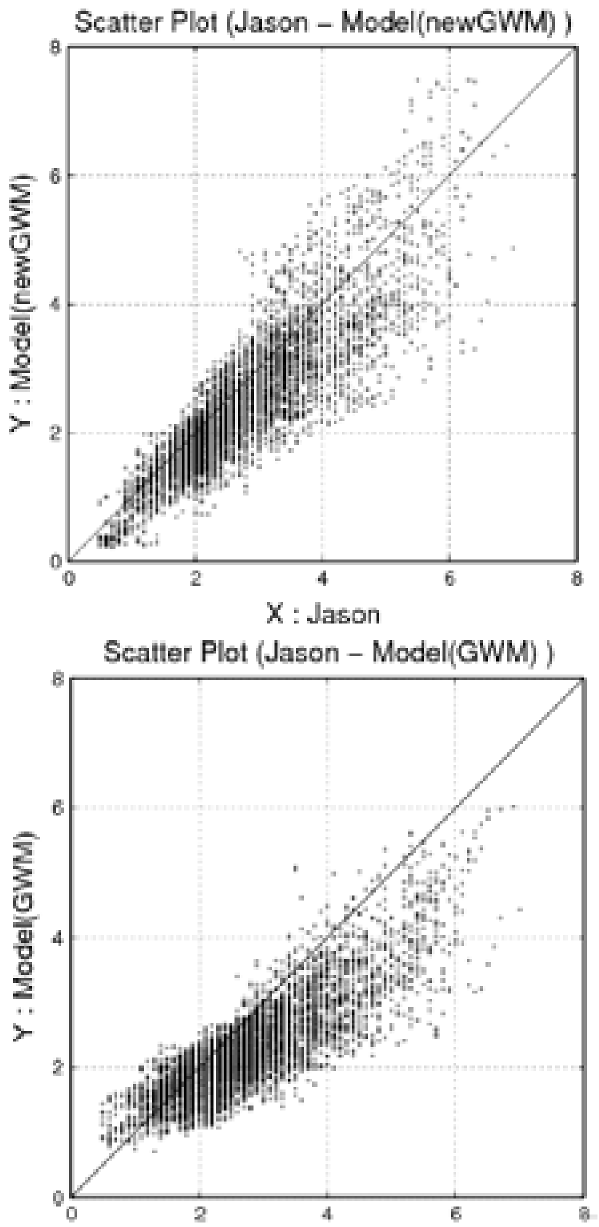


Figure 2: Scatter plots of significant wave height from the global wave model and from observation by Jason-1. The correlation and root mean square error (RMSE) are 0.87 and 0.64 m respectively for the new model (right), while 0.84 and 0.76 m are the values for the previous model (left).

b. Implications for Operational Progress

b.1 RSMC Data Serving System

Since 25 October 2005, JMA has operated a new RSMC Data Serving System (DSS) to stably provide users with higher accessibility to the Agency's products through the Internet.

WMO general file name conventions are applied in the new DSS to facilitate users' identification of the data required. In addition to the data and products provided through the old DSS, high-density atmospheric motion vectors derived from MTSAT-1R images have been available to users through the new DSS since 2 August 2006. The system provides 14 user countries/territories with the data and products shown in Tables 1 and 2 as of October 2007. On 21 November 2007, the system will start providing products of GSMs four times a day.

Table 1 List of GPV Products on the RSMC Data Serving System

Oct 2007

Model	GSM	GSM	GSM
Area and resolution	Whole globe, 1.25° × 1.25°	20°S–60°N, 60°E–160°W 1.25° × 1.25°	Whole globe, 2.5° × 2.5°
Levels and elements	10 hPa: Z, U, V, T 20 hPa: Z, U, V, T 30 hPa: Z, U, V, T 50 hPa: Z, U, V, T 70 hPa: Z, U, V, T 100 hPa: Z, U, V, T 150 hPa: Z, U, V, T 200 hPa: Z, U, V, T, ψ, χ 250 hPa: Z, U, V, T 300 hPa: Z, U, V, T, H, ω 400 hPa: Z, U, V, T, H, ω 500 hPa: Z, U, V, T, H, ω, ζ 600 hPa: Z, U, V, T, H, ω 700 hPa: Z, U, V, T, H, ω 850 hPa: Z, U, V, T, H, ω, ψ, χ 925 hPa: Z, U, V, T, H, ω 1000 hPa: Z, U, V, T, H, ω Surface: P, U, V, T, H, R†	10 hPa: Z, U, V, T 20 hPa: Z, U, V, T 30 hPa: Z, U, V, T 50 hPa: Z, U, V, T 70 hPa: Z, U, V, T 100 hPa: Z, U, V, T 150 hPa: Z, U, V, T 200 hPa: Z§, U§, V§, T§, ψ, χ 250 hPa: Z, U, V, T 300 hPa: Z, U, V, T, D 400 hPa: Z, U, V, T, D 500 hPa: Z§, U§, V§, T§, D§, ζ 700 hPa: Z§, U§, V§, T§, D§, ω 850 hPa: Z§, U§, V§, T§, D§, ω, ψ, χ 925 hPa: Z, U, V, T, D, ω 1000 hPa: Z, U, V, T, D Surface: P¶, U¶, V¶, T¶, D¶, R¶	10 hPa: Z*, U*, V*, T* 20 hPa: Z*, U*, V*, T* 30 hPa: Z°, U°, V°, T° 50 hPa: Z°, U°, V°, T° 70 hPa: Z°, U°, V°, T° 100 hPa: Z°, U°, V°, T° 150 hPa: Z*, U*, V*, T* 200 hPa: Z, U, V, T 250 hPa: Z°, U°, V°, T° 300 hPa: Z, U, V, T, D*‡ 400 hPa: Z*, U*, V*, T*, D*‡ 500 hPa: Z, U, V, T, D*‡ 700 hPa: Z, U, V, T, D 850 hPa: Z, U, V, T, D 1000 hPa: Z, U*, V*, T*, D*‡ Surface: P, U, V, T, D‡, R†
Forecast hours	0–84 every 6 hours and 96–192 every 12 hours † Except analysis	0–84 every 6 hours § additional 96–192 every 24 hours for 12 UTC ¶ 0–192 every 6 hours	0–72 every 24 hours and 96–192 every 24 hours for 12 UTC ° 0–120 for 12 UTC † Except analysis * Analysis only
Initial times	00, 06[1)],12,18[1)] UTC	00, 06[1)],12,18[1)] UTC	00 UTC and 12 UTC ‡ 00 UTC only

Model	GSM	Mid-range EPS
Area and resolution	20°S–60°N, 80°E–200°E 2.5°× 2.5°	Whole globe, 2.5° × 2.5°
Levels and elements	100 hPa: Z, U, V, T 150 hPa: Z, U, V, T 200 hPa: Z, U, V, T 250 hPa: Z, U, V, T 300 hPa: Z, U, V, T 500 hPa: Z, U, V, T, D, ζ 700 hPa: Z, U, V, T, D, ω 850 hPa: Z, U, V, T, D, ω Surface: P, U, V, T, D, R	250 hPa: μU, σU, μV, σV 500 hPa: μZ, σZ 850 hPa: μU, σU, μV, σV, μT, σT 1000 hPa: μZ, σZ Surface: μP, σP
Forecast hours	0–36 every 6 hours, 48, 60 and 72	0–192 every 12 hours
Initial times	00 UTC and 12 UTC	12 UTC

Note: Z: geopotential height U: eastward wind
V: northward wind
T: temperature D: dewpoint depression
H: relative humidity
: vertical velocity : vorticity
: stream function
: velocity potential P: sea level pressure R: rainfall

The prefixes μ and represent the average and standard deviations of ensemble prediction results respectively. The symbols °, *, ¶, §, † and † indicate limitations on the forecast hours or initial time as shown in the notes below.
1) 06 and 18 UTC are to be provided after 21 Nov 2007.

Table 2 List of Other Products and Data on the RSMC Data Serving System

Oct 2007

Data	Satellite wind data	Typhoon information	Wave data	Observational data
Content/ frequency (initial time)	High-density atmospheric motion vectors (BUFR) (a) MTSAT-1R (VIS, IR, WV) VIS: 00 and 06 UTC IR, WV: 00, 06, 12 and 18 UTC (b) METEOSAT-7 (VIS, IR, WV) VIS: every 1.5 hours Between 01:30 and 15:00 UTC IR, WV: every 1.5 hours	Tropical cyclone Related information (BUFR) • tropical cyclone analysis data 00, 06, 12 and 18 UTC	Global Wave Model (GRIB) • significant wave height • prevailing wave period • wave direction Forecast hours: 0–84 every 6 hours (00 UTC) 0–84 every 6 hours and 96–192 every 12 hours (12 UTC)	(a) Surface data (SYNOP, SHIP, BUOY) Mostly four times a day (b) Upper-air data (TEMP, parts A-D) (PILOT, parts A-D) Mostly twice a day

b.2 Provision of satellite imagery data through the Internet

In March 2007, JMA extended its service to provide all HRIT imagery for registered National Meteorological and Hydrological Services (NMHSs) through the Internet as a backup to the direct broadcast. As of 1 November 2007, 21 countries/territories were registered to access the data. JMA also plans to start providing JPEG images over the Internet by the end of 2007.

b.3 Provision of satellite imagery and NWP products as a WIS prototype service

JMA started providing MTSAT imagery and NWP products transformed for display with Satellite Animation and Interactive Diagnosis (SATAID) software as a WMO Information System (WIS) prototype service on 27 March 2007. This software can be used to superimpose NWP products onto satellite imagery. As of 1 November 2007, 13 Members of the WMO (six of whom are TC Members) had applied for the service.

b.4 JMA Ensemble Prediction System Website - EPSWEB

Since June 2006, JMA has operated the Ensemble Prediction System Website (EPSWEB) as a pilot project, with the aim of improving the EPS and increasing the availability of its products to National Meteorological and Hydrological Services (NMHSs). On this website, weather chart guidance (stamp maps), probability guidance (probability maps) and time-series point guidance (EPSgrams) are available. In August 2007, JMA renewed EPSWEB and started providing EPSgrams to WMO Region II (Asia) countries/territories.

b.5 Provision of information under GMDSS

Since 1992, JMA has provided meteorological messages for shipping safety under the framework of the Global Maritime Distress and Safety System (GMDSS). These messages are broadcast via the two independent systems of SafetyNET and NAVTEX. SafetyNET broadcasts messages for ocean regions through Inmarsat-C, while NAVTEX uses MF transmission to cover coastal areas.

SafetyNET

JMA is responsible for the preparation and issuance of meteorological messages for METAREA XI (referred to below as the AREA – see Figure 3) with the cooperation of the Hong Kong Observatory (HKO) and the Australian Bureau of Meteorology (BoM), which cover the South China Sea and the seas south of the equator in the AREA respectively. The messages give warnings and analytical information on disturbances in the AREA, and are issued four times a day for the north of the equator in the AREA and twice a day for the region south of the equator as described in Table 3. When unexpected developments are identified in the disturbances, urgent messages are issued at any of the four scheduled times as necessary.

In addition, JMA issues messages on tropical cyclones for the north of the equator in the AREA when tropical cyclones form in the region. These messages are issued four times a day for individual storms. If a storm is expected to reach (or has developed to) STS intensity, urgent messages are also issued four times a day between routine issuances.

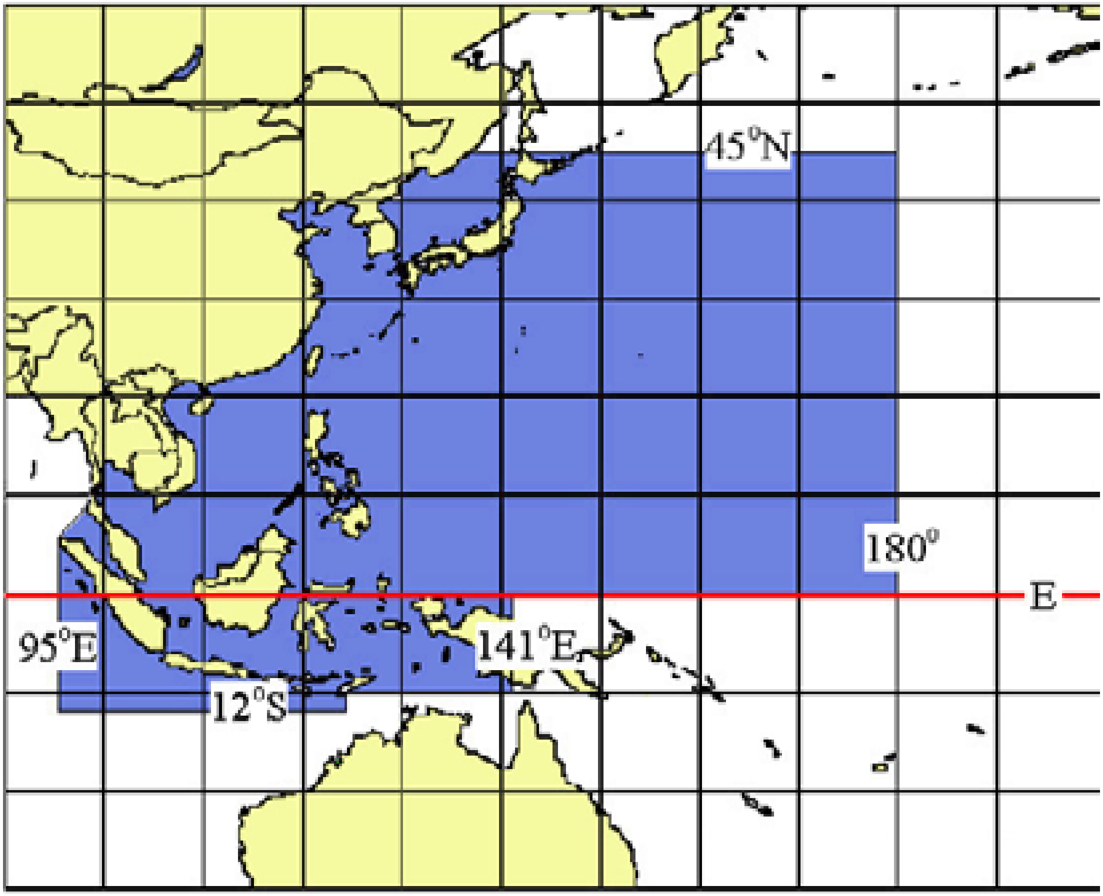


Figure 3 METAREA XI

Table 3 SafetyNET meteorological messages and their issuance schedule

For general disturbances

Type of message	Prepared by	Issuance times (UTC)	Broadcast area
Routine	JMA and HKO	0230, 0830 1430, 2030	North of the equator in METAREA XI
	BoM	0815, 2015	South of the equator in METAREA XI
Urgent	JMA	0530, 1130 1730, 2330	Circular area centered on the disturbance
	HKO	0500, 1100 1700, 2300	South China Sea
	BoM	Four times a day for each disturbance	South of the equator in METAREA XI

For tropical cyclones

Type of message	Prepared by	Issuance times (UTC)	Broadcast area
Routine	JMA	0110*, 0710* 1310*, 1910*	North of the equator in METAREA XI
Urgent	JMA	0410*, 1010* 1610*, 2210*	Circular area centered on the tropical cyclone

Note: *Approximate times

NAVTEX

NAVTEX covers the area within 300 nautical miles of Japan's coastline. The NAVTEX area is divided into 12 regions consisting of 37 sub-regions. Meteorological messages for NAVTEX are prepared by 12 regional JMA forecast centers, and are transmitted as one bulletin at the intervals shown below to the five NAVTEX operation centers via the Japan Coast Guard. The NAVTEX messages provide vital warnings (typhoon, storm and gale), important warnings (near-gale, swell, fog and ice) and forecasts (disturbances affecting the 12 regional areas within 24 hours) as presented in Table 4.

Table 4 Issuance times and intervals of NAVTEX meteorological messages

NAVTEX meteorological message		Issuance interval	Issuance time (UTC) (observation time)
Vital warnings	Typhoon warning	3 hours	0020 (21), 0320 (00) 0620 (03), 0920 (06) 1220 (09), 1520 (12) 1820 (15), 2120 (18)
	Storm warning		
	Gale warning		
Important warnings	Near-gale, swell, fog, ice	6 hours	0320 (00), 0920 (06) 1520 (12), 2120 (18)
	No warning		
Forecasts		12 hours	0045 (21), 1245 (09)

c. Interaction with Users, Other Members and/or Other Components

There are no updates this year.

d. Training Progress

d.1 Seventh Typhoon Committee training seminar

JMA, which is in charge of the Regional Specialized Meteorological Centre for tropical cyclones within the framework of the WMO (through the RSMC Tokyo - Typhoon Center), assists Typhoon Committee (TYC) Members in the improvement of typhoon monitoring through the provision of typhoon analysis/forecast products and the implementation of typhoon analysis/forecast training.

As part of these activities, the Center has conducted an annual TYC Training Seminar at JMA headquarters in agreement with the TYC since 2001. In 2007, the seventh seminar was held from 18 to 27 July with the participation of two female forecasters from Cambodia and the Philippines. In the seminar, they received on-the-job training in typhoon analysis using the SATAID software developed by JMA, and attended lectures on typhoon analysis/forecasting as well as the typhoon-related operations of JMA.

As no tropical cyclone formed for tracking during the seminar, the forecasters tackled the Dvorak analysis using previous satellite images of tropical cyclones including MAN-YI (0704).

Figure 4 Seventh Typhoon Committee training seminar

d.2 Group training course in meteorology

JMA has conducted group training courses in meteorology since 1973, and the course was renewed in 2003. The current training course focuses on the utilization of satellite data including neph-analysis, and the application of numerical weather predictions and climate information/data. In September 2007, the three-month course for the year started with eight participants from eight countries, including Thailand from among the TC member countries.

d.3 Dispatch of an expert to the roving seminar

In September 2007, JMA dispatched an expert to the roving seminar held in Manila to lecture on the topic of *The Interaction of Tropical Cyclones with Monsoon Systems*.

d.4 Technical cooperation

Since July 2006, Japan has implemented a technical cooperation project in Lao PDR with a view to developing human resources on meteorology and hydrology through the Japan International Cooperation Agency (JICA). The project is scheduled for continuation until the beginning of 2010.

An expert dispatched in December 2006 by JICA to the Department of Meteorology in Cambodia continues to be engaged in the rehabilitation/improvement of civil aviation meteorology in the country. The expert is scheduled to be in Cambodia until early next year.

e. Research Progress

e.1 Improvement of the initialization scheme for tropical cyclones

JMA has confirmed an improvement in numerical tropical cyclone (TC) track prediction as a result of modifying the operational initialization scheme for TCs (i.e. the Typhoon-Bogus scheme) in the global spectral model (GSM-TL959L60).

In the Typhoon-Bogus scheme, several "pseudo" observational data are deployed inside a circle around the observed center position of the TC. These data are taken into account in the 4D-VAR global data assimilation process. The radius of the circle is called the Bogus-Radius. While this value for each TC of Tropical Storm (TS) intensity or higher is specified with a function of the radius of 30 kt winds and the Coriolis parameter at the center of the TC, a fixed radius of 360 km has been used as the Bogus-Radius for tropical depressions (TDs), since TDs have no analysis of the 30 kt wind radius.

However, the fixed Bogus-Radius for TDs has occasionally worked inadequately and failed in appropriately correcting erroneous TD positions in the first-guess field. To alleviate the problem, a function has been introduced to enable variation of the Bogus-Radius for TDs depending on their strength and latitudinal location. The newly introduced Bogus-Radius for TDs is defined as a function of their central pressure and the latitude of their center position, with a lower limit of 360 km. The function has been determined on the basis of regression analysis for the parameters of TCs that have just developed to TS intensity. With this modification, TC track predictions by GSM-TL959L60 have shown a significant improvement in the case of Typhoon RANANIM in 2004.

The new function for the Bogus-Radius in the case of TDs will be adopted into GSM-TL959L60 at the beginning of its operation in November 2007.

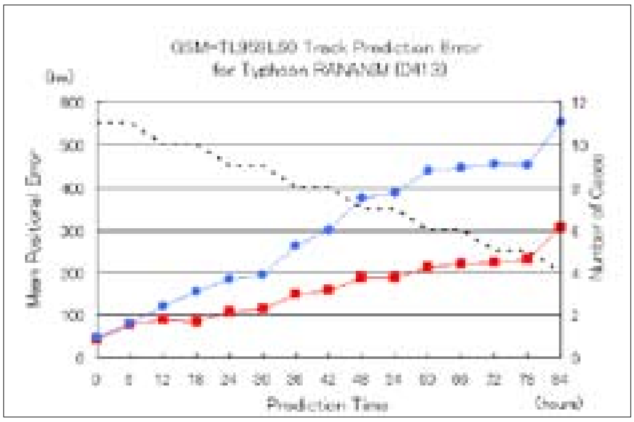


Figure 5 Mean tropical cyclone track prediction error of the GSM-TL959L60 run for typhoon RANANIM (0413) comparing runs with (red squares) and without (blue circles) the modification of the Typhoon-Bogus scheme. The dashed black line shows the number of cases involved.

e.2 Development of a Typhoon Ensemble Prediction System

JMA has developed the Typhoon EPS, a new ensemble prediction system aimed at further improving both deterministic and probabilistic forecasts of tropical cyclone (TC) movements. Its full operation will start no later than the beginning of the typhoon season in 2008, following a period of preliminary operation conducted since May 2007.

In the Typhoon EPS, 11 initial fields are prepared for integration by the JMA global spectral model (GSM) with horizontal spectral truncation TL319 and 60 vertical layers. The EPS is focused on TCs in the western North Pacific Ocean and the South China Sea (0-60N, 100E-180E), and runs four times a day (not fixed) at 0000, 0600, 1200 and 1800 UTC with a forecast range of 132 hours (not fixed), which covers five-day forecasts. A singular vector method is employed to make initial perturbations.

In numerical experiments prior to preliminary operation, statistical verification of TC track forecasts has shown that errors in deterministic predictions obtained using the ensemble mean of the Typhoon EPS are smaller than those obtained using the deterministic GSM or Typhoon model beyond the first three days. More importantly, verification has also shown that the Typhoon EPS provides accurate TC strike probability and an informative spread-skill relationship.

Issues to be tackled in this area include: 1) the introduction of a stochastic physics method that addresses forecast uncertainties caused by imperfections in the NWP model itself, and 2) the improvement of application for more beneficial use of the EPS in both deterministic and probabilistic forecasts.

f . Other Cooperative/ Strategic Plans

There are no updates this year.

2. Progress in Members' Important High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee)

a. Hardware and/or Software Progress

There are no updates this year.

b. Implications for Operational Progress

b.1 Improvement of tropical cyclone information

As a contribution to the mitigation of typhoon-related disasters, JMA provides improved analysis and forecast information for tropical cyclones (TCs) formed on and after 18 April 2007 as described below.

For all TCs:

- Addition of wind gusts to analysis and forecasts
- Provision of analysis and forecasts for tropical depressions expected to attain tropical storm (TS) intensity within the next 24 hours

For TCs expected to affect Japan:

- Provision of three-hourly forecasts up to the next 24 hours
- Provision of distribution charts for 50-kt wind probability (shown in Figure 6)
- Provision of analysis and forecasts as TC information for disturbances transforming from TCs into extratropical cyclones that are still expected to bring serious damage to Japan

In addition to these improvements, JMA introduced the following updates to the TC information chart (shown in Figure 7) on the JMA website at http://www.jma.go.jp/en/typh/:

- Change in the display style for storm warning areas from circles at each forecast time (the next 12, 24, 48 and 72 hours) to a closed line surrounding the area for the whole forecast time (up to the next 72 hours ahead)

Figure 6 Distribution chart of 50-kt wind probabilities (06 UTC, 12 July 2007)

c. Interaction with Users, Other Members and/or Other Components

There are no updates this year.

d. Training Progress

d.1 Expert services

- A JMA expert on the application of numerical weather prediction to city forecasts visited China in November 2006.
- A JMA expert on numerical weather prediction visited KMA in October/November 2006.
- Three JMA experts on numerical weather prediction visited the Hong Kong Observatory in January 2007.

d.2 Technical visits to JMA

- An expert from the Thai Meteorological Department visited JMA for technical exchange on Radar Meteorology from August - November 2007.
- Two experts from the Hong Kong Observatory visited JMA for technical exchange on numerical weather prediction in November/December 2007.

e. Research Progress

e.1 Numerical study on the heavy rainfall associated with Typhoon Meari (2004)

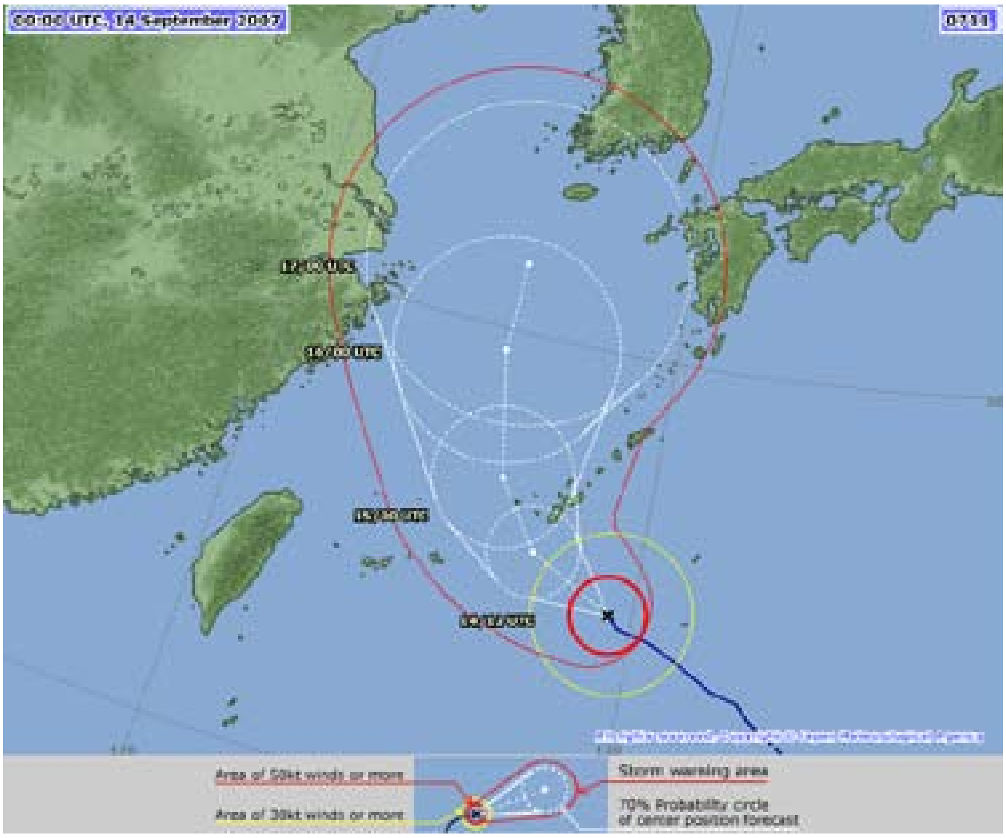


Figure 7 TC information chart (00 UTC, 14 September 2007)

Investigation of the heavy rainfall event associated with Typhoon Meari in the mountainous Kii Peninsula of Japan in 2004 has been carried out using JMA's nonhydrostatic model (JMA-NHM) with a horizontal resolution of 1 km. The precipitation efficiency was calculated in order to elucidate the mechanisms of the heavy rains. The efficiency, defined as the amount of rainfall reaching the ground divided by the sum of vertically accumulated condensation and deposition, is higher in the period of heavy precipitation. The increased rainfall efficiency is attributed to the greater rate of conversion of cloud water to rainwater via accretion of cloud water by rain. Higher clouds in moving precipitation systems provide raindrops for the accretion of cloud droplets in lower clouds in the stationary precipitation system.

e.2 Numerical simulations of the tornado-producing supercell storm and tornado associated with Typhoon Shanshan (2006)

On 17 September 2006, three tornadoes hit Kyusyu Island in western Japan during the passage of the outer rainband that accompanied Typhoon Shanshan. Numerical simulations were conducted to shed light on the environmental field, the tornado-producing storm and the generation processes of tornadoes. The simulated rainband on the right-front quadrant of the typhoon consists of a number of isolated active convective cells as observed by JMA's radar network. Some convective cells have a hook pattern and a bounded weak region of hydrometeors, which are identical to the mini-supercell seen in many previous studies. Simulation using a horizontal grid spacing of 50 m successfully reproduced a tornado spawned by a mini-supercell. The diameter of the vortex near the surface was about 500 m, the vertical vorticity reached 0.7 s and surface pressure drop was about 12 hPa. The model's results indicate that the enhancement of low-level vertical vorticity is essential to the genesis of a tornado.

e.3 Numerical study on the vertical tilt of a typhoon vortex

The relationship between the vertical tilt of a typhoon vortex and the asymmetric components of its thermodynamic fields was investigated in a quantitative manner based on the numerical simulation data obtained for Typhoon Chaba in 2004. In order to understand the mechanism by which the tilt occurs, a Lagrangian trajectory analysis as well as a two-dimensional theoretical formulation were developed and applied to the numerical model data. The results suggest that the robust features of the vortex tilt observed in the simulated data are strongly linked to the asymmetries of the thermodynamic fields caused by the environmental vertical wind shear.

e.4 Investigation of sea state dependency of momentum flux in high wind conditions using a coupled atmosphere-wave model

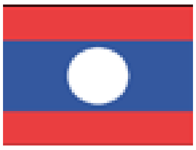
The effect of sea state (i.e. ocean waves) on typhoon intensity was investigated through numerical experimentation using a coupled atmosphere-wave model. For this study, JMA's NHM was coupled with the third-generation MRI-III wave model. Since there are many formulae to describe the sea state dependency of momentum flux, three typical formulae for the drag coefficient were tested and compared to each other. While the three coupled simulations showed different evolutions of momentum flux, the following two features were commonly observed in the simulations: (a) weakening of surface wind by increased drag coefficients, and (b) enhancement of frictional convergence and shrinking of eyewall rainbands, leading to stronger storm intensities at later times than in uncoupled cases. Further investigation is underway to clarify the mechanisms responsible for these features.

f. Other Cooperative/ Strategic Plans

There are no updates this year.

3. Opportunities for Further Enhancement of Regional Cooperation

There are no updates this year.



IN LAOS

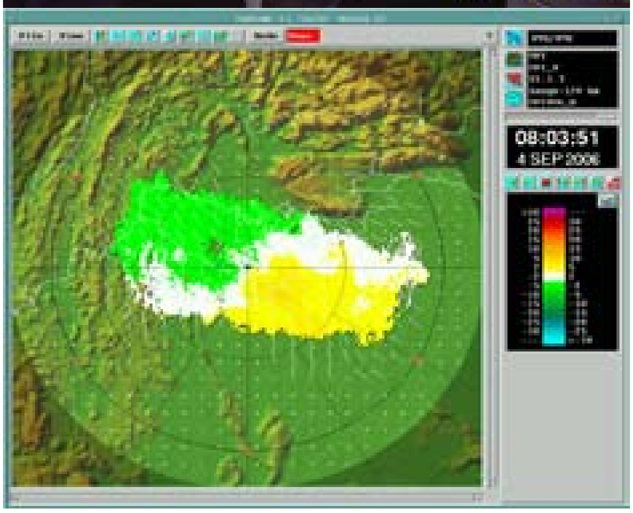
I. Meteorological Component

1.1 Improvement of Facilities progress

For the year under review on progress activity, Department of Meteorology and Hydrology has continued receive assistance from JICA to install the new Operational Weather Monitoring and Forecasting at Head quarter (DMH) of Lao PDR, under the Project for Establishment of Disastrous weather Monitoring System, Grant aid from the People of Japan.

MTSAT receiving system: ***receives and displays the cloud image data transmitted from Multi – Functional Transport Satellite (MTSAT) of Japan.***

Radar System: ***radiates the radio wave of 250 KW amplified by the klystron, processes the signal of the echoes reflected from precipitation and detects various weather data (integrating rainfall, wind direction, wind velocity, etc....).***



- Establishment of the VCP on Broadband Internet Connection in Lao PDR that the service delivery made by the IT Com. was completed and the testing of operation was carried out since 24th May 2007. For the monthly payment for the service to ISP which WMO supports for the first year. The ADSL LAN components that mainly composed of one Server Unit, four workstation Units, one printer, ADSL Modem and switch Hub.
- In the end of year 2006 Data Receiving station has been completed install data
Receiving station at DMH office. The observation data is collected from NHMs of Hanoi by Internet to input to the chart plotter was operated (bilateral cooperation between NHMs of R. Vietnam and Lao PDR).

1.2 Implication to Operational Progress:

Meteorological network:

- Main Synoptic stations 17 (at provinces)
- Secondary Synoptic Climatological stations 33 (at provinces)
- Rain gauge 113 (at provinces)
- Doppler Radar 01 (at Head quarter DMH)
- MTSAT–1R Meteorological satellite receiver station 01 (at Radar building DMH)

Synoptic data observation:

- Under inter Technical Meeting of DMH at the beginning of 2007, the time of Synoptic data observation for 6 stations: Phongsaly, Oudomxay, Samneu, Phonhong, KM 20 and Paksan has been extended from 4 times (00, 03, 06, 09 UTC) in to 5 times (00 , 03, 06 , 09 and 12 UTC).
- Only 4 stations: Luangprabang, DMH head quarter, Savannakhet and Pakse available 8 times synoptic data (00, 03, 06, 09, 12, 15, 18 GMT).
- About 10 stations: Viengxay, Xiengkhuang, Luangnamtha, Hoeixay, Xayaboury, Thakhek, Seno, Saravane, Attapeu and Sekong available 4 times synoptic data (00, 03, 06, 09 GMT).
- Meteorological data quality Control under project of TCP, JICA. The equipments (HF transceivers, PC and peripherals) were delivering by a local supplier in August 2007.

Data collection and transmissions:

- ***National level:*** Public telephone, Email, Facsimile and High Frequency (HF) radio transceivers network that are used for domestic data collection and dissemination.

- ***International level:*** The connection between Vientiane and Regional Telecommunication Hub (RTH) Bangkok is by Global Telecommunication System (GTS) under VCP of WMO. Total of 20 stations of synoptic data observation are transmitting every day to Sub- regional II Bangkok Thailand through GTS. The Weather Forecasting has access to the Global Telecommunication System Bangkok, SENERGIE server system that very useful for forecasting. DMH receive only the observation data from NHMs of Hanoi by Internet.

Tropical Cyclone Monitoring:

Various observational data were applied to reveal tropical cyclone monitoring such as:

- Meteorological observation data
- Weather maps
- Satellite imageries
- Doppler Radar data
- Utilize the typhoon forecast and NWP Products from ECWMF, RSMC (JMA) Tokyo,

KMA, Hong Kong and other centre trough GTS and Internet.

Tropical cyclone forecast methodology:

The forecasts and warnings for the whole country are issued by the weather forecast Division at DMH Headquarter. The forecast methodologies used are:

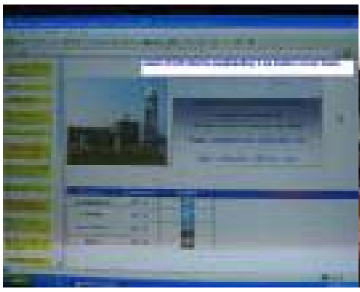
- Track forecasting method: by using the computation of the current surface geostrophic steering of the tropical cyclone and estimate of direction of motion.

- Pressure falling method: the use of pressure changes can be especially helpful in short range forecasting.

- Operational Tropical Cycle analysis and forecasting: With the utility of MTSAT in Tropical Cyclones, Department of Meteorology and Hydrology has improved the operational work in analysing satellite data imageries. The procedure is based on the method delivered by Dvorak technique. The weather forecasters use the determination of the cloud pattern by applying to the typical model of development of Tropical Cyclone as shown from satellite images (cited from Dvorak, 1992). By using both VIS (visible) and IR (infrared) imageries from MTSAT, the weather forecasters understood that more clearly to identify the cloud pattern such as: Cb cluster, curved band, Embed (CDO), eye, shear and low-level vortex patterns. After having practiced many exercises by using different categories / conditions of cloud, by those Forecasters can identify the cloud pattern. Determine cloud system centre (CSC), determine T number (DT), model expected T number (MET), Pattern T number (PT) and Final T number (FT). The EIR analysis using and we analysis using VIS images enhanced infrared images to estimate intensity. Analysis Cloud system of development and weakening of Tropical Cyclones. Analyse surface observation by using compass method to determine pressure center of Tropical Cyclone. MTSAT water vapour channel could reveal the moisture transport at mid and upper levels and utilise the rainfall estimation products from other center for combining, DMH could understand the moisture field within a tropical Cyclone environment. On analysing Satellite imageries by applying DVORAK technique are helpful to accurate forecast and issue warning timely for assistance government and public to take prevention and activities in Lao PDR.

- Interaction with users

Since 2007 DMH improved delivering the daily weather forecast by real voice of forecaster through telephone line and broadcast on air by National Radio station. DMH website has been established and provides many products through this web page such as: Radar observation, satellite imageries, data observation (minimum and maximum temperature and daily rainfall) for 22 stations, Daily forecast, 3 day city forecast, Weekly forecast, flood forecast and other.... Many agencies could access and utilize the weather forecast products from DMH and general users could already watch DMH products under WMO website. Under project of establishment of the VCP (WMO) on Broadband Internet Connection in Lao PDR that the DMH staffs could access through internet more rapidly to get information, products of NWP models, weather forecast for various times, climate products, tropical cyclone advisory, home page etc.. Huge centres



such as: National climate data USA, seasonal forecast UK, JMA, KMA and other meteorological centres in the world.

- Open house in DMH (observation station, data collection and transmission, forecasting, Radar tower) for elementary and high school students was conducted on 15 and 16 October 2007 (about 200 students have been visited). The purpose of this activity is to supply to them with the basis knowledge about the role of DMH so that some of them will be come interested in science and technology.
- Seminar at DMH on 18 October, 2007 for the Mass – media (TV , Radio , Newspaper, Magazines) and line Agencies (information users, about 30 persons). The purpose of this activity is to supply the basis knowledge to them so that they will become able to use information effectively to contribute the protection of people's lives and property.
- Workshop at DMH on 22 - 23 October, 2007 for the staff of PHMS (provincial Meteorological and Hydrological Station) , line agencies and school teachers (30 persons). The purpose of this activity is to supply the basis knowledge to them and to encourage them to teach the knowledge to the school student and the local people.

1.3 Training progress

Under Technical Cooperation Project, Grant aid from the People of Japan (JICA). The Meteorological and Hydrological Services Improvement project has conducted several local trainings at Department of Meteorology and Hydrology of Lao PDR such as the following:

- OJT for maintenance (Operation and maintenance of weather Radar).

- Lecture on PC architecture (Computer network management) at DMH, Head Office.

- Training in creation of web pages, using Dream weaver was conducted at Weather Forecasting Division (DMH).

- Training on archiving of the Weather Radar data was commenced from the beginning of rainy season 2007, include analysis of Radar Data, calibration of rainfall between radar data and rain gauge observation.

- Training course in Aviation Weather was conducted at DMH head office in Vientiane

for the seven local Meteorologists and six air traffic controllers.

Personnel from DMH participated in numerous international Trainings, Workshops

Seminars, Conference, Meetings and Forum related to meteorology such as: Regional Climate monitoring, Climate information and prediction, Annual flood Forum of MRC and other.. that were held internationally. Related to the Tropical cyclone seminar, DMH staff participated to the international workshop on Tropical cyclone Disaster reduction at Guangzhou, China. Some of the International seminars, workshop, meeting, forum of Meteorology, Hydrology and Disaster management, which attended by DMH staffs from 1 October 2006 to 31

Seminar/Workshops/ Conference/ Meetings / Forum	Duration	Financial support	Places	Number of participant
The 14 th Registration Steering Committee Meeting	16 – 20 Oct. 06	IHP	Thailand	1
CLIP (Climate Information and Prediction)	15 – 27 Jan. 07	WMO	Thailand	1
GIS	15 – 30 Jan. 07	MRC	Thailand	1
Evaluation and improvement of Flood Forecasting	5 –7 Feb. 07	MOCT	Korea	1
Annual flood Report evaluation	12 – 14 Feb. 07	MRC	Cambodia	1
Implementation strategy 2007 - 2010	4 – 5 May 07	WMO	Macao, China	1
Training -Workshop on Solar Radiation on Potential	7 – 9 Mar. 07	Thailand	Thailand	7
Seminar on Aeronautical Meteorology Service	6 – 8 Mar. 07	WMO	China	1
RANET	20 – 23 Mar. 07	NOAA, USAID	Indonesia	2
Data base information	22 – 23 Mar. 07	MRC	VIETNAM	1
Response and Rescue Operation	25 Mar. – 7 Apr.07	Malaysia	Malaysia	2
Tropical Cyclone Disaster Reduction	26-31 Mar. 07	WMO	Guangzhou, China	1
Natural Resource Management and Rural Development	24 Apr. – 4 May.07	GTZ	Cambodia	1
Third Session of the Forum on Regional Climate Monitoring	4 – 6 Apr.07	BCC, China	China	1
JOMSRE (Joint Oceanography Marine Science research expedition between Vietnam and Philippine	8 Apr.– 6 May.07	Vietnam	Vietnam, Philippine	1
The 5 th Mekong Flood Forum	17–18 May.07	MRC	VIETNAM	2
Asian Seasonal International Climate Forecasting	21–31 May.07	NOAA	Singapore	2

HYMET, Advances HYMOS and Flood Forecasting	28 May. – 5 Jun. 07	MRC	Cambodia	2
3rd TTF (Technical Task Force) meeting	18 – 19 Jun. 07	BMG	Indonesia	1
Climate Field School and Validation of ASEAN	3 – 6 Jul. 07	BMG	Indonesia	1
SIGMET Seminar for Asia/Pacific Region	11–13 Jul. 07	WMO	Thailand	1
The 29 th Meeting of Asian Sub – Committee on Meteorology and Geophysics	17 –18 Jul. 07	Lao PDR	Philippines	2
Disaster Risk Management	13 – 19 Aug.07	Asian Disaster Secretariat	Beijing, China	1
2nd Meeting of WGDPP	22 – 24 Aug.07	NIDP/NEMA	Korea	1
Agro meteorological Service for Sustainable Agriculture	27 Aug – 7 Sep. 07	WMO/CMA	Beijing, China	1
The Implementation – Coordination Meeting on the WMO's Information System (WIS) and GTS in the Regional Association II Asia Pacific.	10 – 12 Sep. 07	WMO	RUSSIA	1
Management for Meteorological Administration in Africa and Asia Country	12 – 26 Sep. 07	China	Nanjing, China	2
Communication Ocean and Meteorological Satellite (COMS) program, Analysis of COMS Data	2 -17 Sep. 07	KOICA	Korea	1
Social-economic Impact of Extreme Typhoon-related Event	10 – 14 Sep. 07	TCTF IDI MOCT	Thailand	3
Hydrological data observation Lao - Thai	19 Sep. 07	MRC	Thailand	1
GEOSS Information Access and Donation of FUNGYUN Cast	11 –12 Oct. 07	CMA	China	2
Operational Flood Forecasting System and its Application	15 – 21 Oct. 07	TC /WMO	China	1
Training course for Developing Countries on Earthquake Disaster emergency Response and rescue	20 Oct. – 3 Nov. 07	China	Beijing, China	1
Conference on Climate Change	29 – 30 Oct. 07	UK Gov.	Malaysia	2
South and Southeast Asia Workshop on Climate Change	29 – 31 Oct. 07	ECBU	Thailand	1

October 2007, are listed in the table 1.

1.4 Research

Nil

1.5 Other Cooperative / strategy plan Progress:

Ongoing project of TCP assistance from JICA (2006 – 2009)

Project Title: Improvement Meteorology and Hydrology services in Lao PDR.
Continue dispatch of 11 Japanese experts to DMH on:

- Meteorological Data Radar operation and maintenance
- Meteorological Data Quality control (replacements of the existing meteorological equipment for 4 observation stations: Takhek, Km 20, Sayaboury and Napok (under project of TCP, JICA). Drawing of the

standard (equipment layout in observation field, shelter, foundation of equipment, field walking path, field fence, HF antenna pole etc...), which will become part of the observation gridline for Meteorological observation.

- Promotion of Meteorological and Hydrological information for Disaster Management
- Weather Forecast / Meteorological Radar Data Analysis / Aviation Weather
- Computer network Management
- Dispatching of long tern Japanese expert (2 years) on Agro- meteorological for implementing and upgrading of Agro-meteorological activities.

Bilateral cooperation between DMH and NHMs of R. Vietnam

Submit proposal: Through Government Diplomatic channel on Meteorological and Hydrological services improvement and to set up data collection by meteo – television system.

Grant aid assistance from Government of China

Ongoing Project to Establish: 2 Seismic stations and Seismic data Center by cooperation with CEA, china.

Cooperate with Other Agencies

- Establishment of facilities for NWP, i.e. Hardware and appropriate Models
- Personnel Training on both NWP Products Utilization for Weather Forecasting and NWP Model Development for Application in Lao PDR.
- Improvement of the quality of weather forecasting products and services to Aviation by applying the outcomes of two WMO RA.II projects, ASEAN-ROK projects and by a close Cooperation with & Support by KMA.
- Request bilateral assistance from KMA for migration to and application of PC Clusters NWP systems along with capacity building.
- Installation and utilization of Fenyun Cast – Satellite receiption System of CMA, from 2008 .
-

Improvement of national and regional telecommunication systems:

- DMH would like to improve existing link by application of ADSL (Asynchronous Digital Subscriber Link) Internet as back up leased line 64 kbps.
- DMH planning for migration from analogy alpha numeric code to TDCF
- Increase the frequency of issuing forecasts

and warnings and uploading into DMH Web page, and through mass media to public and directly to concerned end users.

In Macao

1. Progress in Member's Regional Co-operation and Selected Strategic Plan Goals and Objectives:

1a.Hardware and/or Software Progress
Nil.

1b. Implications for Operational Progress
Nil.

1c. Interaction with users, other Members, and/or other components

At the invitation of Minister of Transport and Communications, and Minister of Interior of the Democratic Republic of Timor-Leste, a WMO fact-finding mission to Timor-Leste was carried out by a team of representatives and experts from WMO, Australia, Indonesia, Macao-China, Portugal and two collaborating UN Agencies: IOC/UNESCO and UN-ISDR, from 29th January to 2nd February 2007 in order to assist in assessing the basic meteorological infrastructure and to make recommendations for the development of a National Meteorological Service and the establishment of a Meteorological Emergency Management Office. This mission was headed by Dr. Tokiyoshi Toya, Regional Director for Asia and the South-West Pacific. Mr. António Viseu, deputy director of SMG, was the chairman of the Co-ordination Meeting that led to more than twenty recommendations for the Timor-Leste Government to develop its National Meteorological Service and Mr. Hao I Pan, senior meteorologist of SMG, made a presentation on climate data monitoring and prediction.

The High-Level Workshop on the Typhoon Committee Strategic Plan Implementation was held in Macao between 13 and 14 February 2007, covering the fields of: Concept of the Strategic Plan, 2007-2011, and the UNESCAP/WMO context; Relevant Typhoon Committee and International Framework; and Strategic Plan implementation in the perspectives of the Members. Nearly all Members attended this Workshop with the presence of Dr. Roman L. Kintanar, honorable former Coordinator and Secretary of the Typhoon Committee.

The provision of Portuguese version of the WMO/WWIS (World Weather Information Service) homepage was transferred from Macao, China to Portugal during the year 2007. Collaborations were received from Hong Kong Observatory, webmaster of this website, and Portuguese Institute of Meteorology.

Overseas Training Course/Seminar/Workshop	Venue	Duration	No. of participants
2nd Training Course for New Forecasters	Beijing, China	11 Sep – 7 Dec 2006	1
Training Course on Nowcasting of Serious Convection	Beijing, China	11-21 Oct 2006	1
21st Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology	Hong Kong, China	24-26 Jan 2007	9
Management Committee Meeting and Working Group Meeting of COST Action 728 – Enhancing Musicale Meteorological Modeling Capabilities for Air Pollution and Dispersion Applications	Bessel, Belgium	1-2 Mar 2007	1
Seminar on Climate Forecasting in South China during the Rainy Seasons of 2007	Guangzhou, China	15-17 Mar 2007	1
Session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia	Beijing, China	04-06 Apr 2007	1
Visit to Hong Kong Observatory	Hong Kong, China	22 May 2007	7
Workshop on Climate Forecasting	Hong Kong, China	06 Jul 2007	2
Eleventh Meeting of the Communications/Navigation/Surveillance and Meteorology Sub-Group of APANPIRG	Bangkok, Thailand	16-20 July 2007	1
Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Events	Bangkok, Thailand	10-14 Sep 2007	3
3rd Training Course for New Forecasters	Beijing, China	12 Sep – 7 Dec 2007	2
Visit to Guangzhou Airport	Guangzhou, China	27-28 Sep 2006	2

1d. Training progress

Overseas training opportunities/courses/seminars/workshops attended by SMG personnel:

1e.Research Progress

Four papers were presented by SMG colleagues at the 21st Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology held in Hong Kong, China on January 24-26 2007, as follows:

(1) Diurnal corrections of surface temperature forecasts using the Kalman filter;
(2) The climatic characteristics of maintaining periods of South China Sea summer monsoon;
(3) Review of the new thunderstorm warning system for Macau International Airport; and
(4) Preliminary study in establishing forecast model on monthly temperature in Macao.

Two papers was presented by SMG colleagues at the Atmospheric Remote Sensing and Lidar Workshop held in Macao, China on 17-19 April 2007, as follows:

(1) Atmospheric remote sensing using lidar technology; and
(2) Methods of Atmospheric Measurement and Remote Sensing – Examples and Case Studies.

Three papers were presented by SMG colleagues at the 4th Meteorological Technical Conference among China, Macao and Portugal held in Macao, China on 12-14 June 2007, as follows:

(1) Atmospheric remote sensing using lidar technology;
(2) Effect of condensational heating over the Bay of Bengal on the onset of the South China Sea monsoon in 1998; and
(3) Diurnal corrections of surface temperature forecasts using the Kalman filter.

1f. Other Cooperative/Strategic Plan Progress

The signing ceremony of the "Host Country Agreement Between the Government of People's Republic of China and the Typhoon Committee Regarding the Typhoon Committee Secretariat" took place in the Manila Hotel, Manila, at 10:30 on 7th December 2006. The Agreement was signed by Excellency Ambassador of People's Republic of China to the Philippines, Ambassador Li Jinjun, and by the Chairman of the Typhoon Committee Dr Prisco D. Nilo, Officer-in-Charge, Philippine Atmospheric, Geophysical and Astronomical Administration.

Another document the "Agreement between the Macao Government of Special Administrative Region of People's Republic of China and the Typhoon Committee Regarding Administrative, Financial and Related Matters Arrangements for the Secretariat of the Typhoon Committee", was signed at the Government Headquarters, Macao-China, at 15:00 on 13 February 2007, by Excellency the Secretary for Administration and Justice of the Government of the Macao SAR, Dr. Florinda da Rosa Silva Chan, and the Chairman of the TC, with the presence of His Excellency the Chief Executive of the Government of the Macao SAR, Dr. Edmund Ho Hau Wah, to witness this important historic moment, in order to complement the above-mentioned Agreement.

The Expanded Best Track (EBT) data of Macao for 2006 were compiled and sent to the Regional Specialized Meteorological Center (RSMC), Tokyo in March 2007.

2. Progress in Member's Important, High-Priority Goals and Objectives

2a. Hardware and/or Software Progress

The purchase of MTSAT (JMA's Multi-functional Transport Satellite-1R) receiving and display system started in 2007 and is expected to put into operation in the beginning of 2008.

One new-generation automatic weather station was established for weather observations. It is planned to replace all existing stations in the current network.

The Oracle Database was upgraded to the version 10g from existing version 8i database server. Also, applications from Oracle Form to Java based services with application servers were renewed and replaced.

Improvement of Linux Cluster continued by joining new real servers to internal cluster, replacing out-of-date servers, connecting files system to SAN and rearranging server room cabling and rack mounting.

Applications and operating system settings were re-adjusted to integrate the new modem pool hardware of AWS systems.

XML meteorological data were provided to government sites, including government portal website and LED display board on bridge and road-side.

The 2nd Asian Indoor Games, Macao 2007 website was opened for this big occasion as a supporting service.

2b. Implications for Operational Progress

Nil.

2c. Interaction with users, other Members, and/or other components

The Tropical Cyclone Name Nomination Contest was opened to Macao citizens as the first commemoration activity of the World Meteorological Day 2007, with the main objectives of promoting public awareness of the hazards related to tropical cyclones and enhancing public understanding of the Tropical Cyclone Signal

System in Macao.

The annual Typhoon Exercise named LOUCHU, schemed by Macao Security Forces Coordination Office, took place on 24th April 2007 with more than 30 organizations from both private and public sectors participating.

2d. Training progress

Seven SMG colleagues obtained Higher Diploma in Meteorology granted by Macao Polytechnic Institute in March 2007.

Fourteen meteorological personnel of our Bureau are expected to complete the 2-year training course for Meteorological Technicians (MT), according to the requirements of 'Guidelines for the education and training of personnel in meteorology and operational hydrology' (WMO-No. 258), by the end of 2007.

A 3-month training course for operational meteorologists was run at the beginning of 2007 for seven new members of our staff with Bachelor's degree in Meteorology.

Another 2-month training course for operational meteorologists started in September 2007 for two meteorological personnel holding Higher Diploma in Meteorology.

2e. Research Progress

"Cooperation Agreement between Meteorological and Geophysical Bureau and the Macao University of Science and Technology in the area of remote sensing" was signed on World Meteorological Day 2007. The first co-operative 3-year project will be "Development of Nocturnal Atmospheric Water Vapor Raman Lidar" headed by Prof. Y. S. Cheng with funding of around 4.89 million Macao patacas from Science and Technology Development Fund of the Macao SAR.

Meteorological research in collaboration with Department of Atmospheric Physics of Sun Yat-sen University, Guangzhou, China continued. Seven research papers were published in different scientific journals and proceedings from October 2006 to September 2007, as follows,

(1) Numerical comparison study of cloud microphysical parameterization schemes for a moderate snowfall event in North China; Meteorology and Atmospheric Physics; Vol. 95, No. 3-7, 2007, p. 195-204;
(2) Numerical simulation of impact of the microphysical parameterization on snowfall; plateau meteorology; Vol. 26, No.1, 2007, p. 105-115;
(3) Climatic characteristics of the retreat of South China Sea summer monsoon I – 40-year-means; Journal of Tropical Meteorology, Vol. 23, No. 1, 2007, p. 7-13;
(4) Analyzing continuous rainstorm in southern China in June 2005; Journal of Tropical Meteorology, Vol. 23, No.1, 2007, p. 90-97;
(5) A numerical study of the influence of urban expansion on monthly climate in dry autumn over the Pearl River Delta, China; Theoretical and Applied Climatology; Vol. 89, No. 1-2, 2007, p. 63-72;
(6) Numerical experiment research on air pollutants during atmospheric haze over the multi-cities of Pearl River Delta region; Journal of Sun Yat-sen University (Version of Natural Science), Vol. 46, 2007, p.103-107; and
(7) Numerical simulation of Typhoon Krovanh (0312) and typhoon-induced ocean waves; Journal of Tropical Meteorology, Vol. 23, No.5, 2007, p. 48-53.

2f.Other Co-operative/ Strategic Plan Progress

The Atmospheric Remote Sensing and Lidar Workshop was held in Macao, China on 17-19 April 2007. Experts from both educational and operational organizations from China, Hong Kong-China, Macao-China and Australia were invited to share their knowledge and experience in lidar networking, airborne atmospheric measurement, atmospheric modeling and air quality monitoring.

The 4th Meteorological Technical Conference among China, Macao and Portugal was held in Macao, China from 12-14 June 2007. Besides Portugal, five Portuguese speaking countries, including Angola, Cape Vert, East Timor, Guine-Bissau and Mozambique, were invited to present their meteorological achievements, so as to broaden the meteorology knowledge in Macao and enhance the cooperation of China and Portuguese speaking countries.

4. Opportunities for Further Enhancement of Regional Co-operation

Nil.

In Malaysia

Progress in Member's Regional Cooperation, Important, High-Priority Goals and Objectives

a. Hardware and/or Software Progress

JMA-MMD Storm Surge Model

Malaysian Meteorological Department (MMD), with the consent from Japan Meteorological Agency (JMA), runs a JMA Storm Surge Model on operational mode since July 2007. It is a numerical model developed by JMA to simulate and predict storm surges, especially those caused by tropical cyclones. The numerical scheme of the model is based on the shallow water equations and thus this model is two-dimensional. The model has features as listed below:

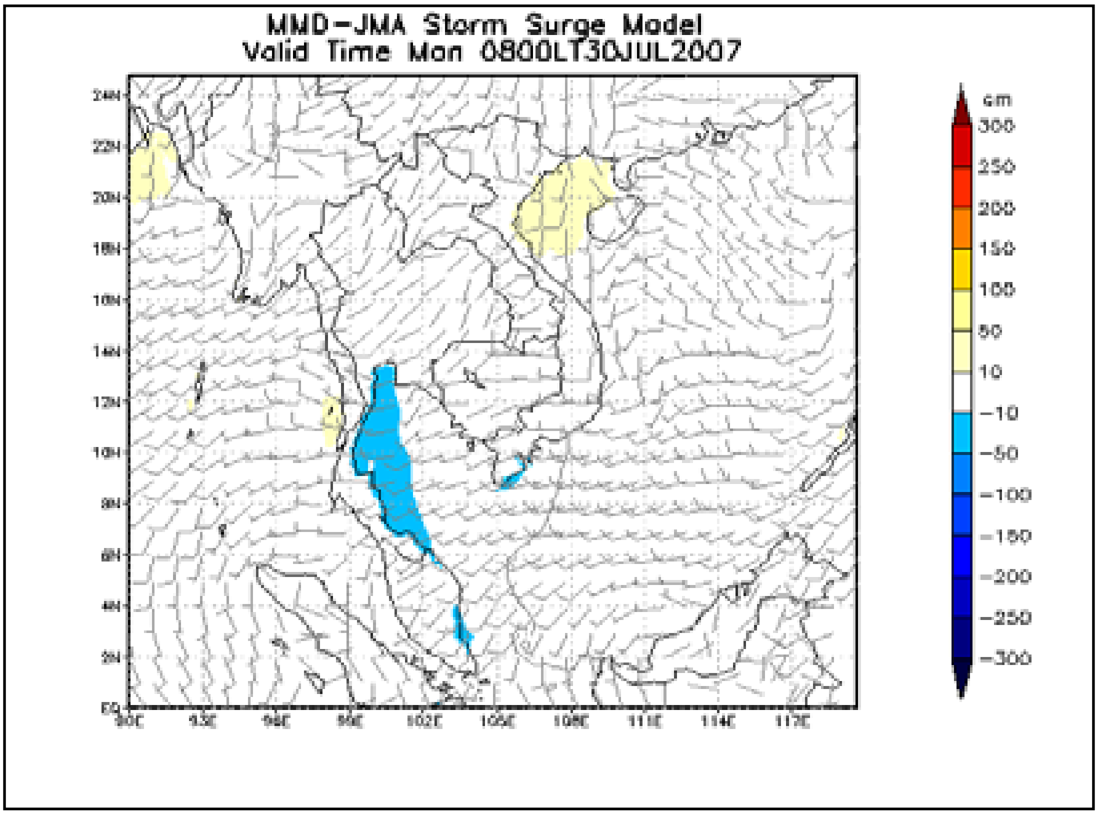
(a) It computes storm surges due to wind setup and inverted barometer effect;

(b) Accepts two types of meteorological forcing data:

(i) GRIB format files containing surface wind and pressure fields, and
(ii) Tropical Cyclone Best Track Data provided by the Regional Specialized Meteorological Centre Tokyo - Typhoon Center.

(c) Writes the storm surge calculation results in a GRIB file using FORTRAN 77 and displays using Grid Analysis and Display System (GrADS).

The model calculates the storm surges anomaly every hour. However the model output is displayed at 6-hourly interval together with wind field map up to 7 days forecast.



Example of JMA–MMD Storm Surge model output:

PRECIS (Providing Regional Climate for Impacts Studies)

PRECIS model is being run at the Malaysian Meteorological Department and the National University of Malaysia to understand the climate change projections for Malaysia. Further collaborative program is to run various greenhouse gas emission scenarios in order to capture the full spectrum of future climate change projections in our region using Grid Computing Facilities. This collaboration is one of the outcomes of the PRECIS workshop successful hosted by MMD from 7th-11th August 2006.

Station Network System

MMD had upgraded the telecommunication network line from dial-up line to broad band internet line called Streamyx for all the principal stations (except for Batu Embun station) throughout the country. However, the dial-up lines are still maintained as back up to the Streamyx. The upgrading allows the transmission of meteorological data from the stations to headquarter at a much faster speed of 1 Mbps.

The least line connecting the five regional forecast offices (Bayan Lepas, Butterworth, Kuantan, Kota Kinabalu and Kuching offices) have also been upgraded from 256 kbps to 512 kbps.

The upgrading of these telecommunication network lines help to deliver meteorological data at a much faster rate so that timely weather forecasts and severe weather as well as strong winds and rough sea warnings could be issued.

Information and Communication Technology (ICT)

MMD had installed video conferencing system to enable face-to-face communication among the weather forecasters working at five different regional meteorological offices throughout the country. Through this system, the duty forecasters are able to discuss and share their understandings and experience on the weather conditions and development of the whole country and region and thus contributing to a more consistent and improve forecasts.

MMD has started using SMS system to send warnings of severe weather as well as earthquake information and tsunami warnings to disaster management agencies.

Fixed line alert system (FLAS) or disaster alert system (DAS)

MMD, with the cooperation with Telekom Malaysia Berhad (TM), had initiated Fixed Line Alert System (FLAS) or Disaster Alert System (DAS) that enable the government to disseminate early warning messages to selected community via fixed telecommunication line provided by TM. Although the system is initially developed for tsunami warning, it will be able to incorporate early warnings for other type of disasters, such as weather related hazards and disasters. The system provides short and precise messages timely to a large number of the targeted regional community.

Satellite Ground Station

MMD has established two (2) Medium Scale Data Utilization Station (MDUS) for the geostationary satellite to receive MTSAT-1R and FY-2C data downlink at half hourly interval. This space-based observation system, also known as GEO satellite, will basically optimize the equatorial location for efficient coverage. At the same time, MMD also receives and processes satellite data from polar orbiting satellites, which is from the NOAA Series (18, 17, 16 and 15) and FY-1D.

b.Implications to Operational Progress

The upgrading of observation facilities, forecast models and ICT systems has enhanced the MMD's capacity and capability in providing timely and improved weather forecast services and weather warning services to the public as well as the disaster management agencies, necessary for the protection of life and property and reduction of the economic loss due to weather related disasters

MMD had also made available its operational intranet web site to a few disaster management agencies, such as the National Security Council of the Prime Minister Department and the Drainage and Irrigation Department, to assess to all the information on weather development and forecasts and warnings so as to enhance their operation in disaster mitigation and management.

c. Interaction with users, other Members, and/or other components

MMD continues its endeavor to improve interactions with users, other Members, and/or other components. MMD meets the users of meteorological services by conducting regular client's day. Discussions with the disaster management agencies and mass media were also regular activities of MMD. MMD also encourages and receives visits from schools, institutions of higher learning and government and private agencies so as to enhance public awareness. These activities had helped MMD to further understand the user requirement and enhance the services provided.

During year 2006/2007, MMD is actively involved in and had also hosted a number of international and national workshop/seminar/meeting on meteorological and seismological related issues. These involvements help to enhance MMD's human capacity and capability buildings as well as national and international cooperation and collaboration. The WMO Regional Seminar on Enhancing Service Delivery by National Meteorological and Hydrological Services in Regional Association V (South-West Pacific) was held in Petaling Jaya from 4 to 7 April 2007. It was held back to back with the Seminar on Tsunami Warning Operations under the Pacific Tsunami Warning and Mitigation System (PTWS), 2 –3 April 2007, in cooperation with International Tsunami Information Centre, UNESCO, Intergovernmental Oceanographic Commission and the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System.

The National Seminar on Socio-Economic Impact of Extreme Weather and Climate Change was held in Putrajaya on 21-22 June 2007.

d. Training Progress

PRECIS (Providing Regional Climates for Impacts Studies) Workshop

MMD successfully hosted the PRECIS Workshop at its Headquarters in Petaling Jaya from 7-12 August 2006. The workshop was sponsored by the Hadley Centre for Climate Research, United Kingdom. A total of 22 participants who are researchers and meteorologists from Thailand, Viet Nam, Philippines, Indonesia, Singapore, Brunei Darussalam and Malaysia attended the Workshop. The objectives of this workshop were to introduce climatological science, climate change and climatological projection model to the participants as well as to train them to run and use the numerical climate model for the purpose of generating regional climate change scenario.

Typhoon Committee Roving Seminar

Two officers from MMD had participated in the Typhoon Committee Roving Seminar held in Manila, Philippines, 5-8 September 2007. The main objective of the seminar was for capacity building purposes, especially on research and operational aspects of typhoons. The seminar had successful and fruitful outcome in providing expert training on topics such as microwave satellite images analysis, Doppler radar analysis and tropical cyclones' interaction with monsoon systems.

Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Event

Malaysian participants also contributed in the discussion at the Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Events, held in Bangkok, 10-14 September 2007. The integrated workshop discussed issues and explored in depth ideas on research projects and operational aspects of typhoons.

Others

MMD had also participated actively in other international trainings, workshops, seminars and conferences, including those related to typhoons, disaster management and floods, such as the followings:

(i) International Roundtable on: Lessons from Natural Disasters, Policy Issues and Mitigation Strategies;
(ii) High-level Workshop on the Implementation of the Strategic Plan 2007 - 2011 of the Typhoon Committee;
(iii) WMO International Conference on "Secure and Sustainable Living: Social and Economic Benefits of Weather, Climate and Water Services";
(iv) WMO International Training Workshop on Tropical Cyclone Disaster reduction and
(v) Training Course on Severe Convective Storm Nowcasting

e. Research Progress

The recently completed research activities at MMD are the followings:

(i) The Regional Intra-Seasonal Rainfall Distribution Associated With The El Niño Southern Oscillation (ENSO) Events;
(ii) The Influence of Regional Sea Surface Temperature (SST) on the South China Sea Near-Equatorial Vortices During Northern Winter Monsoon;
(iii) Air Quality Trends and Climate Change in Malaysia and
(iv) Testing of different cumulus parameterization schemes, different time steps and different moisture schemes

The current on-going research activities at MMD are the followings:

(i) Tropical Cyclone Landfall Mode over Indochina and Its Effects on the Malaysian Rainfall and
(i) Local Extreme Weather Events: Mesoscale Convective Complexes and Their Evolutions over Peninsular Malaysia.

In Philippines

1 Progress in Regional Cooperation and Selected RCPIP Goals and Objectives

a. Progress in Hardware and/or Software Development and Applications

a.1 Progress in Doppler Weather Radar Acquisition

PAGASA has three projects geared towards the acquisition of Doppler radars in northern Philippines (Subic and Tagaytay), central Philippines (Cebu) and southern Philippines (Mindanao).

a.1.1 Doppler Weather Radar Network for Disaster Prevention and Preparedness in Metro Manila (Subic and Tagaytay)

This proposed network was part of the country report submitted to the 39th Session by PAGASA. It envisions to enhance the early warning system in Metro Manila thru the establishment of two Doppler radars to the west and southeast of the capital city. As of August, the Doppler site in Subic has completed its construction of a radar control room; installation of electrical, plumbing and drainage systems and excavation of electrical linkages from the building to the power house site. The facilitiy in Tagaytay has yet to accomplish the achievements made in Subic but excavations for the foundations has already started. Efforts in bidding at the procurement service and in the securing of the required permits and clearances from the national agencies concerned are still ongoing.

a.1.2 Doppler Weather Radar Network for Disaster Prevention and Preparedness in Cebu and Adjacent Areas

This project was approved in the latter part of 2006 and was requested for funding in March of the current year. However, the request is still on hold. As of August, detailed specifications for the Cebu Doppler radar were the subject of a consolidated working meeting. A site selection for the proposed radar station in the province of Cebu is still ongoing.

a.1.3 Doppler Weather Radar Network to Support Sustainable Socio-Economic Development in Mindanao

Right after the budget for the project was endorsed in June, PAGASA requested for a joint survey with defense officials for possible sites in Mount Manticao and other Armed Forces of the Philippines (AFP)-owned lands in Mindanao. Like the similar project in Cebu, the fund request is still on hold.

a. 2 Installation of MTSAT Receiving Facilities

A year after the installation of the NOAA HRPT Receiving System in 2006, the Weather Forecasting Section of PAGASA got another boost with the acquisition and installation of an MTSAT receiving facility. It comes with a DirectMet Analysis software which brings satellite images (ref. Figure 8) in any form the user wants. The software ingests satellite data in raw form and automatically creates specified image products in the frequency bands desired. Once the product is displayed, DirectMet provides enhancement functions, temperature measurements, map projections and other functions geared towards ease in manipulation of data.

a.3 Tropical Cyclone Information Processing Systems

PAGASA's Weather Forecasting Section (WFS), thru cooperation with the Meteorological Systems Section of the Commonwealth Bureau of Meteorology of Australia, acquired an application which provides functionality for the tracking of tropical cyclones. Called the Tropical Cyclone Module (TC Module), the software also provides a framework for enhancements such as integrated display tools for satellite imagery, radar data, numerical model output and observational data. Its flexibility and ease in deployment on laptop and personal computers affords convenience for familiarization and training purposes. These efforts are currently in progress (ref. Figure 9) but currently is not optimally exercised due to manpower requirements and to the usual priorities encountered during the summer season.

a.4 Consensus Tracks

In line with the regional thrusts towards consensus forecasting, PAGASA has recently started producing images detailing the forecast tropical cyclone tracks (ref. Figure 10) from various numerical models and meteorological centers. Plotted in ACAD 2000 software, the lat-lon positions are still encoded manually and no averaged track is produced. The agency could, in the future, do away with this present setup as the recently-introduced TC Module could afford a much better platform for data encoding, averaging and processing.

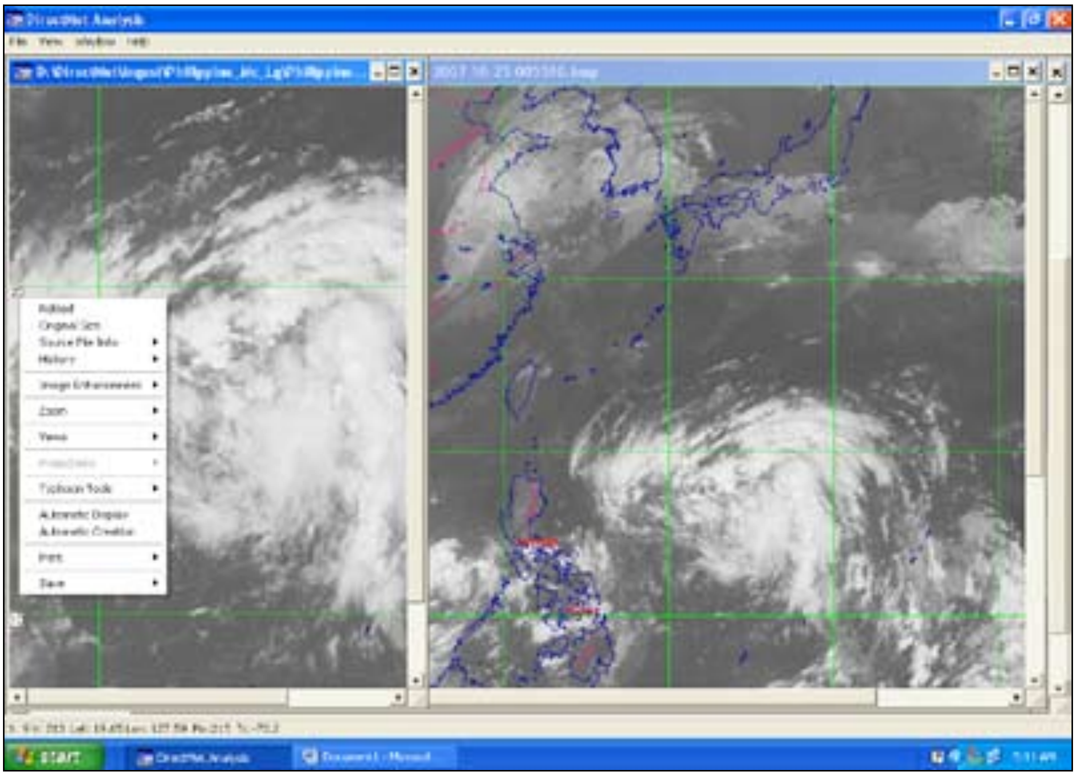


Figure 8. User interface for the DirectMet Analysis software (*MSF-WB-PAGASA*)

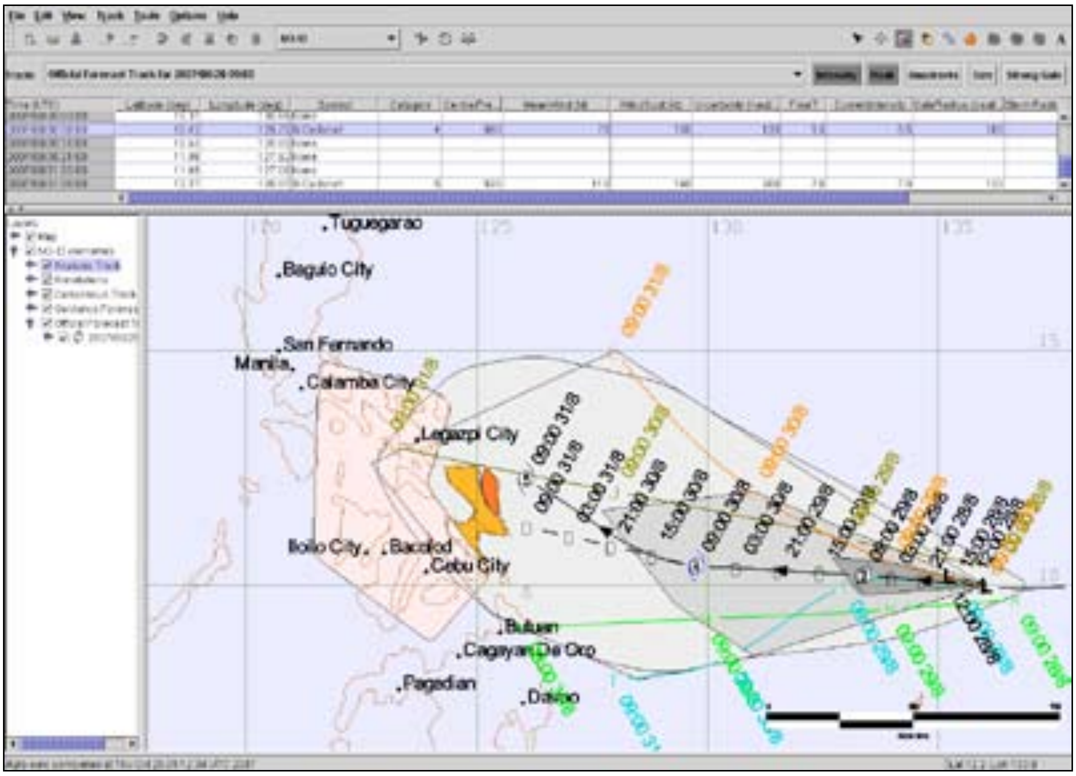


Figure 9. A sample exercise on the TC Module by personnel of the Weather Forecasting Section (WFS), PAGASA (WFS-WB-PAGASA)

a.5 Storm Surge Model

The storm surge model was the latest in the inventory of numerical aids in PAGASA's Numerical Modeling Group (NMG). Still on experimental mode, the model is based on Japan Meteorological Agency's Storm Surge Model and was introduced into the country during the WMO-sponsored 4th Regional Workshop on Storm Surge and Wave Forecasting in 2006. The dynamical scheme involves the shallow-water equations and computes storm surges due to wind setup and inverted barometer effect. Currently, the model utilizes the external forcing data containing the GRIB format files of the recently-introduced High Resolution Model (HRM). Bogusing could be applied where the pressure and wind regimes of the HRM fails. Its outputs include a time series of thirty-six (36) coastal points throughout the country (ref. Figure 11). A deficiency of continuous observational datasets, however, is the major restraint in the verification of the model. Examination of in-situ observations from previous field studies are verified against the forcings of Tropical Cyclone Best Track Data which is being provided by RSMC-Tokyo. This comes as a result of the relatively new process of archiving numerical data in the agency.

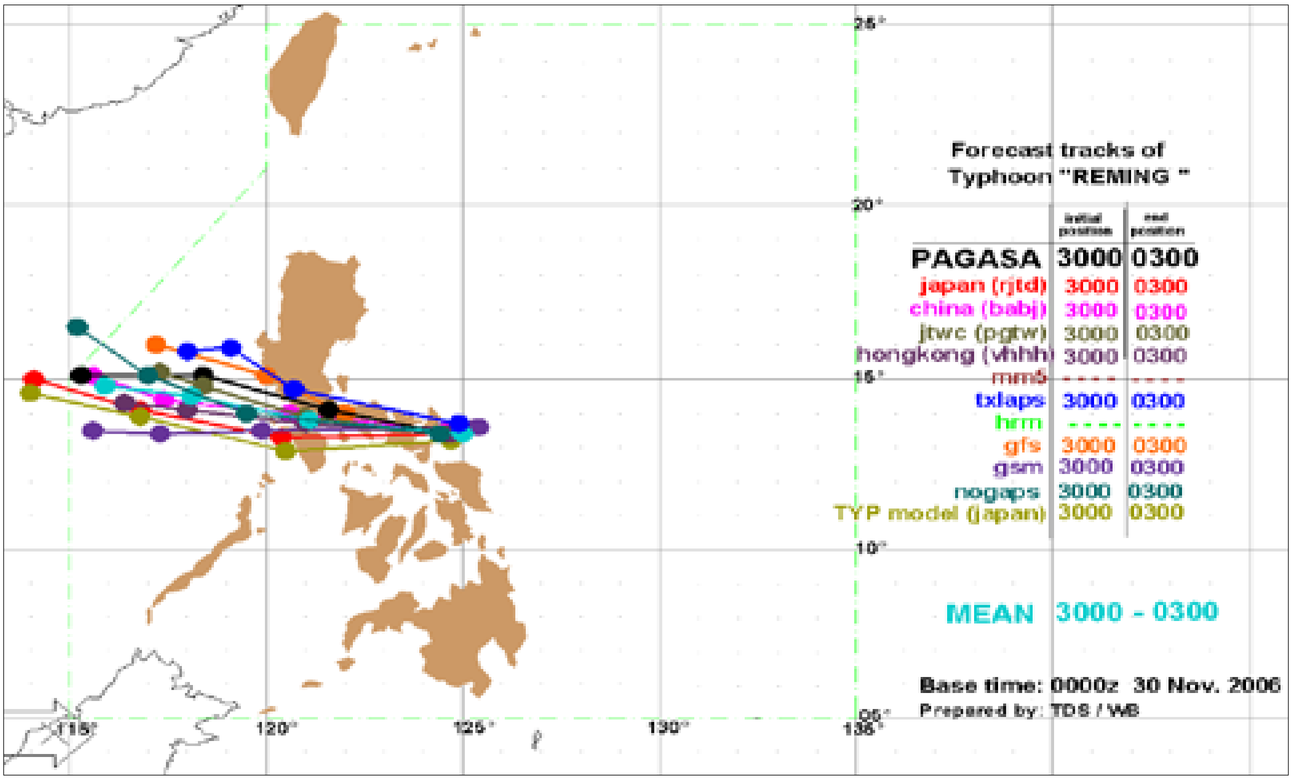


Figure 10. Tracks available for consensus during the occurrence of typhoon DURIAN (0621/local name:*Reming*) inside the area of responsibility (*TDS-WB-PAGASA*)

a.6 Repair of the GTS Message Switching System in NMC Manila

An earthquake near southern Taiwan in December 2006 caused PAGASA to request assistance from the WMO Voluntary Cooperation Programme (VCP) on a restoration project geared towards the urgent repair of its damaged GTS Message Switching System. A review of the initial damage revealed a permanent setback to one of the MSS servers including hardware and disk drives. Very important parameter files and other information also went missing. After assessing the beneficial considerations to the national development plan of the Philippines and also the implications to the World Weather Watch (WWW) and World Information System (WIS), WMO accorded favorably to PAGASA's request for assistance

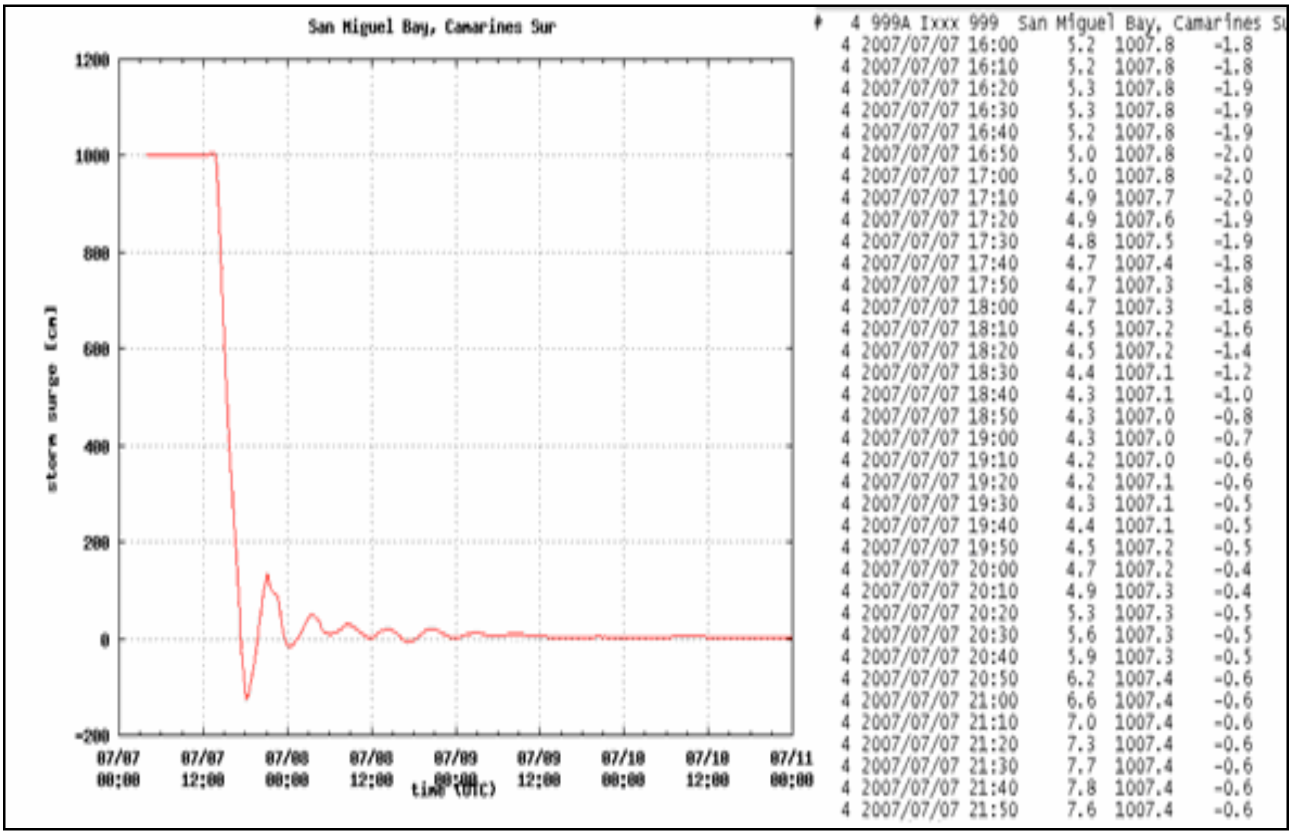


Figure 11. A sample time-series output of the JMA Storm Surge Model. Initial forcings for the model comes from the GRIB analysis fields of the High Resolution Model (HRM), a limited-area model used in PAGASA. (NMG-PAGASA)

Following discussions with the Japan Meteorological Agency, Oriental Electronic Inc., Kyoto, Japan, has agreed to offer the hardware and software for a new MSS as its contribution to VCP. Other expert services include GTS communication and performance test and on-the-job training on maintenance and operation to PAGASA personnel. As of early September, these efforts are still in progress.

Circuit configuration speeds for the new GTS MSS to and from Tokyo as well as Singapore will be 64 kbps Frame Relay. A summary of the upgrade is shown in Figure 12. Very notable in the envisioned set-up is a data visualization software called the Digital Atmosphere (ref. Figure 13). Like the TC Module, the software affords a future 'one-stop-shop' facility for weather and tropical cyclone analysis. The software also affords an opportunity for the weather forecasters to do away with manual chart analysis.

a.7 Further Expansion of the World Area Forecast System (WAFS)

Last year, the World Area Forecast System (locally called the AvIS or Aviation Information Service), was installed at the Ninoy Aquino International Airport (NAIA) in Manila with future plans of setting-up complimentary AvIS centers at other international airports in the country particularly in Cebu, Davao, Subic Bay and the Diosdado Macapagal Airport in Pampanga. PAGASA is set to install the second AvIS at Mactan International Airport in the central Philippine city of Cebu. This comes after the installation of the MTSAT facilities were completed. Cebu will act as a redundant station for PAGASA.

The AvIS software includes multi-level wind and temperature forecasts from six to thirty-six (36) hours in the future (updated at least twice daily), among others. This will guide pilots and dispatchers to calculate the expected fuel requirements of both domestic and international flights. By the end of the year, a similar software will also be installed at the Clark International Airport in Pampanga. There are no significant efforts yet on AvIS in the main southern island Of Mindanao.

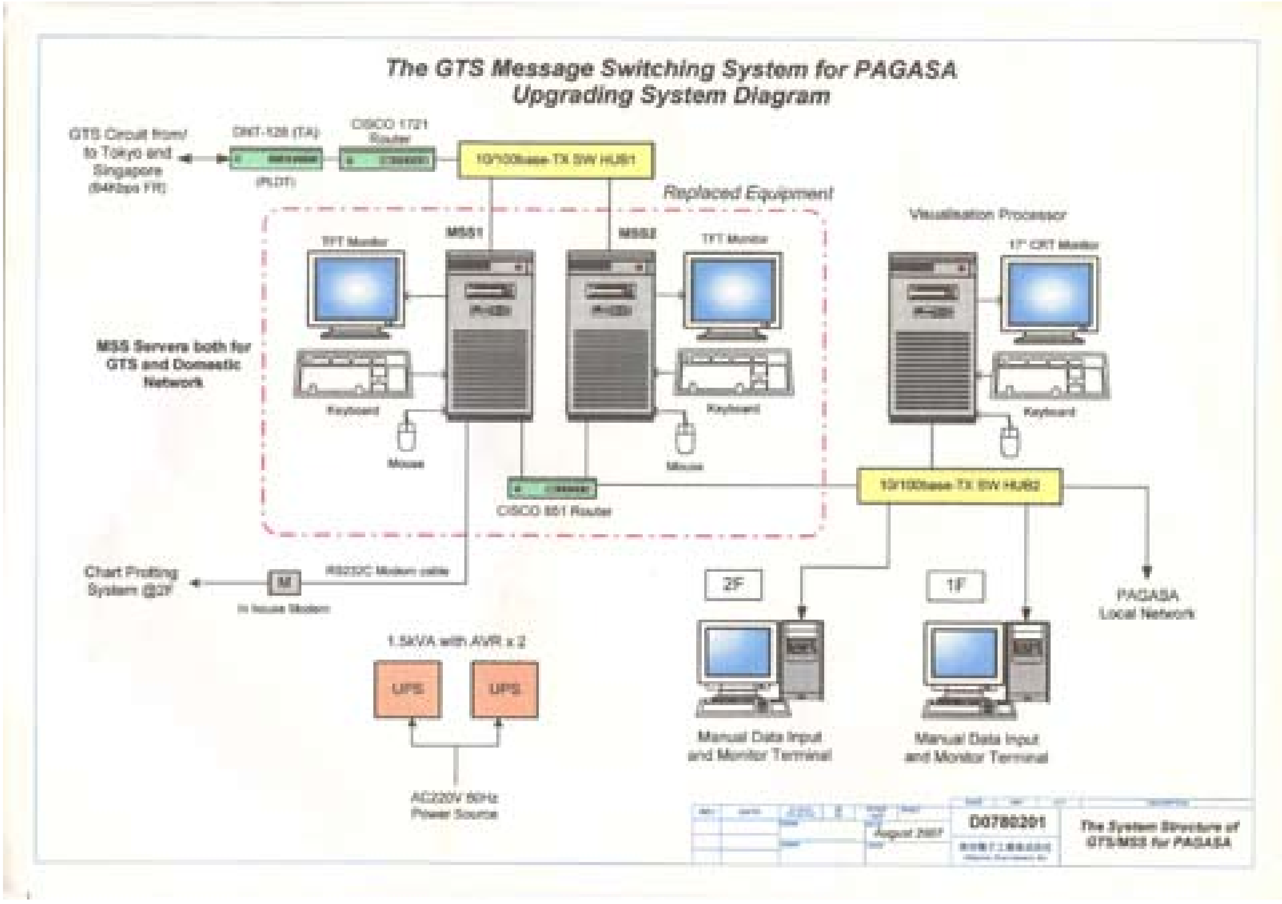


Figure 12. Upgrade system diagram of the new GTS Message Switching System for PAGASA/NMC Manila (MTS-WB-PAGASA)

a.8 Migration to Table Driven Codes

Although no definite date is clear, PAGASA's efforts towards migration may be earlier than expected. The repair of the GTS systems in NMC-Manila included enhancements which are geared to support PAGASA's future plan of migration towards Table Driven Codes (TDCF). The new system could decode data from the regional telecommunications hub but is still lacking in software and other associated technicalities for data encoding. As of current, a request for assistance on this matter was sent to WMO's Voluntary Cooperation Programme (VCP).

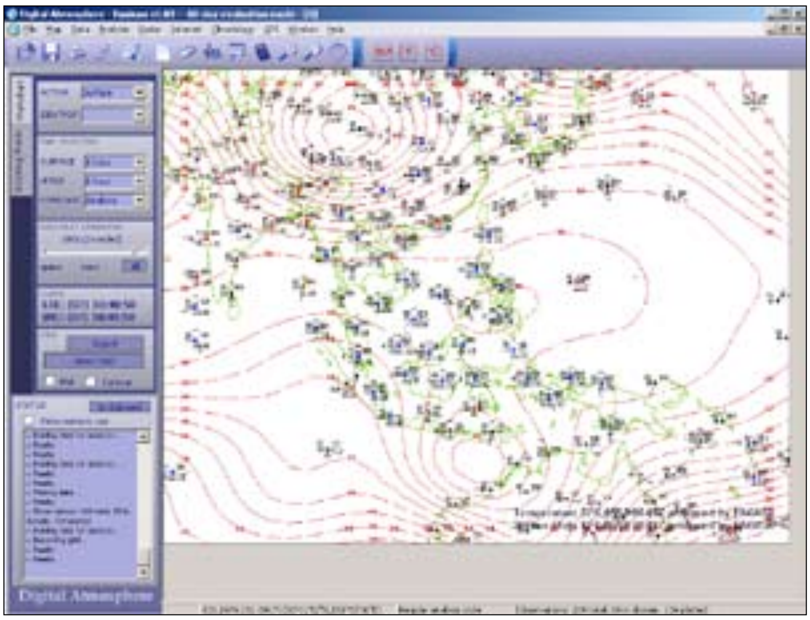


Figure 13. User interface for a data visualization software (Digital Atmosphere) included in the restoration project of the GTS MSS of NMC-Manila (WFS-WB-PAGASA)

a.9 Repair and Strengthening of the Observational Capabilities of PAGASA Stations

For this year, seven (7) agrometeorological and eight (8) synoptic stations were repaired and its observational capabilities strengthened. Rehabilitation of three more agrometeorological stations are currently in progress.

Enhancing community-based observations of rainfall remain a primary focus on this year's activities. In Southern Leyte, the province where the disastrous Ginsaugon landslides occurred early last year, twenty-three (23) rain gauges, twelve (12) water level gauges and twenty-three (23) flood markers were installed at the request of the local government. These are parallel efforts to last year's community-based projects in eastern Luzon and Mindanao.

b. Implications to Operational Progress

b.1 Storm Surge Forecasting
The local adaptation of the JMA Storm Surge Model is part of a worldwide effort aimed at increasing the capability of tropical cyclone-prone areas to mitigate its adverse effects. The Philippines, with a coastline of roughly 17,800 kms, could benefit in many ways. Aside from formulating forecasts having a higher degree of confidence, experimentations on the model using perturbed tropical cyclone tracks could enhance the probabilistic thrusts of PAGASA. By also helping raise attention to the need for addressing the vulnerability of coastal areas and forecasting not only hazards but risks, the introduction of the model could open new endeavors geared towards observational automation. This will help address the current restraints on model verifications.

b.2 Telecommunications Upgrade / Migration

The new GTS systems in NMC Manila include enhancements aimed at accelerating migration efforts towards Table Driven Code Forms (TDCFs). Data ingested in BUFR and CREX formats afford human readability and condensation. With its exhaustible storage facilities, PAGASA could stand to benefit from the new protocol's significant compression of data. This will also provide more efficient use of bandwidths and thereby reduce the overhead for software maintenance and development.

b.3 Integrated Information Processing Platforms

The recently installed information processing softwares (TC Module, Digital Atmosphere and DirectMet Analysis softwares) afford 'one-stop-shop' facilities to forecasters while in performance of their tasks. Digital Atmosphere could lead efforts towards abandoning the traditional practice of manual analysis in the Weather Forecasting Section. The TC Module could perform vector averaging functions on specified tropical cyclone forecast tracks. This comes at a time when consensus forecasting has become a trend despite the procedure's lack in physical meaning. All these are highly synonymous to convenience and ease in data centralization, manipulation and analysis..

b.4 Observational Systems / Facilities Upgrade
The continued rehabilitation on the existing observational facilities constitute PAGASA's grassroot effort in providing timely and reliable forecasts. Because rainfall has become a critical client commodity, the agency also endeavors on increasing rainfall resolution thru rain gauge installations particularly in high-risk areas. These information are critical in forecast formulations and although a majority of these observations are still not sent on real-time, short-messaging has become crucial with regards to its transmittal. The impending expansion of the WAFS facilities will further improve the provision of quality and consistent en route guidance of air traffic to different airports in the country.

c. Interaction with users, other members and/or other components

c.1 Information Education and Communications (IEC)

The IEC is a public service activity of the PAGASA aimed at increasing awareness on natural disasters that may result from tropical cyclones, thunderstorms, floods, storm surges and other extreme weather events. Recently, resource persons were deployed to different parts of the country to accommodate invitations from different organizations for lectures and presentations. Topics range from beginner's courses to seasonal outlooks on tropical cyclones.

c.1 Community-based Efforts
Community-based efforts involve the tapping of manpower from the Local Government Units (LGUs) and organizing them into an expanded rainfall monitoring network. The whole system is manned by trained municipal personnel and its capacities enhanced thru constant exchange of information, dry-runs and regular disaster information activities.
An inter-agency collaboration (of which PAGASA is one of the responsible agencies) called the Hazards Mapping and Assessment for Effective Community-Based Disaster

Risk Management (READY) was formed and aims to empower, at a community level, the most vulnerable municipalities and cities in the country and enable them to prepare disaster risk management plans. This was in direct response to the disastrous flash floods of December 2004 in eastern Luzon. It targets twenty seven (27) high-risk areas in the Philippines. As of current, READY focuses on the provinces in Leyte (ref. Section a.9) and Bohol. After preliminary discussions with disaster officials in the region, preliminary hazard maps for Southern Leyte were completed and submitted to the country's lead mapping agency (NAMRIA).

d.Training progress

From the start of 2007 up to current, 48 foreign workshops, trainings, fellowship and seminars were attended by PAGASA personnel. From all these, 35 were held in Asia; 7 in the Australia-Pacific region; 4 in Europe and 2 in the Americas. Local trainings and lectures were also conducted in 2007. These are shown in Table 3.

Table 3. Local trainings/seminars/lectures conducted by PAGASA in year 2007

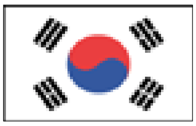
Course/Lecture Title	Date	Number of Graduates
Seminar Workshop in Message Switching System (24 training hours)	5-7 February	30
Chief Meteorological Officers (CMO) Congress (24 seminar/ workshop hours)	20-22 March	67
Training Course in LINUX for IT Personnel (38 training hours)	23-27 April	29
Training on the Use of Weather and Climate Information and New Technologies in Improving Agricultural Production (80 training hours)	4-15 June	36
Meteorological Technicians Training Course (1,920 training hours)	Tentative start date on 19 November up to 18 April 2008	-

e. Research Progress

The status of research and development thrusts in PAGASA are shown in Table 4.

Table 4. Ongoing and completed researches/studies conducted by PAGASA as of September 2007

Title	author / proponent
Low Cost Automatic Weather Station (DOST-WIND Tunnel Project) (Technical report completed as of June 2007)	Ferdinand Y. Barcenas
Philippines-China Protocol Program on Geomagnetic Field Survey and Modeling in the Philippines and South China Sea (Technical paper completed as of June 2007)	Dr. Bernardo M. Soriano / Dr. Carina G. Lao
Statistical Rainfall Forecasting over Metro Manila (continuing research / data extraction on-going)	Juanito S. Galang
Probabilistic Quantitative Precipitation Forecasting (continuing research / drafting of technical report on-going)	Shirley J. David
Study of Storm Surge affecting Western Philippine Seas (San Fernando basin- Cape Boreador area) (continuing research / data collection on-going)	Marino Mendoza
Correlation of the Phases of the Moon onTropical Cyclone (continuing research)	DL de la Cruz et al
Feasibility Study of Nightime Cloudiness in the Philippines (continuing research)	Salvador G. Quirimit et al



In Republic Of Korea

1. Progress in Regional Cooperation and Selected Strategic Plan Goals and Objectives of the Republic of Korea:

a. Hardware and Software Progress

NTR (Not To Report).

b. Implications in Operational Progress

Development of combined system for typhoon forecast based on the web

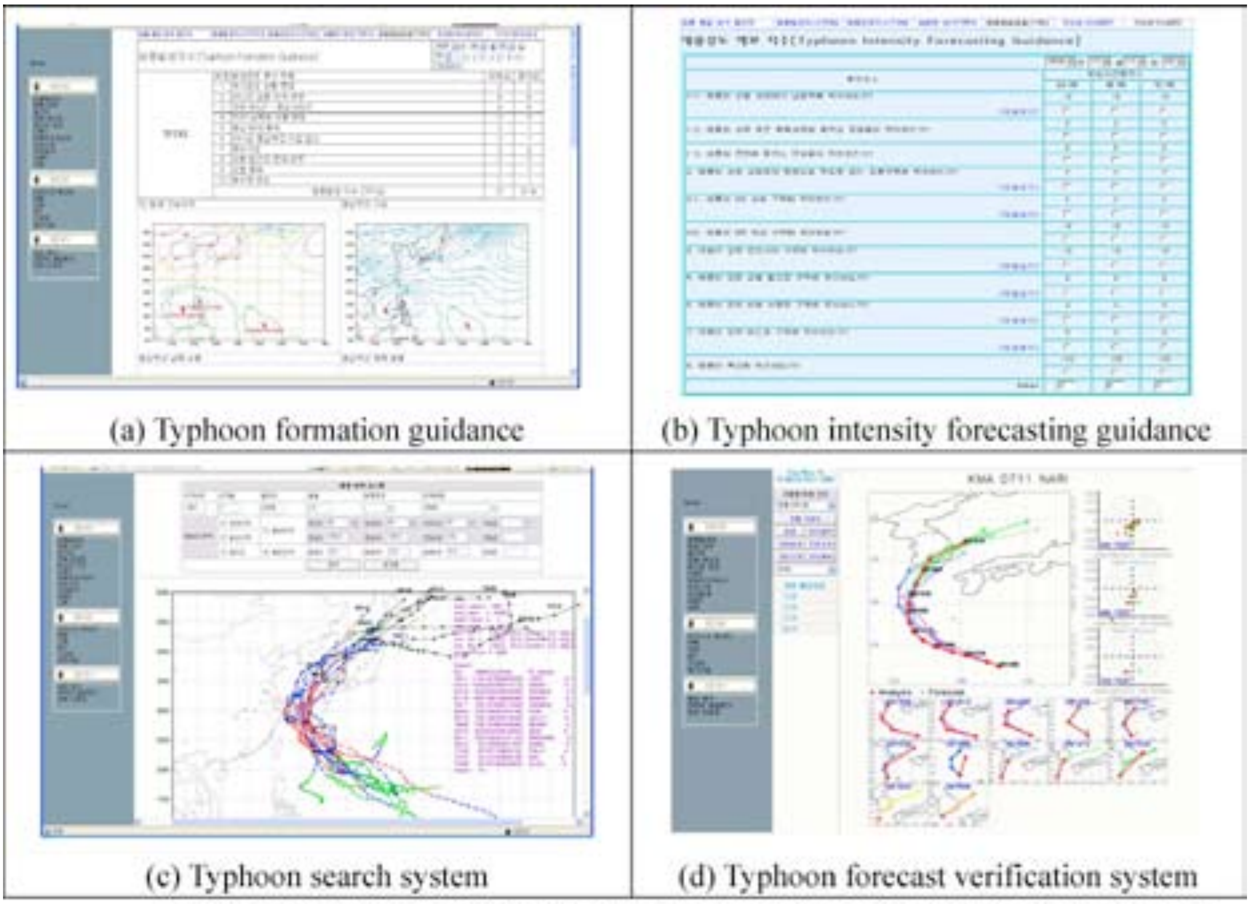
KMA has been developing a various tools for typhoon forecast based on the web since 2006.

In initial stage of typhoon, it is hard to detect typhoon formation with only a few observations over the sea and model results. The components affecting typhoon generation were investigated to develop the "typhoon formation guidance". This guidance consists of ten components such as existence of cyclonic circulation, maximum wind at the center, central pressure, sea surface temperature, and so on (Fig. 1.1 (a)). The "typhoon intensity forecasting guidance" was also developed in July 2006 (Fig. 1.1 (b)). The intensity guidance focuses on depicting the trend of each component. These two guidances have been used for the operational typhoon forecast since August 2006.

In 2007, two systems were developed such as "typhoon search system" and "typhoon forecast verification system". The "typhoon search system" (Fig. 1.1 (c)) provides the track, intensity of the past typhoon records from 1951 to 2006. The typhoon forecaster can be used for easy searching of the past typhoon tracks and intensities which are similar to the current typhoon. Forecasters can also look up the synoptic charts along with tracks and intensities of past typhoons.

The "typhoon forecast verification system" (Fig. 1.1 (d)), it provides the verification results of typhoon forecast produced by operational meteorological centers and numerical models. The verifications results can be introduced into new forecasts on real time basis.

KMA is developing new tool for typhoon forecast and analysis, Integrated Typhoon Analysis and Prediction System (iTAPS). This system will integrate various functions for typhoon analysis and forecast. The National Typhoon Center of KMA which will be opened in March 2008 and will introduce iTAPS as a main tool for typhoon analysis and forecast. KMA will be willing to support this system to other TC member countries via TC in the future.



(a) Typhoon formation guidance

(b) Typhoon intensity forecasting guidance

(c) Typhoon search system

(d) Typhoon forecast verification system

Fig. 1.1 The example of combined system for typhoon forecast based on the web

c. Interaction with users, other Members, and/or other components

NTR.

d. Education and training

Education and Training Activities

The Course on Information and Communication Technologies for Meteorological Services was held by the Korea Meteorological Administration (KMA) sponsored by the Korea International Cooperation Agency from June 3 to July 2, 2007, and was attended by 14 participants from 13 countries, including two ESCAP/WMO Typhoon Committee member countries – Viet Nam and the Philippines (Fig. 1.2).
This training course was designed to help the participants improve their IT-related jobs in meteorological services by broadening the understanding of both basic and state-ofthe-art ICT that are used in WMO IT Programs and meteorological services in NMSs.
The curriculum includes:

1) Meteorological Information and Communication
Basic Linux, Network basic, Network security, Internet protocol, FTP server, Data management, WMO Information System (WIS)
2) Meteorological Information Service
PC-clustering and its application, Introduction to the Forecaster's Analysis System, Meteorological service using web technology, Introduction to the Combined Meteorological Information System (COMIS), Use of KMA NWP products
3) IT Applications in Agrometeorology
Introduction to WAMIS (AgroMeteorological Information Service), Operational technology of Agrometeorological models, Application of GIS to Agrometeorology
4) Presentation and Discussion
Presentation of Country Report by the participants, Group Discussion

And one of the most important training course conducted by the KMA is the Upgrading Course for Career Forecaster, which is special course begun newly this year for the staff engaging in forecasting. The objective is to train the next generation of excellent forecaster with both meteorological theory and practical affairs, and to strengthen the prediction ability for severe weather such as typhoon, torrential rain, heavy snow. The curriculum includes the latest meteorological theory, weather forecasting and warning issuing, case studies of severe weather causing disaster, etc.

International Training Course on Analysis of COMS Data

The KMA and the Korea International Cooperation Agency (KOICA) jointly organized the First International Training Course on Analysis of COMS (Communication, Ocean, and Meteorological Satellite) Data. The Course took

Fig. 1.2 Course on ICT for Meteorological Services (June 3 to July 2, 2007, Seoul, Korea)

place at KMA in Seoul, Republic of Korea during 2-17 September 2007 (Fig. 1.3). The objectives of the course is to introduce the COMS which is the first geostationary meteorological satellite to be launched by Korea in 2009; to understand the COMS program such as development plan, satellite system, and data processing system; and to form a user community to share various information on the COMS.

The participants came from 13 countries in Asia-Pacific area, namely: Bangladesh, East Timor, Fiji, Indonesia, Laos, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam. There were given 17 lectures including 'COMS Meteorological Imager (MI)', 'Production and Application of COMS Meteorological Data', and 'Dissemination Plans of COMS MI User Data'. The participants also presented the status of meteorological satellite services in their own countries and experienced Korean culture as well. KMA is planning to hold this training course every year to extend the user community of the COMS in the Asia-Pacific area.

Fig. 1.3 Mr. Man-Ki Lee (fourth from the right, front row), Administrator of KMA, the training course instructors and staff members of KMA with the 13 participants from 13 developing countries at the training course on analysis of COMS data

1st JCOMM Scientific and Technical Symposium on Storm Surges

One of the most important objectives of the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) of the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO is to facilitate and support the delivery of the most visible operational outputs of the world's marine meteorological and oceanographic organizations, including warning of gales, storms, severe tropical weather systems, such as typhoons, hurricanes and tropical cyclones, and ocean associated phenomena and other marine hazards. The continuing provision of safety-related weather and oceanographic products and services is an absolutely fundamental priority of JCOMM (Fig. 1.4).

In this context, the second session of JCOMM (JCOMM-II, September 2006, Halifax) addressed the importance of enhancing storm surge forecasting capabilities, and the need to complement other international efforts including the series of capacity building workshops on storm surge and wave forecasting (organized by JCOMM and the WMO Tropical Cyclone Program) and JCOMM efforts in assisting the development of marine-related hazards warning system.

To this end, the 1st JCOMM Scientific/Technical Symposium on Storm Surges did take place at the Convention & Exhibition center (COEX), in Seoul. Republic of Korea, from 2 to 6 October 2007. The focus of the Symposium was similar to the very successful JCOMM Scientific and technical workshops in other related fields, including the International Workshop on Wave Hindcasting and Forecasting and the CLIMAR Workshop on Advances in Marine Climatology. The 150 scientist of 26 countries was participated in this symposium and the oral presentations were over 50.

Attending WMO Congress in Geneva

When he was elected as a member of the WMO Executive Council (EC) during the 15th World Meteorological Congress, Mr. Man-Ki Lee, Administrator of the KMA, pledged KMA's further expanded contribution to the capacity building of in particular developing countries in meteorological and hydrological services (Fig. 1.5).

Fig. 1.5 Mr. Man-Ki Lee (Administrator of KMA, middle of front row) attended Cg-XV in Geneva

As part of efforts to meet the expected role, KMA is planning to expand the scope of training areas and the number of trainees from developing countries and will actively participate in the WMO Voluntary Cooperation Programme by increasing its contribution of funding and in kind.

The ninth session of the joint working group in the field of Meteorology between KMA and CMA

The Ninth Session of the joint Working Group on Cooperation (JWG-9) in the field of Meteorology between KMA and the China Meteorological Administration (CMA) was held from 10 to 12 October 2007 in Seoul. At the session both sides decided to hold Joint Workshop on Tropical Cyclones (JWTC) every year from 2008 (Fig. 1.6).

right and Mr. Shen Xiaonong, Deputy Administrator of CMA) of the session signed on the summary report

As a follow-up to JWG-9, several KMA experts were sent to the Shanghai Typhoon Institute from 6 to 9 November 2007 in order to participate in the 14th National Workshop on Tropical cyclones (NWTC-XIV) of China, where they had a working-level discussion about some practical issues such as agenda to be addressed at the first JWTC to be held in Seoul, 2008.

e. Research Progress

Predicting the extratropical transition of typhoons

A number of tropical cyclones usually move into the midlatitudes and some of them transform into extratropical cyclones. This process is referred to as extratropical transition (ET). The storms undergoing ET experience an asymmetric thermal structure with the approach into the baroclinic midlatitude environment

and get a cold-core structure. As a result of this ET, the cyclones produce intense rainfall and strong winds. Presently, universally accepted definition of ET of tropical cyclones has not existed yet, and forecasters depend on the subjective experiences for the ET onset and complete. KMA is developing an objective method to determine the extratropical transition of tropical cyclones over the North western Pacific following the Evans and Hart's (2002) scheme which is based upon the Cyclone Phase Space (CPS) using the three parameters : 1) 600-900hPa lower-tropospheric thermal wind – V_t^L, 2) 300-600hPa upper-tropospheric thermal wind –V_t^U, 3) parameter B calculated as the area averaged difference of 600hPa and 900hPa geopotential heights at the right side of the storm motion minus the same term but evaluated at the left side of the storm motion to represent the level of the lower-tropospheric thermal asymmetry. These parameters are calculated in a cylinder of radius 500km surrounding the cyclone center.
An example of the CPS diagram for typhoon 'SHANSHAN (0613)' is shown in Fig.

1.7. The ET for this typhoon was declared to take place at 12 UTC 18 September by the Regional Specialized Meteorological Center (RSMC)-Tokyo, and Fig. 1.7 shows that CPS prediction of ET timing is in good agreement with the observation. This ET prediction system is under verification and will be put into operation for the typhoon forecasters.

(photo)

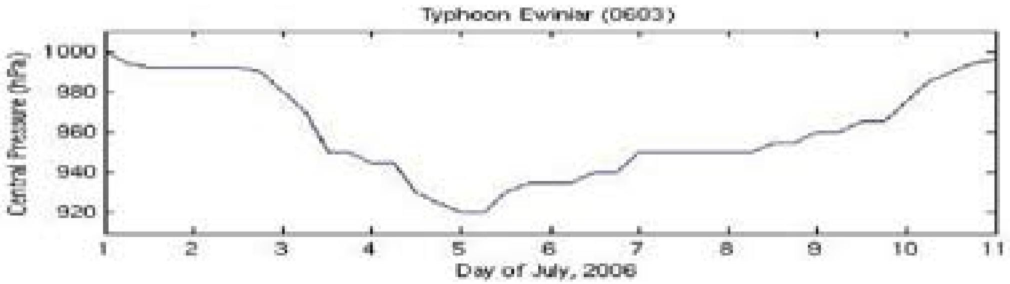
Fig. 1.7 An example of CPS Diagram for typhoon 'SHANSHAN (0613)'. In panel (a) when both –V_t^L and –V_t^U values belong to cold-core range, it is assumed that the extratropical transition of typhoon takes place. This is the same in panel (b) except that B value is in the asymmetric range for ET

Typhoon-Ocean Interaction: Ocean heat content and typhoon intensity

The upper oceanic thermal structure has been suggested as an indicator of the hurricane intensity change. Recently, Hong et al. (2000) reported the intensification of hurricane by warm core ring which has relatively higher thermal energy than around. KMA has been carrying out a study of relationship between the typhoon intensity change and oceanic heat. A Typhoon-related Oceanic Heat Content Index (TOHCI) was defined to represent the ocean thermal heat energy. The TOHCI was calculated by integrating the vertical temperature of the layer whose value is over 26 °C, which is considered as a potential energy source for the typhoon to be intensified over the ocean. The water temperature data from the International ARGO (Array for Real-time Geostrophic Oceanography) Project were used in this study. TOHCI showed that the higher thermal energy of ocean could more decrease the central pressure of typhoon indicating that TOHCI could be an excellent potential indicator to predict the typhoon intensity change.

Fig. 1.8 shows an example of comparison of sea surface temperature and TOHCI with the intensity change of typhoon 'EWINIAR (0603)'. We divided into two phases centered on July 5, 2006: before and after typhoon intensification. The Sea surface temperature (SST) was almost homogeneous above 29 °C from July 1 to July 5 (upper left panel in Fig. 1.8 (b)) even the typhoon intensity was continuously increased. After July 5, typhoon EWINIAR started to become weakened and made the ocean surface cooling. One thing interesting is that the typhoon was already under the decaying processes after July 5 even SST was over 29 °C. The TOHCI plots of lower two panels in Fig. 1.8 (b) explain the reason for the rapid intensification of typhoon over the high thermal energy area in the ocean during July 2-4 as well as the weakening over the low thermal energy area after July 5.

(a)



(b)

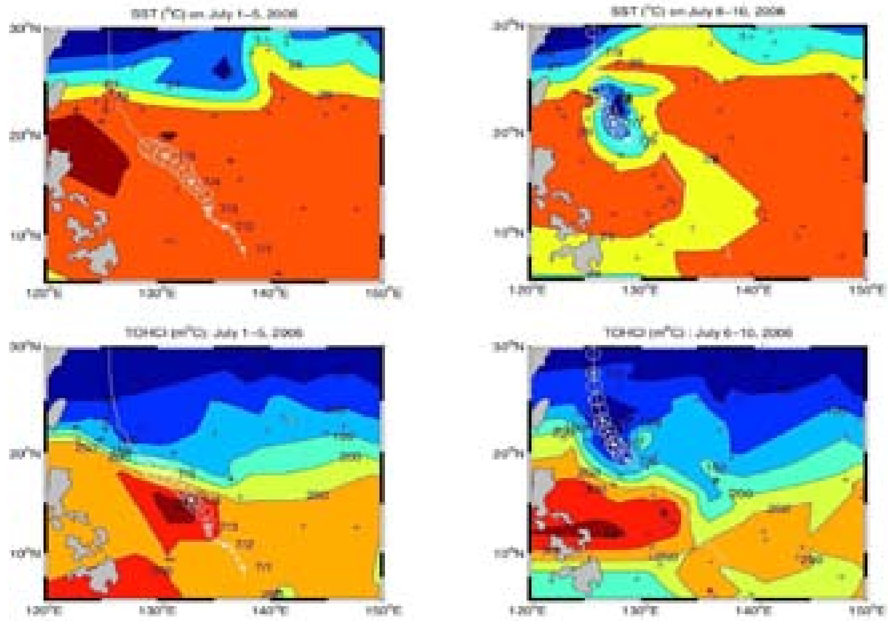


Fig. 1.8 Time series of the central pressure (a) and horizontal distribution of SST and TOHCI before and after July 5, 2006 (b), for typhoon 'EWINIAR (0603)'
Unit of TOHCI is m°C

Typhoon model development based on the WRF

KMA has been running the global and regional models together with one barotropic model for typhoon prediction. The performance of these models in typhoon prediction has not been fully satisfactory, especially in the intensity prediction, and the necessity of new dynamic model which is solely dedicated to typhoon prediction has been raised with years. The National Institute of Meteorological Research (new name of the Meteorological Research Institute, METRI) of KMA set the goal to develop new typhoon model TWRF (Typhoon Weather and Research Forecasting) based on the WRF model of NCAR. Since the KWRF (KMA WRF) which will be the KMA's next regional model already started parallel run this year with the old regional model Regional Data Assimilation and Prediction System (RDAPS) with an aim for KWRF to replace the RDAPS from May 2008, KWRF system is selected as an appropriate model to start with. KWRF will be optimized in the grid system and physics for the best typhoon prediction, and the GFDL type typhoon bogussing scheme will be implemented to improve the initial field within and around the Typhoon.

Verification of the numerical typhoon track forecasts

Four numerical models predicted the typhoon tracks in 2006: the Global Data Assimilation and Prediction System of T426L40 (GDAPS), RDAPS, Double Fourier Series Barotropic Typhoon Model (DBAR) and Ensemble Prediction System of T213L40 (EPS). Fig. 9 shows the verified model performance in the track prediction against the best track data from the RSMC-Tokyo Typhoon Center. RDAPS showed best prediction capability overall in 2006, and GDAPS was the next in TC track prediction longer than 1 day.

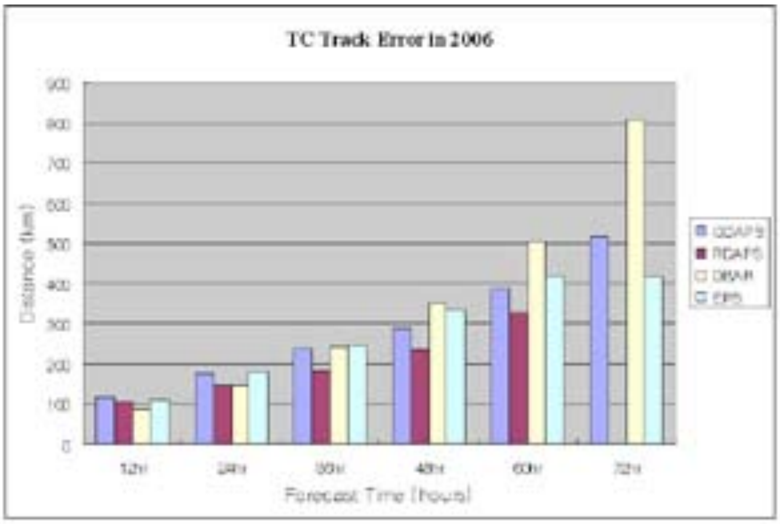


Fig. 1.9 Mean typhoon track errors in 2006 for GDAPS, RDAPS, DBAR and EPS

f. Other Cooperative/RCPIP Progress

NTR.

2. Progress in Important, High-Priority Goals and Objectives of the Republic of Korea

a. Hardware and Software Progress

Expansion and improvement of upper-air observation network

KMA has been constructing the KMA wind profiler network (KWPN) composed of ten wind profilers since 2003 to improve the temporal and spatial resolution of upper-air observation network (Fig. 2.1). In the beginning of Munsan and Gangneung in 2003, the wind profiler was installed at Gunsan in 2004 and at Masan in 2005. KMA operates currently five wind profilers including the one that was installed at Haenam by METRI. In 2007, five more wind profilers will be installed at Uljin, Chupungnyeong, Wonju, Cheolwon and the Base Station of Oceanic-Meteorological Observation 75 km off the west coast of Korea and then the KWPN will be completed. The horizontal resolution of the upper-air observation network in Korea will be highly improved from 128 km in 2002 to 74 km in 2007.

Wind data up to 5 km is collected every 10-minute through the KWPN and then assimilated in the operational regional numerical model after the automatic quality control. It may improve the prediction accuracy of heavy rain, heavy snow and typhoon track.

Nine microwave radiometers will be also installed at the sites of the wind profilers in 2008 to acquire the various information on the upper-air, such as wind, temperature, humidity, liquid water and etc. The integrated upper-air observation network will be established, which is composed of GPS observation network as well as wind profiler and microwave radar.

Enforcement of the law on Standardizing Meteorological Observation

KMA published the law on standardizing meteorological observation in Korea on December 31, 2005. The law has been in force since July 1, 2006 to protect the lives and property of the people from the meteorological disaster and promote social benefits by improving the quality of meteorological data and public use of the data (Fig. 2.2).

34 governmental and public organizations in Korea have been separately operating meteorological instruments and data acquisition facilities for their own purposes. These separate operations resulted in not only duplicate investments, but also difficulties in sharing the data with each other.

Now, in accordance with the law on standardizing meteorological observation, Korea expects to establish more efficient meteorological observation network and then to reduce meteorological disasters including typhoon. All the data acquired by each organization will be collected to KMA and their quality will be automatically checked in real time. Additionally, we can quickly cope with severe weather events and expect to increase positive economic effects in fields of various industries.

KMA will assess the grade of all the meteorological observation facilities in Korea, on the basis of the observation site and its exposure, meteorological instrument, observation procedure, data quality control and data exchange, and so on. The facilities in lower grade will be improved or removed.

Fig. 2.2 The ordinary observation facility (left) and excellent observation facility (right)

Ocean Wind Wave Prediction System

KMA has operated numerical ocean wave prediction system since 1992. The 1st major upgrade had been done in 1999 with adaptation of the 3rd generation wave model (WAM) for regional (ReWAM, 0.25° resolution, covers Northeast Asia) and extension to global (GoWAM, 1.25° resolution) domain. In 2005, the KMA replaced the NEC SX5 with a 1024-CPU Cray X1E system, which is a Parallel Vector Processor (PVP) machine with 128 node modules. The coastal ocean wave prediction system (CoWAM), which may comply intricate those environment, is designed and under testing mode. The mesh size of 1km with 6 encompassing 3° longitude and 2° latitude domains nested inside regional ocean wave prediction system. The directional wave spectra at boundaries were provided from 1/12° upgraded version of operational ReWAM. The WAVEWATCH-III code (developed at NOAA) is used for the upgraded ReWAM and new CoWAM system. To secure the required model performance in MPP architecture of new supercomputer, the Message Passing Interface (MPI) is realized in model source level. The sea surface wind and significant wave height are verified routinely in monthly bases. The global moored buoy data including the coastal ones operated by KMA and remote sensing data from Topex/Poseidon, Jason retrieval wave height and QuikSCAT retrieval wind data are used for verification of wave prediction system.

The third generation WAM cycle 4 (WAMDI, 1988) was adopted in application of Northeast Asia and global wave prediction. Two wave prediction system GoWAM (Global WAve Model), ReWAM (Regional WAve Model) are running operationally twice daily (00 & 12UTC) since then (Park, 2000). The two systems are set up on a fairly standard configuration. The wave spectrum is resolved into 24 angle bins at 15 degree resolution and 25 frequency bins from 0.0418 Hz to 0.4114 Hz. The source terms and propagation terms are integrated every 6 minutes for ReWAM and 12 minutes for GoWAM. The GDAPS T426L40 provides the sea surface wind in every 12-hour interval for GoWAM and the RDAPS 30km for ReWAM in every 3-hour interval. As the wave observation data are not assimilated in both systems, the previous 12 hour job time's forecast wave spectrum is used as an initial spectrum for the next job time integration.

The Cray X1E system is a Parallel Vector Processor (PVP) machine with 128 node modules housed in 8 cabinets. Each node module has eight Multi-Streaming Processors (MSP) with 32 Gigabytes of globally addressable shared memory. An MSP, providing 18.08 Gigaflops of peak performance, is composed of four internal Single-Streaming Processors (SSP), each containing both a superscalar processing unit and a two-pipe vector processing unit. This machine is ranked at the 16thamong the most powerful supercomputers of the world with sustained speed of 15.7 Teraflops at the time of installation.

The main focus of new system lies in accommodating coastal high resolution wave prediction. The western and southern coastal area of Korean peninsular is one of challenging places in ocean modeling for accurate prediction of wave and tide conditions. To resolve the scattered islands and complex coastal lines, the spatial mesh of 1/120° (near 1km) with 3° longitude by 2°latitude size domain was established. The directional discretion is also increased from 15 to10 degrees. Those systems for coastal wave named CoWAM (Coastal WAve Model), and there are 6 CoWAM domains corresponding to regional marine forecast zones. The 6 CoWAMs are nested inside the ReWAM which has increased spatial resolution from 1/4° to 1/12°after examining the boundary spectra made from it. The period of boundary spectra generation is set for 20 minutes interval. The bathymetry for each CoWAM domains is provided by KORDI (Korea Oceanographic Research and Development Institute). Another major shift from current system is changing the source code from WAM to WAVEWATCHIII (Tolman, 2002). Although both model show similar performance, the latter supports optional MPI interface and user friendly pre and post modules.

The WAVEWATCH-III codes supply optional choice of OpenMP and MPI switch to on and off for parallel computation. Although the MPI is platform independent interface, several modifications were needed. The original 'persistent' point-to-point MPI communication in W3GATH and W3SCAT modules are replaced by 'collective' all-to-all MPI communication to speed up. Another optimization of code was done in increasing the vector length of 'do-loop' to optimal use of multi streaming vector processors (MSP). The calculation speed of 32 MSPs cut down to 13% of 1 MSP. With new ReWAM configuration, it takes 560 seconds in 48 hour forecast. The case of typhoon 'SHANSHAN (0613)' in 2006 was examined under new wave prediction system. The CoWAM results of Southwest and Southeast domains are shown with point spectrum at KMA buoy locations in Fig. 2.3. The model spectra are presented in polar plots with concentric circles representing frequencies linearly increasing from 0.05 Hz (inner circle) to 0.25 Hz (outer circle) in 0.05 Hz interval. The isopleths of wave energy are in normalized units of m^2/Hz/rad in the direction to which waves are traveling. The significant wave height in number and wind vector in center of plot are also shown. The high and mid frequency range spectra directs southwestward while the low frequency range spectra moves northward. The sea surface wind directs southward in both locations. The CoWAM 12 hour prediction at those two buoy location shows 3.41 m and 3.95m while the observed height on corresponding time was 2.5 m and 3.5 m.

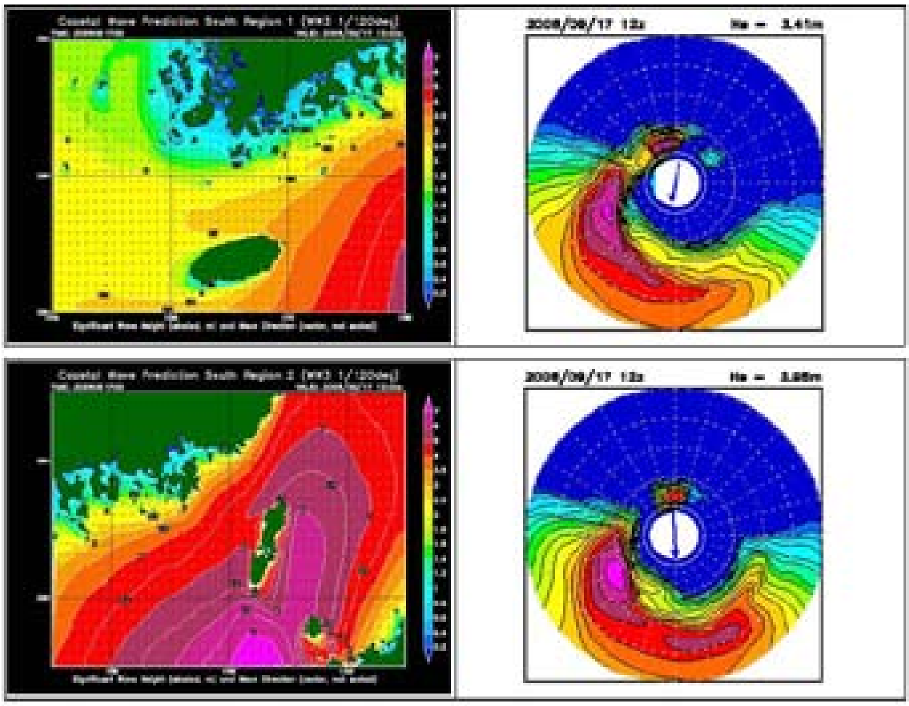


Fig. 2.3 CoWAM Southwest (upper) and Southeast (lower) domain significant wave height 12 hour forecast on Sept. 17, 2006, and the point wave spectra at Geomundo (upper) and Geojaedo (lower) buoy location

KEOP (Korea Enhanced Observing Program)

In order to mitigate the weather disaster and find out the occurrence and development of the high-impact weather, KEOP project was started from 2001. The major goals of KEOP are

1) the establishment of intensive observation network
2) the observation of high impact weathers such as typhoon, Changma front, meso
scale convective system, and heavy snowfall
3) the verification of the characteristics of high impact weather
4) the accuracy improvement of numerical weather prediction

A. National Center for the Intensive Observation (NCIO) of Severe Weathers

The NCIO was established at Haenam (south-western part of the Korean peninsula) in 2002-2003 for observing and watching three dimensional structure of high-impact weather. An unmanned automatic balloon launcher was installed for upper air observation and a flux observation tower was established for measuring the latent and sensible heat and radiation. Also, micro rain radar and optical rain gauge for cloud and precipitation research and a wind profiler for wind sounding observation were set up. In 2007, a microwave radiometer was installed for vertical temperature and humidity sounding observation. These unmanned equipments have been operated stably at the NCIO until now (Table 2.1).

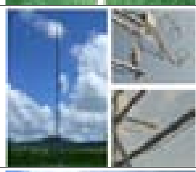
B. Intensive Observation Periods (IOPs)

In order to verify mechanism of high-impact weather, IOPs have been archived since 2001 (Table 2.2). The first phase (2001-2005), we focused on the better understanding and predictability of typhoon using aerosonde, Changma fronts and anti-cyclones at the NICO which located in the south-western part of the Korean peninsula. Although most high-impact weathers were passed through at NCIO, the observation at the NCIO was not enough to verify high-impact weathers. The reasons were very serious weathers with small scales occurred over whole area frequently. From the second phase (2006-2010), we extended our observation network into the whole area over South Korea.

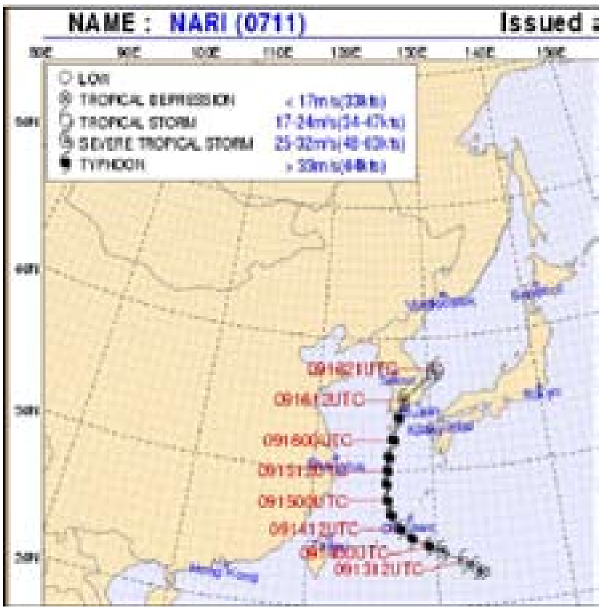
In 2006, intensive observation during summer time was performed at three sites including NCIO for two weeks (21 Jun. to 5 Jul.) with the scientific aiming at research of mesoscale phenomena in the Changma front.

In 2007, intensive observation (KEOP-2007) was made from 15 June to 15 July. During KEOP-2007, high resolution upper air observations in time and space were conducted. For increasing space resolution, additional three observational sites were added including the ordinary five KMA upper air observational sites (Fig. 2.4). Also, for increasing time resolution, two more times per a day were also conducted. Using KEOP-2007 data, the dynamic structure and evolution of high impact weather, especially Changma front, can be resolved. We implemented the experiments which examine the impact of enhanced rawinsonde observations at initial state by the assimilation using the KMA unified 3DVAR system. The cumulus parameterization scheme (CPS) at 3.3 km grid spacing domain was employed or not to test the impact of CPS on the high resolution model.

Table 2.1 The observation equipments at the NCIO Table 2.2 History of the KEOP intensive observations since 2001

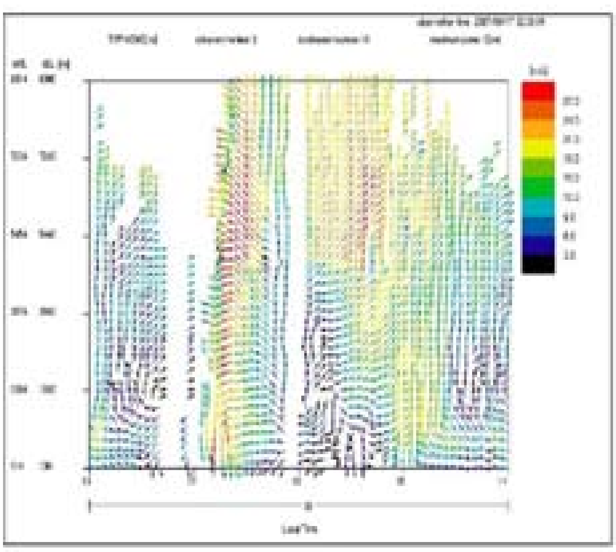
Equipment	Observation	Installation date	Picture
Windprofiler (Sumitomo)	Wind speed (U,V,W) Wind direction Signal to Noise Ratio	Dec. 2002	
Autosonde (Vaisala)	Pressure / Height Temperature Humidity Wind speed Wind direction	Jan. 2002	
Micro Rain Radar (Met-tech)	Precipitation intensity Reflectivity	May 2002	
Optical Rain Gauge (STCI)	Precipitation type Precipitation intensity	May 2002	
Flux Tower (Campbell/ADTEC)	Flux Wind speed Wind direction Concentration of CO_2 and H_2O	Jul. 2002	
Microwave radiometer (Radiometrics)	Temperature Humidity Brightness Temperature	Jul. 2007	

Year	Times	Target of intensive observation
2001	One	Typhoon 'LEKIMA'
2002	Four	Summer/Winter, Typhoon 'RUSA', Atmosphere flux
2003	Three	Spring/Summer and Typhoon 'MAEMI'
2004	Eight	Spring/Summer/Winter and Typhoon 'MEGI', Anti-cyclone
2005	Three	Spring/Summer/Winter
2006	Two	Spring/Summer
2007	Three	Winter/Summer and Typhoon 'NARI'



C. Typhoon 'NARI (0711)' intensive observation

Typhoon 'NARI' occurred on 13 September and it passed through south-western part of the Korean peninsula between 16 and 17 September (Fig. 2.5). During this period, we observed typhoon 'NARI' using the wind profiler and the microwave radiometer at the NCIO. From the observation, the vertical structure and its characteristics of typhoon 'NARI' can be resolved (Fig. 2.6 (a) and (b)).



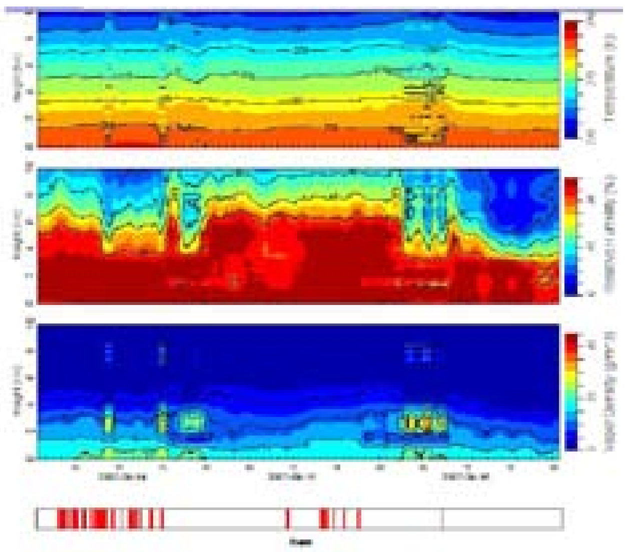


Fig. 2.6 (a) The wind vector profiles, (b) temperature and humidity of typhoon 'NARI (0711)' at NCIO

Typhoon Analysis Using Meteorological Satellite Images

Geostationary Meteorological Satellites and Polar Orbit Satellites data are very useful tools for analysis of typhoon center position and intensity. KMA has received and used satellite data from GMS, GOES-9, MTSAT-1R, Aqua and so on.

After the termination of GMS-5 and GOES-9, MTSAT-1R mission has been replaced by GMS-5 and GOES-9. Since July 1, 2005, KMA has operated the receiving and analysis system of MTSAT-1R satellite's HiRID data and has been developing a new system for typhoon analysis using them. This typhoon analysis system utilizes SSEC/UW-Madison (Space Science Engineering Center/University of Wisconsin-Madison)'s Advanced Objective Dvorak Technique which is based on satellite observations (Dvorak Technique).

Dvorak Technique (Subjective Dvorak Technique, SDT) relies on image pattern recognition along with analyst interpretation of empirically-based rules regarding the structure of convection surrounding the storm center. While this method performs well enough in most cases to be employed operationally, there are situations that the estimated centers of the same typhoon by the analysts are different form one another. In an attempt to eliminate this subjectivity resulting from analyst interpretation of the standard Dvorak methodology, Velden et al. (1998) of SSEC/UW-Madison (Space Science Engineering Center/University of Wisconsin-Madison) developed AODT (Advanced Dvorak Technique, AODT). AODT is a computer-based algorithm to objectively analyze the digital infrared information and KMA adopted AODT and has been testing it. However, since AODT was developed mainly for hurricane occurred in the Atlantic Ocean, there is a difficulty in its application to typhoons occurring in northwestern Pacific Ocean.

KMA analyzed Current Intensity (CI) number using SDT for 2004 typhoons and took AODT results from SSEC/UW-Madison for the same events and compared them. The correlation coefficient between SDT CI number and AODT CI number is as high as 0.85 and the regression coefficient is 0.7861 and the bias is 1.1361 when significant level is 0.95. Although the correlation coefficient is large, the systematic bias is more than 1 and so the results of AODT should be corrected. Moreover, the difference between both indices depends on CI number and so KMA tried to analyze the nonlinearity of them. Hsieh (2004) introduced nonlinear multi-variable time series analysis through Neural Network (NN) and KMA used that method for seeking applicable correction equation of AODT. As expected, the obvious nonlinearity appears on nonlinear regression analysis and there is a distinct difference between both CI numbers in case that CI number estimated by AODT is small. Those results represent the systematic bias is relatively large in the initial and extinct stage of typhoon. Therefore, the cause of this systematic bias should be found in order to estimate the exact typhoon CI number in northwestern Pacific Ocean.

For availability and easy accessibility, KMA developed web-based Satellite Image Analysis System, which is included in AODT algorithm version 6.3. This web-based system can access satellite DBMS system on a real time basis as user-friendly system via KMA's intranet and display lots of satellites' data from MTSAT-1R, NOAA QuikSCAT, AMSR-E on user personal computer screen. In addition to these, this system provides image overlay, image and graphic editing, simple statistical function for comparison with other typhoon information like that of RSMC, Satellite Report (SAREP) and Joint Typhoon Warning Center (JTWC).

The Supercomputer Systems

As weather and climate forecasting requires massive computing resources, KMA is exploiting the power of the 2nd supercomputer, Cray X1E system procured in 2004 and 2005. By replacing the 1st super computer NEC SX-5, KMA has met the goal of providing enough computing power for numerical weather prediction operated in recent years. KMA is also using the X1E system to develop high resolution numerical models for more accurate forecasts.

The X1E supercomputer system is composed of the main computing server with eight main frame cabinets, login servers, pre/post servers and storage systems. The theoretical performance of the computing server is 18.5 TFlops and the sustained performance is 15.7 TFlops. The X1E system is a liquid cooled parallel vector processor system. As of June 2007, the X1E system at KMA is ranked as the 53rd supercomputer, according to TOP500.org.

KMA has two major plans with regard to the future supercomputing needs. One is to procure a new supercomputer system with estimated performance of over 200 TFlops and the other is to build a new supercomputer center which accommodates the 3rd and 4th supercomputer systems in the future (Fig. 2.8).

Typhoon Prediction System

A. Improvement of Regional Forecast System

The most significant event of 2007 in the numerical weather prediction was the launch of new regional forecast system. The 10km resolution regional prediction model based on NCAR-WRF model was introduced into the semi operational suite. The WRF is the regional

(a) (b)

(c) (d)

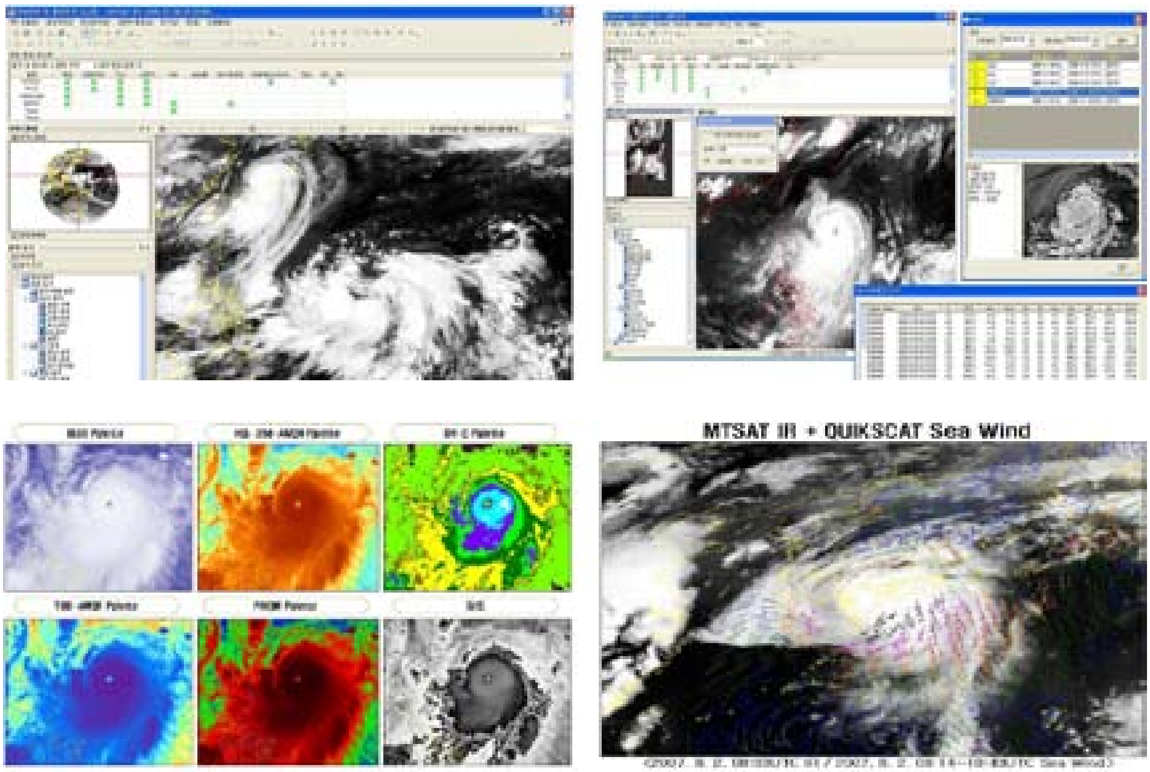
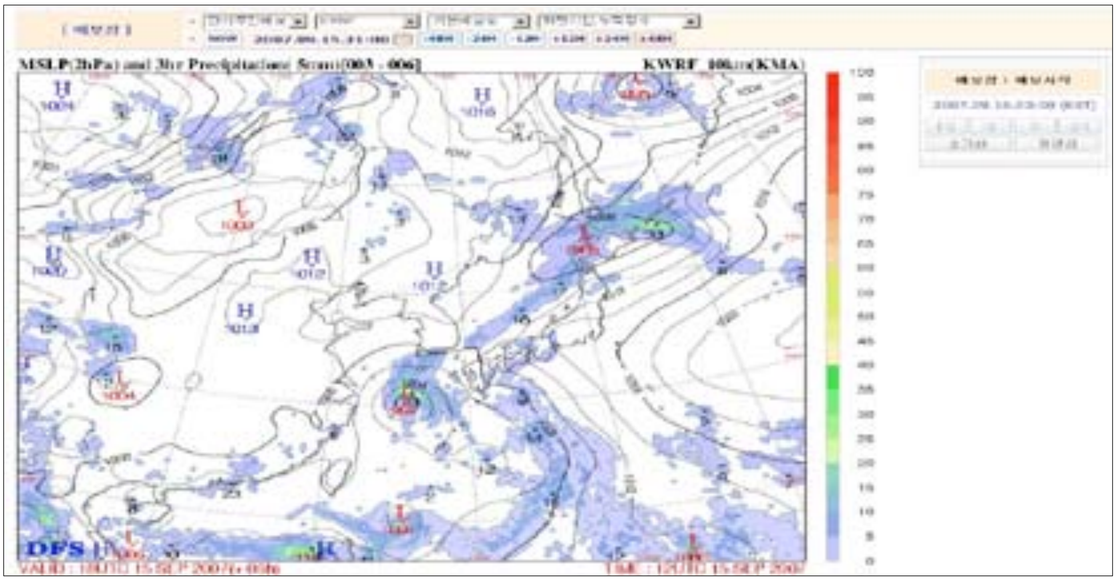


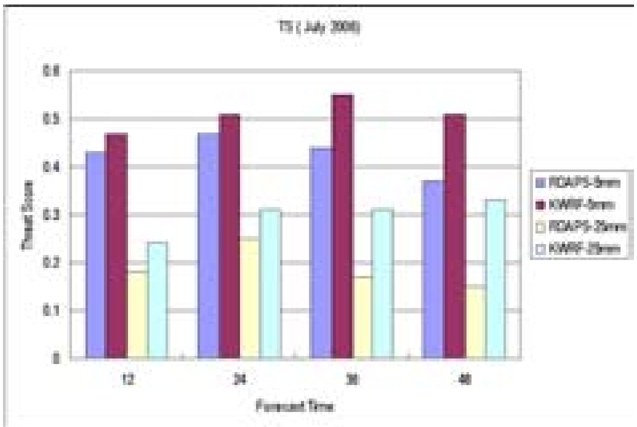
Fig. 2.7 (a) Main menu of Web-based Satellite Image Analysis System, (b) Determination of Typhoon Center location, (c) Various Palettes, (d) Image Overlay

Fig. 2.8 Location of the new supercomputer center

atmospheric model that was developed for both the operational use and research purpose, focusing on scales of 1~10 km. KWRF was coupled with KMA unified-3dvar which was made by expanding NCAR WRF-3dvar on the purpose to use for KMA global model as well as a regional model. KWRF has been operated twice a day as 6-hour data assimilation cycle since May 2007 and will completely replace the current operational RDAPS based on MM5, in summer of 2008. Figure 2.9 shows the example of typhoon forecast produced by KWRF.

The verification result states that KWRF has the superiority against the current regional model in simulating convective rainfall in point of its amount as well as its location. Figure
2.10 shows the threat score of precipitation from the current regional forecast system (RDAPS) and KWRF, where RDAPS-5mm and KWRF-5mm are for 5mm threshold and RDAPS-25mm and KWRF-25mm are for 25 mm threshold. Improvements at high thresholds of precipitation were more significant.





B. KWRF Configuration

o Governing Eq.: Primitive Equations based on the non-hydrostatic frame.
o Resolution: (1) Horizontal resolution : 574x514 grids (10km interval)
(2) Vertical resolution : 30 sigma levels
o Initial condition : 3dvar analysis (Unified 3dvar)
o Boundary condition: GDAPS T426L40 forecast
o Physics : new Kain-Fritsch scheme for deep convection, Non-local boundary layer,Dudhia radiation and NOAH land surface scheme with 4-soil layers.

Typhoon bogus with KWRF

Typhoon bogusing process was applied to KWRF and the impact was tested. The typhoon bogus module was brought from KMA GDAPS. GDAPS typhoon bogus uses the Fujita (1952)'s formula to correct the sea level pressure with the typhoon observation data in the typhoon area. It also determines the geopotential height through the empirical formula which explains the relation between the geopotential height and surface pressure. The wind components are derived by the relation of gradient wind and the temperature is calculated referring to the lapse rate.

The impact of typhoon bogus was evaluated for the selected case in July 2006 and 2007. Fig. 2.11 indicates that the typhoon track predicted by bogused KWRF (KWRF_TYBS) is closer to the best track than that of KWRF without typhoon bogus (KWRF_CNTL) and RDAPS for the case of typhoon 'EWINIA (0603)'. The distance error of typhoon center location was decreased (Fig. 2.12). The typhoon intensity is also improved a little bit, especially within 24 hour forecast (Fig. 2.13).

Fig. 2.11 The left panel is the best track and the right panel shows the predicted typhoon track from operational RDAPS (purple line with triangle mark), KWRF_OPER (KWRF without typhoon bogus; red line with diamond mark) and KWRF_TYBS (KWRF with typhoon bogus; blue line with square mark) for typhoon 'EWINIA (0603)'

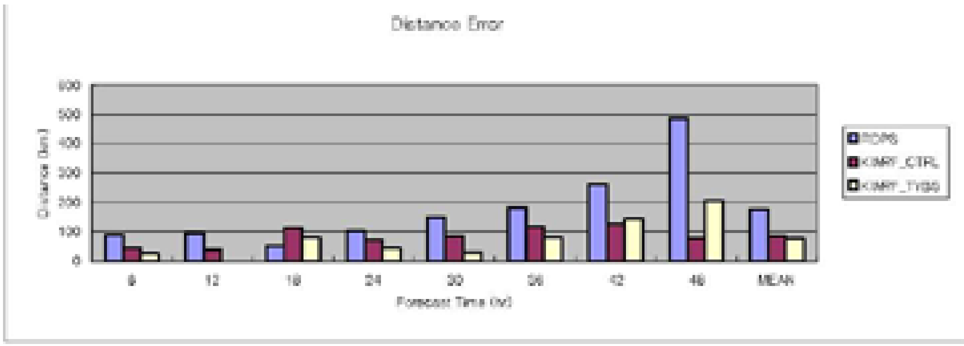


Fig. 2.12 Distance error of the typhoon center location for operational RDAPS, KWRF_CNTL (KWRF without typhoon bogus) and KWRF_TYBS (KWRF with typhoon bogus)

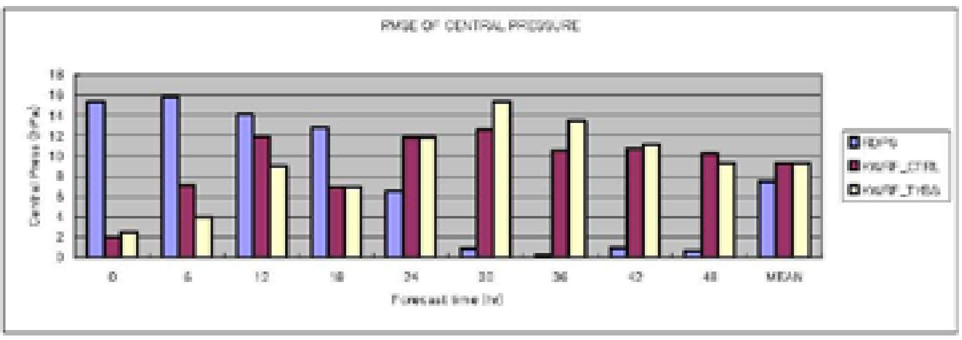


Fig. 2.13 RMSE of the typhoon central pressure predicted by RDAPS, KWRF_CNTL, and KWRF_TYBS against observation for the typhoon 'EWINIA (0603)'

D. QuikSCAT sea surface wind data assimilation in KWRF

The QuikSCAT Operational Standard Data Products (Level 2.0), which have been processed and distributed by the NASA Jet Propulsion Laboratory (JPL), were assimilated in KWRF and its impact was evaluated. The width of swath of QuikSCAT/Sea Winds is 1800 km with a spatial resolution of 25 km. It provides valuable information over the ocean, so it makes positive effect to improve forecast accuracy. Especially, it is crucial to forecast the position of typhoon because typhoon originates over the ocean where few conventional soundings or surface data are available. The QuikSCAT data assimilation will be applied to KWRF operational cycle in November 2007.
To evaluate capability of the QuikSCAT assimilation in regional forecast system, the following 3 experiments were compared.

- o KWRF_OPER : The operational KWRF as a control run
- o KWRF_QS : The experiment including QuikSCAT without data thinning
- o KWRF_QS_thinned : The experiment including the thinned QuikSCAT

Both two experiments with QuikSCAT data assimilation gave the more improved typhoon track forecast than the control run (KWRF_OPER) (Fig. 2.14). Between KWRF_QS and KWRF_QS_thinned, KWRF_QS_thinned showed better typhoon track result than KWRF_QS (Table 2.3). But, in case of the typhoon intensity, KWRF_QS showed stronger intensity than KWRF_OPER and KWRF_QS_thinned, suggesting that enough QuikSCAT data make typhoon intensity strengthen (Fig. 2.14).

Table 2.3 Distance error (km) of typhoon center location from KWRF_QS_thin, KWRF_QS and KWRF_OPER for the typhoon 'MAN-YI (0704)'

TIME	0	6	12	18	24	30	36
KWRF_QS_thin	0	166	89	46	37	102	131
KWRF_QS	0	182	106	80	11	77	138
KWRF_OPER	0	210	110	118	83	99	154

TIME	42	48	54	60	MEAN
KWRF_QS_thin	118	216	311	397	147
KWRF_QS	151	266	380	483	170
KWRF_OPER	174	274	391	555	197

b. Implications for Operational Progress Combined Meteorological Information System

The main telecommunication system of KMA is called COMIS (Combined Meteorological Information System, operated with forecasting, satellite data processing, research systems and so on. The COMIS consists of the systems for data communication, web display and database. This system collects, analyzes, and disseminates the enormous amount of data on real-time basis. It also exchanges meteorological data with other

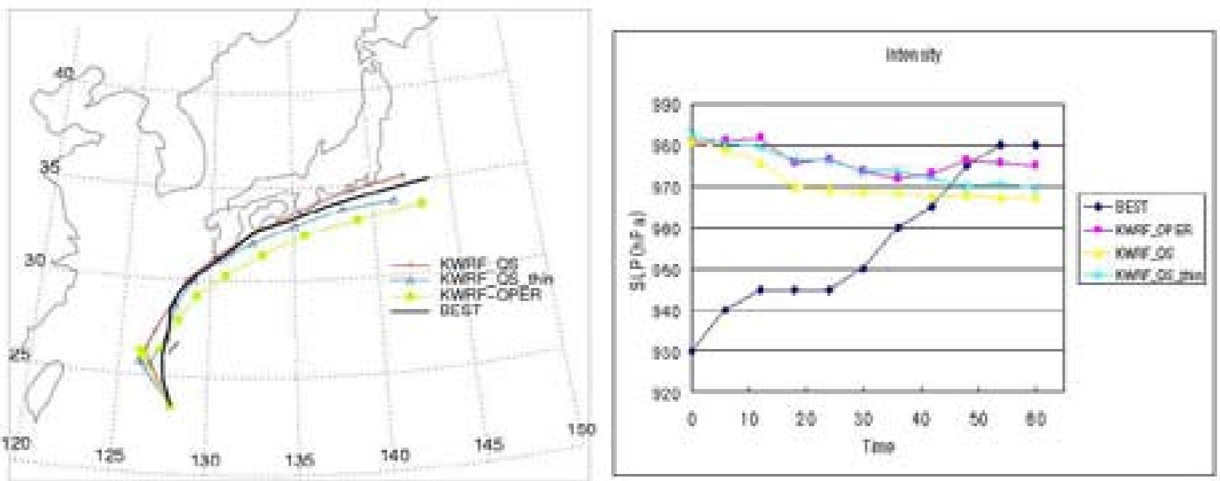
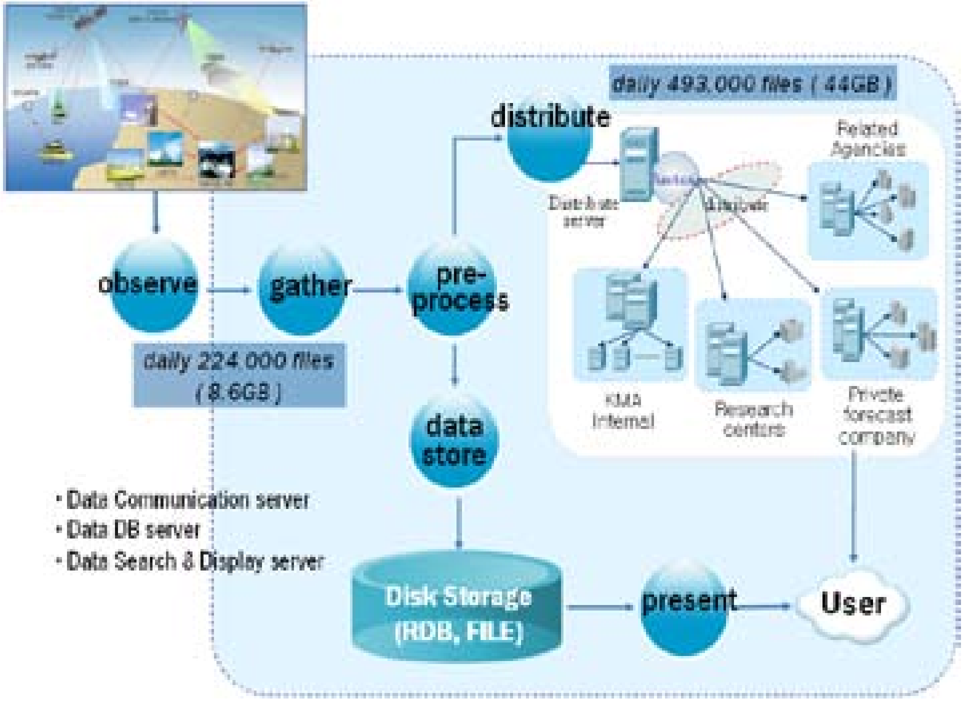


Fig. 2.14 Typhoon track (left panel) and intensity (right panel) forecasted by KWRF for the typhoon 'MAN-YI (0704)'

countries through the Global Telecommunication System (GTS), under which KMA is connected to Regional Telecommunication Hub (RTH) Tokyo and Beijing with the dedicated lines. More than 20 kinds of surface and upper air observation data and severe weather prediction maps are disseminated to all domestic weather stations and relevant organizations.
The Information Service System for Disaster Prevention



(MISS-DP) is a homepage especially designed for governmental organizations involved in disaster prevention. It provides integrated meteorological information in real time. Authorized organizations can access to MISS-DP to monitor the severe weather events.
The wide area telecommunication network of KMA has been established using the Asynchronous Transfer Mode (ATM). It integrates all of the data lines for voice, facsimile transmission, video, alpha/numeric and graphic data. The main trunk circuit of this network is the ATM of e-Government Network of Korea.

Forecaster's Analysis System (FAS)

KMA has been developing a forecaster's workstation with new forecast preparation concepts and interactive display in cooperation with the NOAA Earth System Research Laboratory (ESRL) in the US since 2000. It is a two-dimensional forecaster workstation developed to serve the National Weather Service (NWS) by ESRL. This system was designed to query all kinds of weather information interactively on a single display and can easily overlay, combine, and animate different types of data and analysis (Fig. 2.16). The FAS consists of the several display workstations and servers based on LINUX OS with the many advantages of the vendor independent system for the data processing. The operational FAS has been launched at the KMA headquarters, six regional offices in April 2002 and 38 Weather Stations in July 2003. Also, FAS has been released as an educational tool over the 14 universities since 2005. The FAS keeps up the routine maintenance and upgrade of the capabilities over the year. It was refreshed by including a state-of-the-art System for Convection Analysis and Nowcasting (SCAN) – an integrated suite of multi-sensor applications which detects, analyzes and monitors convection and generates short-term probabilistic forecast. SCAN also generates warning guidance for severe weather automatically within FAS, and it is now being used for severe weather detection (Fig. 2.17).
Nowadays by rapid developing of information technology and infra-structure, KMA is developing the construction WebFAS which allows the users to easily use and access at any places from 2006. The basic mission of the WebFAS is easily to deal with real time numerical model outputs, remote-sensing observation data, as well as synoptic data and synthetically to analyze relating dataset for forecast (Fig. 2.18). KMA hopes and supports that WebFAS will be available at any member country from 2008.

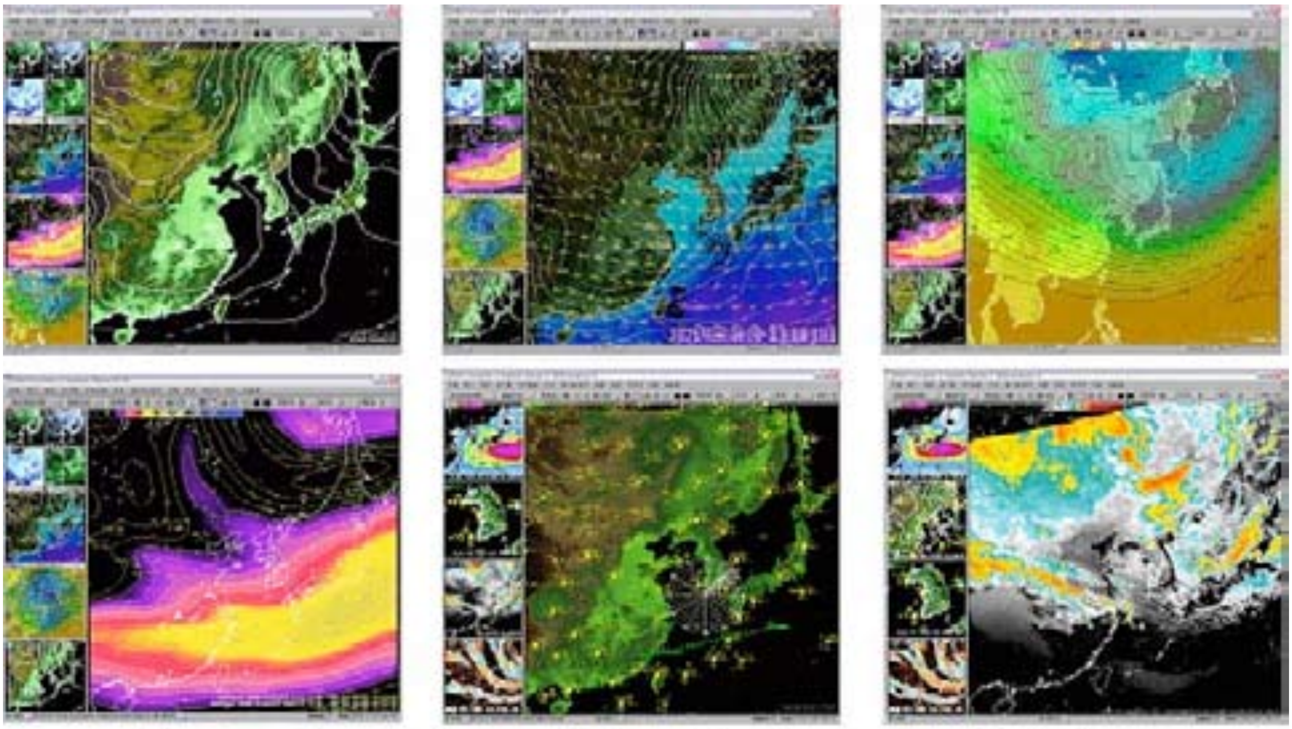
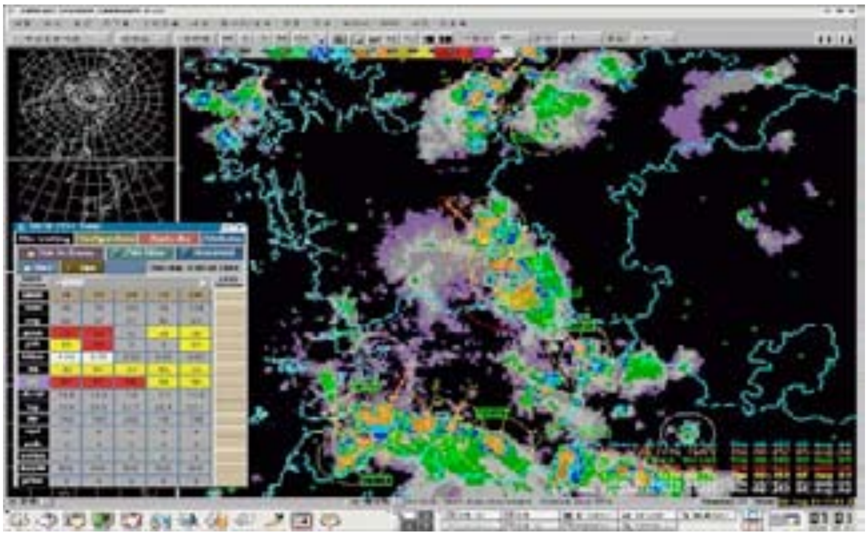
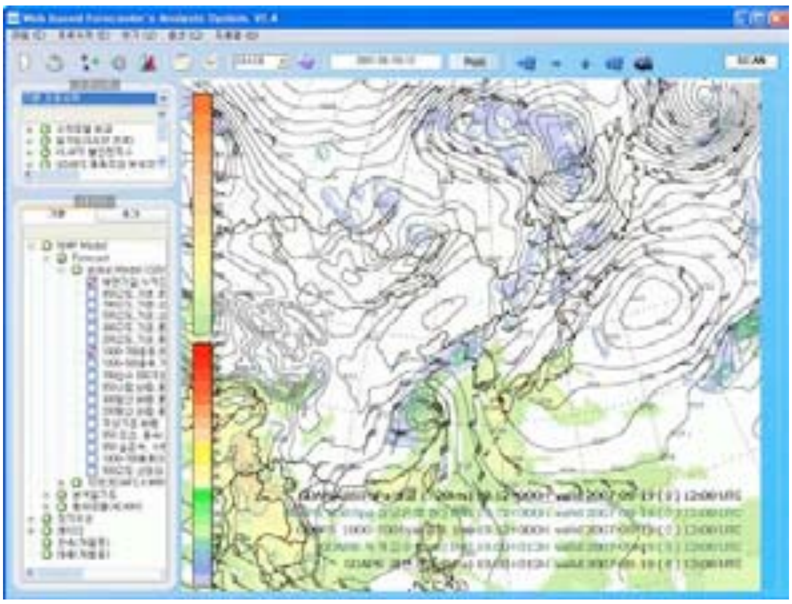


Fig. 2.16 The main frames of FAS with various meteorological data





KMA digital forecast system

While the formal conventional forecast is committed to the forecast for a wide area like a city or province, KMA Digital forecast system provides the detailed weather information focusing on small region like a village or town. It is a quantitative forecast for 12 sensible weather elements and the detailed forecast that is produced every three hours up to 48 hours based on 5 km horizontal resolution over the Korean peninsula.

Digital Forecast system (DFS) consists of

MOS (Model Output Statistics) or PPM (Perfect Prog. Method), GEM (Graphic Editing Module), and WEM (Web Editing Module). The digital forecast data which is produced by MOS or PPM are modified and edited by forecasters using GEM and displayed on the web by WEM (Fig. 2.19).
Several improvements will be made this year to upgrade DFS. In order to facilitate MOS development, an automatic production tool for MOS will be devised. It will enable users to construct MOS easier and faster. A smart tool that helps the forecasters to use GEM effectively by providing a way to select the graphic technique optionally and the improved version of WEM with higher performance and speed are to be developed.

Fig. 2.19 Main processes of KMA Digital Forecast System (DFS) that consists of PPM or MOS, GEM, WEM

Public Relations related Typhoon

KMA issued press releases periodically during the whole life of typhoons and had interviews with the media effectively to disseminate the information of typhoons to the public.
KMA produced also some VNRs (Video News Releases) itself, such as forecast commentary videos, aimed at the people's understanding and utilization of meteorological information (Fig. 2.20). KMA provided VNRs to the public through KMA's homepage at "http://www.kma.go.kr" and the Internet Meteorological Broadcasting System at "http://tv.kma.go.kr" so that people could be effectively prepared against meteorological disasters (Fig. 2.21).
In addition, KMA has tried to perform the public activities in order for the public to understand meteorological phenomena and minimize the damages by natural disasters, through diversified ways as follows;

- Running of the video for the prevention from disasters by typhoons through the gigantic electric outdoor boards in downtown and KMA headquarters
- Campaigns for the reduction of disasters by typhoons with the broadcasting media
- Publicity activities through scientific exhibition events, such as "Korea Science Festival 2007" held in Seoul, Korea (Fig. 2.22)
- Contribution to daily newspapers and magazines including the KMA's magazine, called GISANGSOSIC

Fig. 2.20 Snapshot of 'Video News Releases' related to the natural disasters

Significant improvement in operational typhoon prediction of 2007

A. Improvement of the next generation Typhoon Analysis and Prediction System

KMA is developing new tool for typhoon forecast and analysis Integrated Typhoon Analysis and Prediction System (iTAPS). This system will integrate various functions for typhoon analysis and forecast. The National Typhoon Center of KMA which will be opened in March 2008 and will introduce iTAPS as a main tool for typhoon analysis and forecast. KMA will be willing to support this system to other TC member countries via TC in the future.

B. Seminars by invited experts

- Name : Prof. R. L. Elsberry
- Affiliation : Graduate School of Engineering and Applied Science Department of Meteorology Naval Postgraduate School
- Date : 19~20 March 2007
- Title : Some recent research to improve 120-hour tropical cyclone track forecasts

- Name : Dr. T. Nakazawa
- Affiliation : Meteorological Research Institute/JMA
-Date : 19 April 2007
- Title : New challenges for Typhoon Mitigation

- Name : Mr. E. Fukada
- Affiliation : Joint Typhoon Warning Center (JTWC)
-Date : 18 May 2007
- Title : The discussion of forecaster's training in JTWC and advice of role of National Typhoon Center

- Name : Prof. M. C. Morgan
- Affiliation : University of Wisconsin - Madison
-Date : 11 June 2007
- Title : An adjoint –derived forecast sensitivity study of Hurricane Floyd (1999)

C. Set up KMA's own criteria for extratropical transition
When typhoons are under decaying stage in middle and high latitudes, in general, typhoons change to extratropical low. Extratropical transition (ET) means the changing process from typhoon to extratropical low. Although the decision whether a tropical cyclone is still keeping typhoon or changes to extratropical low is very significant work for not only meteorology, but also other fields such as hydrology and disaster prevention, it is not a quite easy job to decide ET or make extratropical low in operational field because even the definition of the ET is not very clear yet. Thus, the ET affair has been one of the most scientifically challenging problems for typhoon forecasters. As the first step to set up the ET affair scientifically, KMA established criteria for extratropical transition in August 2007. The criteria consist of five steps including many components such as wind speed, satellite image, sounding, and so on (Fig 2. 24). KMA has been employed operationally this criteria for announcement of extratropical lows on typhoons since August 2007.

Welcoming typhoon expert and organizing typhoon expert committee

KMA has held several technical seminars to improve typhoon analysis and forecast skills with invited overseas typhoon experts. In the seminars, there were fruitful discussion between invited experts and KMA experts on the overall fields related to tropical cyclones.
KMA has also been cooperating with academies through organizing typhoon expert committee. KMA lets the theoretical knowledge and operational skills for typhoon be harmonized and be developed with the expert committee. In particular, the "definition of super typhoon" and its meteorological and social meaning were discussed at the expert meeting of super typhoon in 14 May 2007 (Fig. 2.24). Many experts proposed the new classification of typhoon intensity in this meeting due to the outbreak possibility of super typhoon. KMA is considering new classification of typhoon intensity positively according to the suggestion by the committee.

Fig. 2.23 The expert meeting of super typhoon (14 May 2007)

Launch of the National Typhoon Center in 2008

The construction of the National Typhoon Center (NTC) is now under way in Korea for more timely and effective typhoon forecast (Fig. 2.25 and Fig. 2.26). The NTC will be located at Jeju Island, Korea and will be completed in December, 2007. Thus, KMA will conduct forecasting and monitoring of typhoons at the NTC from early 2008. The mission of this center is to produce more accurate and appropriate typhoon forecast for all typhoons generated in the Northwest Pacific as well as when the typhoons are drawing close to the Korean Peninsula. In addition, it is expected that disasters by typhoons would be mitigated by promoting the cooperative activities and researches with other countries and international organizations.

c. Interaction with users, other Members, and/or other components

NTR.

d. Training progress

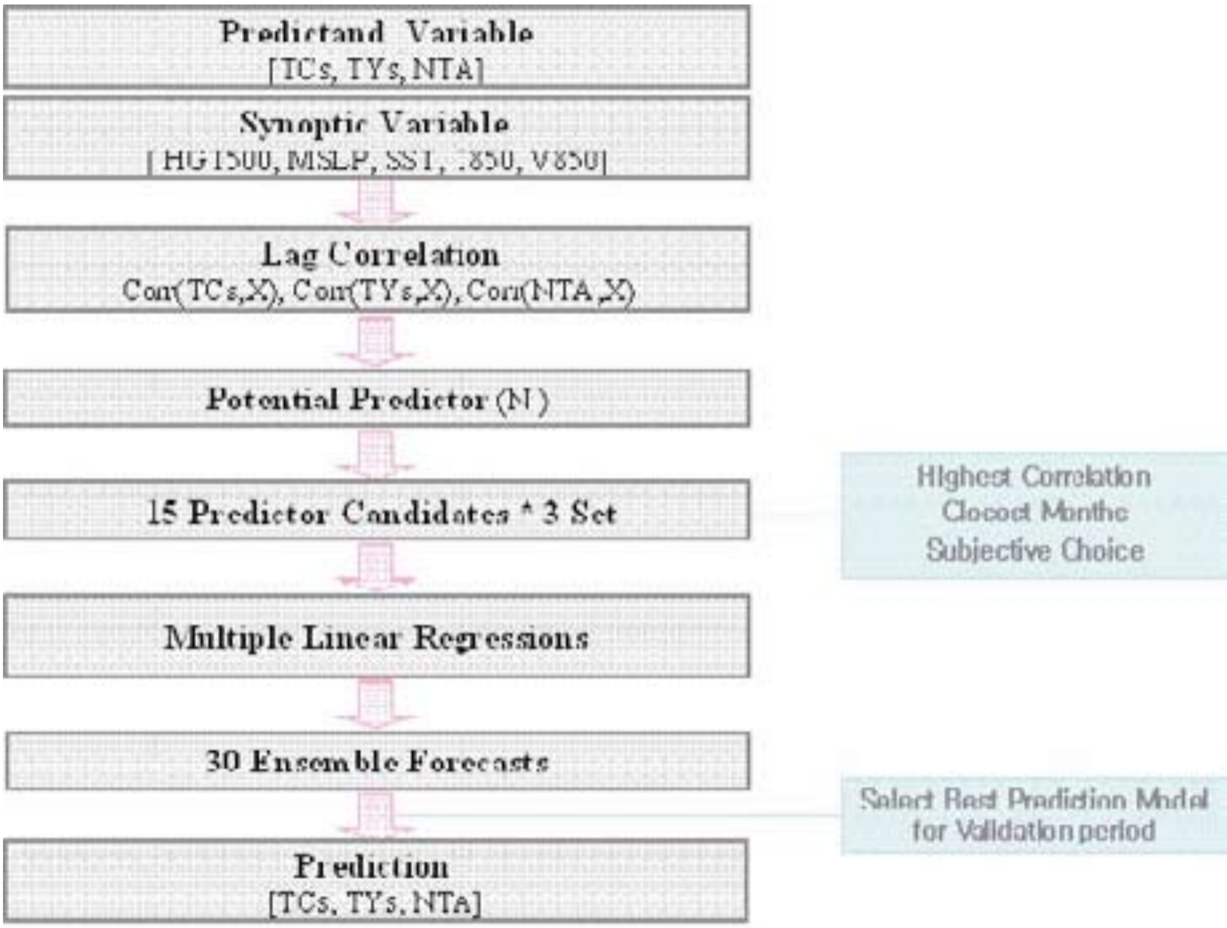
NTR.

e. Research Progress

Seasonal Prediction of the Tropical Cyclone Activity over the Western North Pacific and the Korean Peninsula

Tropical cyclone is the most destructive natural phenomenon in the world. To predict this destructive tropical cyclone there have been many prediction studies using a statistical model or a dynamical model.

A statistical model has been developed for the purpose of predicting the seasonal activity of tropical cyclones over the Western North Pacific (WNP) and the Korean peninsula. The predictors are the number of tropical cyclones (TC), tropical cyclones that exceed typhoon strength (TY) and the overall TC activity index which is referred to as Normalized Typhoon Activity (NTA) index during summer period (June to August), fall period (September to November), and over the whole year (May to December).



Using the lag correlation among synoptic predictors such as sea surface temperature (SST) and mean sea level pressure (MSLP) and the frequency of typhoon genesis, high lag correlation predictors used for statistical models were selected. After making three sets of data based on closest months, highest correlation and subjective choice, the prediction equations were derived by using selected predictors in the multiple linear regression applying the 30year moving window method-after creating a prediction value, produces prediction value with a same method by moving one year by one year, and the combination of independent variables with the lowest root prediction error of sum of squares (RPRESS) from all the possible combinations was selected. In addition, to reduce the uncertainty of forecast existing when predicting by a single prediction value, the ensemble model of 60 members for the frequency of tropical cyclones was predicted by differentiating validation periods. From 1972 to 2004 typhoon data reported at RSMC-Tokyo are used as variables. Using the data such as 500 hPa geopotential height, monthly sea level pressure, SST, 850 hPa temperature, and 850 hPa meridian velocity from May 1971 to August 2004, 30 ensemble forecasts are made for predicting typhoon activity. Fig. 2.27 shows the flow chart for processing the statistical model.
TC, TY, and NTA index are ensemble predicted by a statistical model in three summer months, fall months, and over the whole year in WNP and TC that may affect over the Korean Peninsula is also ensemble predicted in three summer and fall months. Table 2.4 shows the predicted TC, TY, and NTA over the western North Pacific and TC forecasts

over the Korea peninsula from statistical model. As a result, over the western North Pacific, 19.6~25.9 TC was predicted for May-December, 4.2~13.4 for June-August, and 7.9~12.1 for September-November. With respect to the frequency of cyclones that may affect over the Korean Peninsula, 1.6~4.2 was predicted for June-August, and 0.3~1.4 for September-November. For in the whole year, TY is predicted between 9.8 and 17.2 and NTA index is predicted between 103.5 and 176.9 over the western North Pacific. For in three summer months, TY is predicted between 5.4 and 8.7 and NTA index is predicted between 20.3 and 47.7 over the western North Pacific. For in three fall months, TY is predicted between 3.1 and 6.2 and NTA index is predicted between 40.6 and 79.2 over the western North Pacific.
Ensemble predictions of the three summer months, three fall months, and over the whole month in WNP and the three summer months and three fall months in Korea are verified by Reliability, Brier score (BS), Relative operating characteristic (ROC), Economic value (EV) from 1994 to 2005. It is verified by category because there are a few ensemble data, and added the each of prediction variables, object season, category of above normal, normal, and below normal. Above normal is the best result in the verification methods, but normal and below normal also show good results. Generally, the statistical model show high forecast in all of the verification methods. The seasonal prediction of the TC activity over the western North Pacific and Korea with this scheme has been applied over the 2007 year. It turns out that the overall TC activity of 2007 was slightly overestimated while the TC activity which affects Korea was reasonably successful (Table 2.4).

Table 2.4 Ensemble prediction result of 60 members by statistic model in 2007 and climatology and observation data over WNP and the Korean peninsula.

2007		Predictand variable	Ensemble Prediction (Spread)	Observation	Climatology
WNP	May-Dec	TC	23.0 (19.6-25.9)	17 + ?	25.0
		TY	14.4 (9.8-17.2)	13 + ?	12.5
		NTA	141.5 (103.5-176.9)	71.0 + ?	128.4
	Jun-Aug	TC	10.2 (4.2-13.4)	7	11.2
		TY	6.8 (5.4-8.7)	5	5.0
		NTA	34.7 (20.3-47.7)	32.3	48.1
	Sep-Nov	TC	9.6 (7.9-12.1)	8 + ?	11.5
		TY	5.1 (3.1-6.2)	6 + ?	6.4
		NTA	63.2 (40.6-79.2)	31.2 + ?	68.1
Korea	Jun-Aug	TC	2.4 (1.6-4.2)	2	2.4
	Sep-Nov	TC	0.8 (0.3-1.4)	1 + ?	1.0

f. Other Cooperative/RCPIP Progress

NTR.

3. Opportunities for further Enhancement of Regional Cooperation

NTR.

In Singapore

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress.

Nil

b. Implications to Operational Progress

Nil

c. Interaction with users, other Members, and/or other components

The International Research Institute for Climate and Society (established through a cooperative agreement between Columbia University and the National Oceanic and Atmospheric Administration of the United States of America -NOAA) and the ASEAN Specialized Meteorological Centre (ASMC) conducted a joint training workshop on the ASEAN Seasonal-Interannual Climate Prediction and its Applications in Singapore on 21-30 May 2007.

The workshop provided participants with an overview of seasonal forecasting methods, with a focus on statistical downscaling. The central theme was the tailoring of forecast and other climate information for risk management applications, for which practical statistical approaches were introduced.

The workshop was hosted by ASEAN Specialized Meteorological Centre (ASMC) which is co-located in Meteorological Services Division (MSD) of the National Environment Agency (NEA). It was held at NEA, Environment Building, Singapore. This workshop was a collaborative activity under the Memorandum of Understanding between NOAA and NEA-MSD for Technical Cooperation in Meteorology and Climate.

This 2007 workshop is a follow up of the 2006 activities. In Nov 2006, a team of scientists from five ASEAN countries (Indonesia, the Philippines, Singapore, Thailand, and Vietnam) were invited by International Research Institute (IRI) for a one month working visit in IRI. The attachment to IRI involved the study of the correlations of various large-scale global circulation data and SSTs with the local rain fall gauges data, brought by the participants. The result of the attachment is the selection of an IRI-developed statistical tool, Climate Prediction Tool, and the use of appropriate data sets, namely the global climate model, ECHAM, and tropical SSTs, for the 2007 workshop.

The model outputs are currently being used in MSD in addition to other tools.

d. Training progress

With the establishment of the Tsunami Early Warning System, MSD has in the past year been very active in staff training in both professional and administrative fields. The following lists the participations in regional training programs.

- Three meteorological officers are currently attending the "Applied Meteorology Course for Forecasters" at Nanjing University of Information Science & Technology (NUIST), China from May 2007 – January 2008.
- One meteorological officer participated in the Typhoon Committee Roving Seminar held in Manila, Philippines on 3–8 Sept 2007.
- One meteorological officer participated in the "3rd Session of the Forum on Regional Climate Monitoring Assessment & Prediction for Asia" on 3–7 April 2007 in Beijing Climate Centre, Beijing, China.
- One meteorological officer attended the "WMO Regional Seminar on Enhancing Service Delivery" in Kuala Lumpur, Malaysia on 1-6 April 2007.
- One meteorological officer attended the "Training Course on Severe Convective Storm Nowcasting in Beijing, China on 31 March–13 April 2007.
- One meteorological officer attended the WMO International Training Workshop on Tropical Cyclone Disaster Reduction on 25 March-1 April 2007 in Guangzhou, China.
- The ASEAN Specialised Meteorological Centre (ASMC) in collaboration with NOAA-IRI organized a "Workshop on ASEAN Seasonal-Interannual Climate Forecasting and its Applications in Singapore on 21–31 May 2007. The Workshop was attended by officers from the ASEAN Member countries (Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam). Climate experts

from USA, Australia, Indonesia and Singapore were invited as lecturers at the Workshop.

A number of the above were Typhoon Committee sponsored training programs. MSD would like to express her gratitude to the host countries for providing the opportunities.

e. Research Progress

f. Other Cooperative/ Strategic Plan Progress.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress

Development of National Tsunami Early Warning System

The development of Singapore's national Tsunami Early Warning System comprises the enhancement of the seismic and tidal monitoring systems, development of tsunami modelling capability as well as a national tsunami response plan. The objective of the system is to enable Singapore to better assess potential impacts of tsunamis on the country, enhance its national preparedness and contribute to regional and international efforts to monitor and mitigate potential disasters. The upgrade of the seismic and tidal gauge systems and the development of the tsunami modeling capability are in progress and is expected to be completed as planned in Aug 2008. A national tsunami task force led by MSD has been formed to coordinate the efforts of the various response agencies to deal with a tsunami incident. A preliminary response plan has been formulated to guide agencies in the event of a tsunami incident.

Migration of the Main Computing System

The mainframe computer is the core data processing system in MSD and handles the processing of weather data generated locally as well as those received from weather stations around the world. These data are used for performing weather analysis and forecast and for the generation of specialized products and services customized to meet the specific requirements of MSD main user groups. The current mainframe computer system which was installed in 1994, is in the process of being replaced with an open system based on a J2EE 3-tier (web, application and database) architecture, which will facilitate further development and integration of various computing resources in MSD. The migration process which has taken about a year and a half is close to completion and is expected to be rolled out to users by Nov 2007. The new system will present users with a more user-friendly web portal interface as well as support the provision of web services to users.

Revamp of Weather Information Dissemination System

MSD is currently in the process of upgrading its integrated weather information dissemination system, which provides weather information to the public through various communication channels (such as interactive voice, fax, pager and SMS). With the increasing popularity of mobile phones, the system has been enhanced to enable the dissemination of a large volume of SMS to users in a very short period of time. This system is currently used for automatically disseminating SMS alerts of earthquakes/tremors and heavy rain incidents to public agencies as well as lightning risk warnings to subscribers.

b. Implications to Operational Progress (including exchange of in situ and remotely sensed data and uses; development of guidance and data requirements; improved use of consensus/ensemble model guidance; exchange of information with other Members via the internet; validation and verification activities; exchange/provision of information among Members; use of these exchanged data/information for improved forecasts; establishment of networks; expansion of the area coverage of forecasts and warnings; improvement of accuracy of forecasts/ warnings; development of related tools and techniques; and improvement of timeliness of forecasts/warnings dissemination).

c. Interaction with users, other Members, and/or other components (including improvement of meteorological products to meet users' requirements and expectation; enhancement of community participation;

linkage with other components (hydrology and DPP); use of integrated meteorological products and services in capacity building and sustainability decisions; and development of regional requirements; new dissemination methods).

d. Training Progress (As in 1d)

e. Research Progress

The Research and Development Section of MSD has developed the Systematic Objective Area Prediction (SOAP) system which uses WRF as the underlying mesoscale prediction model. The system is developed in Linux with open-source tools and shell scripting. SOAP is on operational trial and is evaluated daily with the images from of the precipitation radar.

f. Other Cooperative/ Strategic Plan Progress.

Nil

3. Opportunities for Further Enhancement of Regional Cooperation

Nil.

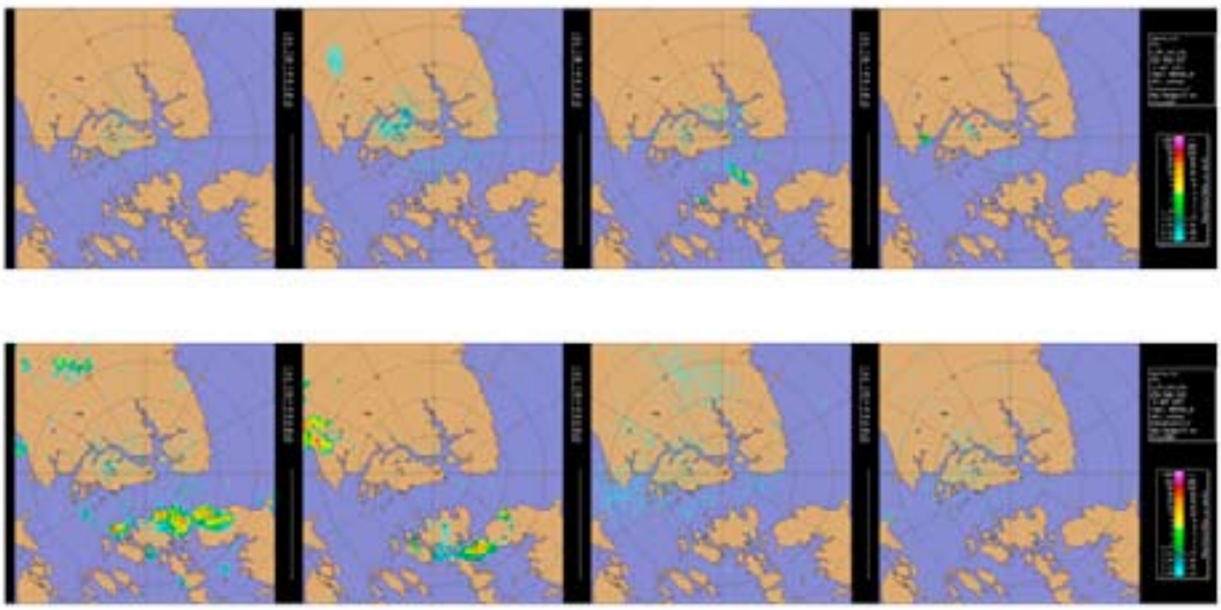


Figure 1 Radar images of rainfall over Singapore on the 6 Sep 2007

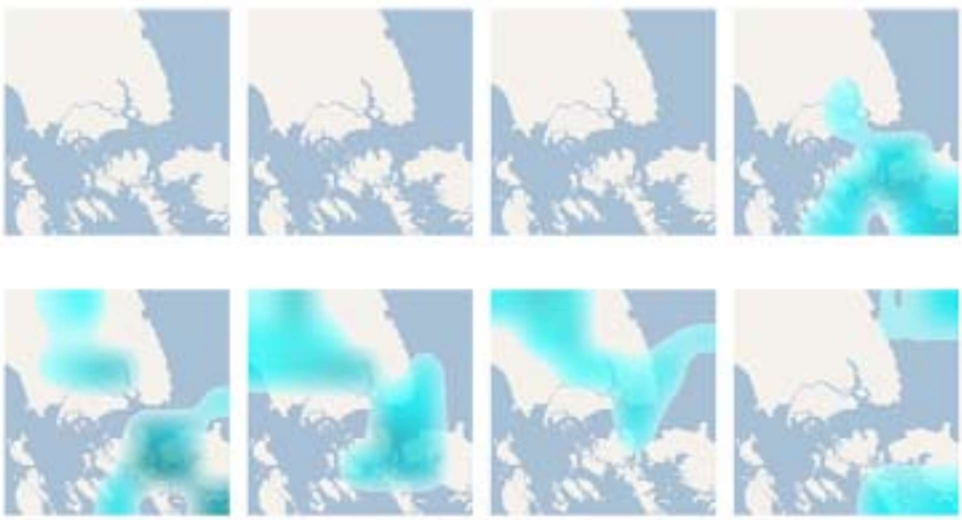


Figure 2 SOAP prediction for the same day, issued a day earlier on the 5th Sep 3pm.

In Thailand

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress

+ To enhance data exchanges among the TC Members, the Bangkok – Singapore GTS circuit has been upgraded from X.25, speed 9.6Kbps to the TCP/IP Frame Relay with the speed of 16 Kbps (CIR), and Bangkok – Phnom Penh GTS circuit has also been connected using VPN via internet.

+To strengthen the Indian Ocean Tsunami Warning System, TMD in collaboration with NOAA will deploy 2 more DART Bouys (Deep-ocean Assessment and Reporting of Tsunami) in 2007-2008 after the first DART Bouy was installed in December 2006. It will be a major milestone of the Tsunami warning system in the region for all 27 Indian Ocean countries. The detected information and Tsunami warning message will be disseminated via the GTS of TMD for all to access.

+ Installed a new communication system to improve the stability and speed of international data exchanges, and developed the Tsunami information check and monitoring system from GTS.

+To support Tsunami warning system, 9 tidal gauges will be added to the existing 9 tidal gauges deployed in the Andaman Sea along the coastal areas of Southern Thailand. The installations are expected to completed by 2008 . With the expanding coverage of the tidal gauges, TMD assures that the tidal wave monitoring will contribute beneficial information for the betterment of Tsunami warning in the Indian Ocean region..

b. Implications to Operational Progress

+The tropical cyclones and other NWP forecasts from other forecasting centers such as RSMC Tokyo, ECMWF, IMD, KMA, and BOM have been taken in to considerations together with TMD's NWP products for more forecasting accuracy, in both medium and long range terms.

c. Interaction with users, other Members, and/or other components

+ TMD has developed a website at Suvarnabhumi Airport to facilitate data users(Air lines) to immediately access necessary data for the Take-off Condition, and other data including TAFOR, SIGMET, and METAR.

d. Training Progress

During 1 October 2006 – 30 September 2007, the staff of the TMD has opportunities to participate in the overseas training courses as shown below:

No.	Course Title (s)	Duration	Country	No. of participant (s)
1	Training Course on Nowcasting of Serious Convection	11 Oct.- 21 Oct. 06	China	1
2	Training Course on Agrometeorological Information Services	23 Oct.-3 Nov. 06	China	1
3	Training Course on Numerical Weather Prediction Products (ASEAN-ROK)	30 Oct.-3 Nov.06	Korea	2
4	Training on Seasonal Climate Information for Climate Risk Management	30 Oct.-27 Nov. 06	USA	1
5	Training Course on The Use and Interpretation of City-specific Numerical Weather Prediction Products	31 Oct.-3 Nov. 06	Hong Kong	1
6	Training Course on Emergency Network Implementation Technology	5 Nov.-18 Nov.06	Japan	1
7	Regional Training Workshop on Water Affairs	4 Dec.-7 Dec.06	Vietnam	1
8	Training Course on Integrated Approach and Sustainable Management of Adverse Climate Changes Drought and Desertidiation	4 Dec.-22 Dec. 06	Israel	1
9	The RANET Training Course Technology for Operator	20 Mar.- 23 Mar.07	Indonesia	1
10	Training Course on Severe Convective Storm Nowcasting	1 Apr.-12 Apr.07	China	1
11	Training on “Third Session of the Forum on Regional Climate Monitoring Assessment and Prediction for Asia”	4 Apr.-6 Apr. 07	China	1
12	Training Course on Forecaster Foundation	14 Apr.-22 Jul. 07	UK	1
13	Training Course on Satellite and Radar Meteorology	28 Apr.-27 May. 07	China	1
14	Training Course on Seismology, Seismic Data Analysis, Hazard Assessment and Risk Mitigation	5 Aug.-8 Sep.07	Germany	1
15	Training Course on Coastal Zone Natural Disaster Prevention & Warning	25 Jul.- 8 Aug.07	China	1
16	Training Course on Agrometeorological Services for Sustainable Agriculture	27 Aug.-7 Sep.07	China	1
17	Attachment training on Quality Management System	24-28 Sep. 07	Airport Meteorological Office, Hong Kong, China	2

e. Research Progress

+TMD, in cooperation with Asian Disaster Preparedness Centre (ADPC), initiated a joint research project on “Investigation of the 2006 Utaradit Major Flash Flood using WRF”. The success of the joint research would hopefully reveal meteorological mechanisms behind this hazardous flood.

f. Other Cooperative/ Strategic Plan Progress

+The workshop on formulating the **TMD Strategic Plan** (2008-2011) has been organized with great assistance of Typhoon Committee ‘s AWG expert, Mr. James Weyman. The findings of the workshop would be important for TMD to develop a more comprehensive Strategic Plan to effectively address the challenges that lay ahead of us.

+TMD and WMO/UNESCAP, with the collaborative efforts of the Ministry of Construction and Transportation of Republic of Korea (MOCT), Korea Institute of Construction Technologies (KICT), Korea Water Resources Corporation (K-Water), the Ministry of Land, Infrastructure and Transport of Japan (MLIT), the Infrastructure Development Institute – Japan (IDI) and the National Institute of for Land and Infrastructure Management (NILIM) jointly hosted the **"Typhoon Committee Integrated Workshop on Socio-economic impacts of extreme Typhoon-related Events "** from 10-14 September 2007 at UNCC building, Bangkok, Thailand. It is TMD's pleasure to play one of the important roles of Typhoon Committee

2. Progress in Member's Important, High-Priority Goals and Objectives

a. Hardware and/or Software Progress

+ Three C-band Doppler radars have been added to the existing 20 stations in the TMD's Radar Network in order to enhance the radar observation of the country to closely monitor rainfall pattern, cloud movement, and its intensity in the remote areas.

+ Replacing volunteer rainfall stations in northern Thailand with 110 automatic raingauge stations, apart form the existing 161 automatic stations in the telemetring system of TMD. Data from the automatic stations will be incorporated into the existing telemetering network to strengthen flood monitoring and warning in the critical flood-risk areas of the country. Moreover, additional 820 stations will be incorporated into TMD's automatic raingauge network by 2008.

+ Each TMD meteorological station will be equipped with an automatic station, thus there will be additional 87 automatic stations in TMD meteorological observation network by 2008.

+ The Vaisala Model RP20 will replace the Vaisala 's retired model at 4 upper air stations, the installations are expected to complete in 2008.

+ The improvement of observation for aviation by the deployment of 3 Automatic Weather Observation System (AWOS) at 3 local airports of the country.

+ GIS-based Typhoon information system was developed to transform the recorded typhoon data into GIS for further development of TMD's Typhoon Information Processing system (TIPs).

b. Implications to Operational Progress

+Newly designed main website of TMD, in both Thai language and English, has been improved to incorporated more information of tropical cyclones, including tracks, radar observations, satellite imageries and NWP products to be more user-friendly warning tool.

c. Interaction with users, other Members, and/or other components

+ To give warning messages to people promptly, 79 Disaster Warning Towers have been constructed in 6 provinces directly affected by the Tsunami as a result of the tragedies due to the 26 December 2004 Tsunami Event. However, to be able to cost-effectively use and cover all types of natural disasters, including torrential rain, flash floods, and landslide etc. apart from Tsunami and earthquake, TMD has constructed 48 more Warning Towers in the disasters prone areas of the country. Totally there are 127 multi-hazard Warning Towers in National Warning System of Thailand which will play the major role to deliver disaster warning to public more timely, and 144 more towers will be constructed by 2008.

+ In 2007, the continuation of the **outreach program on disaster alert** focusing on school children in disaster prone communities around the country has equipped more than 60,000 students with general knowledge and understanding of natural disasters that may take place in their communities.

d. Training Progress

+ TMD in cooperation with the Hong Kong Observatory (HKO) jointly organized the training course on Aviation Weather during 20-26 July 2007 at TMD's Bureau of Meteorology for Transportation, Suvarnabhumi Airport, to enhance the capacity in aviation forecasting, with participations of more than 50 meteorologists from TMD and Cambodia. Lectures on low-level windshear, thunderstorms, and lightening have been given by Mr. C.M. Shun, Acting assistant Director of HKO ,and Dr. P.W. Li, Senior Scientific Officer of HKO.

+ As a part of capacity building, TMD has cooperated with the Hydrometeorological service of Macedonia holding the training courses to TMD staff and other related governmental agencies on 1.)Hydrological Forecast and Flood Warning System, and 2.) 3D Cloud Model Application during June and August 2007. The training courses provided participants with better understanding of processes behind convective cloud formation, and will strengthen research activity of TMD.

e. Research Progress

In 2007, a number of research topics have been done by TMD staff to support the improvement of severe weather and meteorological-related forecasting. The researches range from monsoonal study, heavy rain, tropical cyclone to Tsunami, and drought issues, including:

1. Thailand Monsoon Onset Estimation Using MM5 Model,
2. Meteorological indicators for Heavy Rainfall Forecast: Case study of June 2006 Heavy rainfall in the North and Northeast of Thailand,
3.Application of GIS for Tropical Storm-induced Windstorm Assessment over Thailand,
4 The correlation between Run up of Tsunami and Coastal Characteristics,
5. A Study of Meteorological Drought Index Model for Drought Areas in Northeastern Thailand.

f. Other Cooperative/ Strategic Plan Progress

Nil

3. Opportunities for Further Enhancement of Regional Cooperation

+Thai Meteorological Department in collaboration with the WMO hosted the WMO CLIPS Training workshop for RA II (Eastern Part) for two weeks in Bangkok from 15 to 27 January 2007 to enhance understanding the CLIPS project by the Focal Points, and to improve the capabilities of the NMHSs in the provision of climate information and prediction services. The workshop was attended by 26 participants, representing the CLIPS focal points from 12 countries in Eastern Asia, and invited resource persons from well-recognized institutes and universities. The outcomes from the meeting will benefit the RA II members particularly in climate-related issues.

+TMD strengthened technical cooperation with the Regional Meteorological Training Center, Israel in the area of agro-meteorology focusing on hydrological assessment and drought determination for crop plantations. Seminar at TMD and expert attachment to Israel Meteorological Department were successfully carried out as the initiative of the cooperation. In 2007, the wok shop on “Application of Meteorology in Agriculture and Water Management” was organized at TMD with 40 participants from TMD and other related organizations.

+In Mid-December 2007, TMD is very pleased to collaborate with WMO and NOAA to host the “WMO Multidisciplinary Workshop on the Exchange of Tsunami Warning, Related Information and other Warning in the Indian Ocean” at Bangkok, Thailand. The participants will be from the NMCs/NMHSs of the Indian Ocean countries and other international centers concerned.

In USA

I. Weather Forecast Office (WFO) Guam, Micronesia, Western North Pacific

a. Meteorology

United States of America (U.S.) tropical cyclone activities in Micronesia involve the U.S. National Weather Service (NWS) and the U.S. military's Joint Typhoon Warning Center (JTWC). The NWS Weather Forecast Office (WFO) Guam, which is part of the National Oceanic and Atmospheric Administration (NOAA) under the U.S. Department of Commerce (DOC), provides weather forecasts, and watches, warnings and advisories within its AOR, which encompasses an ocean area of more than four million square miles with more than 2000 Micronesian islands (see Figure 1). The AOR includes the Commonwealth of the Northern Mariana Islands (CNMI), Republic of Palau (ROP), Federated States of Micronesia (FSM), Republic of the Marshall Islands (RMI), and the U.S. Territory of Guam. The FSM includes the States of Chuuk, Yap, Pohnpei, and Kosrae.

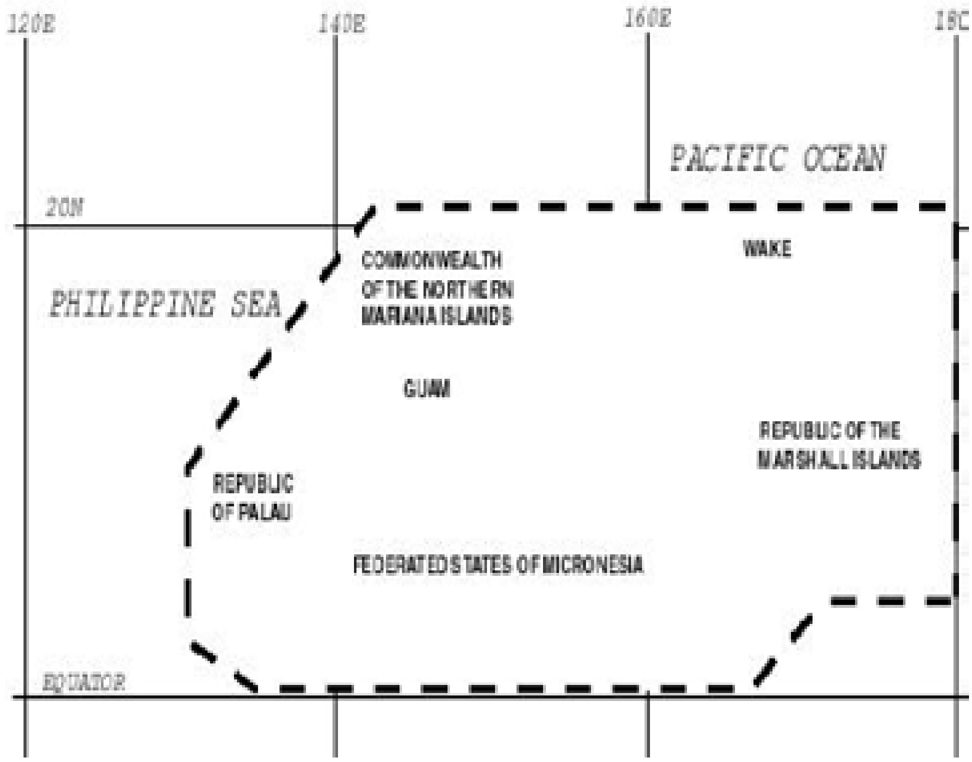


Figure 1. WFO Guam's area of responsibility (AOR). Within this AOR, WFO Guam issues tropical cyclone watch, warning and advisory products based on JTWC tropical cyclone forecasts.

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and/or Software Progress.

Nothing to report (NTR).

b. b. Implications to Operational Progress.

NTR

c. Interaction with users, other Members, and/or other components

- German Film Crew. During October 9-13, 2006, a German film crew spent a week on Guam filming a documentary on the birthplace of typhoons. Two days were spent filming at WFO Guam. This was the final leg of a trip that included the Observatory in Hong Kong and the RSMC Tokyo. The WFO Guam Warning Coordination Meteorologist (WCM) also took the crew to many locations around the island. They were able to film the birth and development of a tropical cyclone (Typhoon Soulik), WFO Guam in action providing real tropical cyclone support, regional response to the cyclone (Saipan and Agrihan islands), weather and surf, and many other aspects of WFO Guam activities. A high surf event on the island provided for some great footage. Initially, the producers wanted to attribute western Pacific typhoon and weather activity to Global Warming. However, once it was explained why it was not scientifically possible to do so due to database limitations and high uncertainty about affects in the tropics, the story line then focused on the birthplace of typhoons.
- IWTC-VI Participation. The WFO Guam WCM attended the 6th WMO International Workshop on Tropical Cyclones (IWTC-VI) from 20-30 November 2006 in San Jose, Costa Rica. In addition to co-writing two subject area rapporteur reports, the WCM was a member of the Recommendations Committee. The WCM was also selected to rewrite the WMO Guide to Tropical Cyclone Forecasting and to develop a program to catalogue tropical cyclone intensity databases and to try to resolve large discrepancies in intensity analysis. The Group also developed a statement on Global Warming and Hurricanes that was later adopted by the WMO and the American Meteorological Society. Although he did not attend the Workshop, the WFO Guam Science and Operations Officer (SOO) also co-authored two of the subject area rapportuer reports on uses of microwave imagery and scatterometry for tropical cyclone analysis. A listing of available training material for these new technologies was also presented.
- USPACOM Tropical Cyclone Conference (TCC). WFO Guam Meteorologist-in-Charge (MIC) participated in the 2007 TCC on 6-8 February. The Joint Typhoon Warning Center plays a major role in the distribution of tropical cyclone forecasts in the Western North Pacific. WFO Guam bases its Public Advisories and Local Statements on the guidance provided by JTWC. Much of the conference focused on the changes experienced by the DOD organizations around the Pacific Rim regarding weather support and the decrease in funding support. It also emphasized bridging the gap between the research community and operations.
- Korean Broadcasting System Visit to Guam. During September 2007, the Korean Broadcasting System (KBS) visited WFO Guam to film part of a documentary on typhoons and disasters. The crew interviewed the Guam SOO on methods of detecting tropical cyclones and was particularly interested in learning about variations in seasonal formation from one year to the next in the western North Pacific due to changes in ocean temperature and on such large scale effects such as El Nino and Global Warming.

a.Training Progress

- University of Guam Environmental Science students. A basic meteorology lesson including various topics such as typhoons, ENSO, climate, climate change or tsunamis and tour of the WFO Guam facilities are an integral part of the University of Guam's Environmental Science class. Each semester, WFO Guam hosts the students for a 2-hour lecture, an office tour and the highlight of the weather balloon launch. In 2007, an estimated 250 students participated in the classes.
- Educators Academy. On 2 March, the WFO Guam WCM made three 1.5-hour presentations at an annual Educator's Academy on Guam. The presentations attracted over 90 participants. Topics included climate change, tsunamis, tropical cyclones, and El Nino. The Educators' Academy is a professional development conference for all the teachers, nurses, counselors and administrators from the Guam Public School System.
- Meteorologist Internship. Ms. Meiang Chin, Micronesian Meteorologist Intern, completed her internship on Guam on 9 March. Ms. Chin is the sixth Meteorologist from Micronesia and the second from the Republic of Palau to have graduated from the National Weather Service Pacific Region Micronesian Meteorologist Intern Program. The program was developed to allow islanders to attend the University of Hawaii and obtain a degree in meteorology. Graduates from this program are not only familiar with

the NWS products, operations, training, and science, but will be able to develop their own effective outreach and preparedness programs using their own languages. Ms. Chin completed several weeks of training on all WFO Guam programs including satellite analysis, Micronesia climatology, and marine forecasting, and spent several hours on outreach materials associated with the annual tropical cyclone disaster preparedness training. She also networked with officials from the University of Guam Water and Environmental Research Institute, Pacific ENSO Applications Center and PEACESAT, a satellite-based distance education program located at the University of Guam and the University of Hawaii with nodes scattered throughout the North and South Pacific.

- Marine Patrol Training. Over 30 officers from the Guam Police Department received basic weather training from WFO Guam as part of their recruitment to the Marine Patrol Division. In addition to learning basic water safety, the officers rely on the National Weather Service for sea and surf training and basic weather understanding. The visits are normally 2 hours long. On one such visit in July, officers were able to watch the staff in action during real-time tropical cyclone operations as Tropical Storm Man-Yi moved through the region.

e. Research Progress
NTR

f. Other Cooperative/RCPIP Progress.
NTR

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress.
NTR.

b. Implications to Operational Progress.
NTR.

c. Interaction with users, other Members, and/or other components.
NTR

d. Training Progress.
NTR.

e. Research Progress.
NTR.

f. Other Cooperative/RCPIP Progress.
NTR.

3. Opportunities for Further Enhancement of Regional Cooperation (including identification of other meteorological-related topics and opportunities, possible further exchange of information and priority needs for assistance).

NTR

II. Regional Specialized Meteorological Centre (RSMC) Honolulu / Weather Forecast Office (WFO) Honolulu

B. Meteorology

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and/or Software Progress.

- Interactive Forecast Preparation System (IFPS) and the Graphical Forecast Editor (GFE). This is the main forecast system in the U.S. NOAA National Weather Service which produces the forecast by first having the meteorologists prepare a set of gridded data for all elements of the forecast and then use automatic formatters to take these gridded data to generate a worded forecast. The meteorologists have new tools to edit the digital forecast database in this system, which can import the tropical cyclone maximum sustained wind and wind radii from RSMC Honolulu's tropical cyclone track and intensity forecast and apply them to the local domain of gridded data which has a resolution of 2.5 km. Forecasters can apply an appropriate eye diameter for the tropical cyclone, and a wind speed reduction factor over land. This provides higher resolution spatial and temporal weather information to local disaster preparedness personnel.

- High Resolution Weather and Research Forecasting (WRF) Model - Nonhydrostatic Mesoscale Model (NMM) data. RSMC Honolulu began ingesting high resolution WRF-NMM data from the University of Hawaii Mesoscale Modeling Group into the Interactive Forecast Preparation System approximately 20 July 2007. The model is comprised of several different domains, with a maximum spatial resolution of 3 km over Maui and the Big Island of Hawaii, and 1.5 km over Kauai and Oahu. The model will provide forecasters with high resolution wind fields over the islands and provide insight into meso beta and gamma-scale terrain-forced local wind effects.
- Hurricane WRF. Forecasters at RSMC Honolulu began utilizing and evaluating the new Hurricane WRF model provided by the National Centers for Environmental Prediction (NCEP) during the 2007 tropical cyclone season. The Hurricane WRF is eventually expected to replace the Geophysical Fluid Dynamics Laboratory (GFDL) model.
- Probabilistic Wind Guidance. RSMC Honolulu began generating graphical and text products of probabilistic guidance of 34, 50, and 64 knot winds for discrete and cumulative time periods from 0-120 hours in 2006. However, there were no significant land-based threats to Hawaii in 2006. With the approach of Hurricane Flossie, this was the first opportunity that land-based users had to evaluate the guidance during a significant threat to the Hawaiian Islands.
- Graphical Watches and Warnings. RSMC Honolulu implemented graphical depiction of tropical cyclone watches and warnings on the RSMC Honolulu webpage. This is in addition to graphical depiction of tropical cyclone track forecasts, both deterministic and probabilistic.
- Targeted Email Notification. RSMC Honolulu began targeted email service (listserv) to those key customers requesting delivery of RSMC Honolulu products via email. Approximately 1000 customers signed up for the service for Hurricane Flossie.

b. Implications to Operational Progress.

- Hurricane Flossie. Hurricane Flossie entered the Central Pacific on 11 August as a major hurricane, and was the first serious threat to the Hawaiian Islands in several years. Many significant advances have taken place in tropical cyclone detection and forecasting since the last major hurricane threatened Hawaii, and Hurricane Flossie allowed RSMC Honolulu Hurricane Specialists to evaluate many of them. The ability to use the Interactive Forecast Preparation System (IFPS) and the Graphical Forecast Editor (GFE) to both ingest RSMC Honolulu wind fields and manipulate those fields to represent localized topographic effects both on land and in the nearby channels gave the Weather Forecast Office (WFO) Honolulu forecasters the ability to add mesoscale details to the wind forecasts of far greater detail than in the past. Probabilistic wind guidance gave users the ability to judge the threat to their respective interests quantitatively for each wind field (34, 50, and 64 knots). The Director of RSMC Honolulu requested deployment of the Hurricane Hunters (4 C-130s), which flew numerous critical missions into the cyclone until the threat passed. Intensity estimates from both manual and automated Dvorak techniques were compared with reconnaissance data, and were shown to be very accurate. Along with the reconnaissance data, remotely sensed wind fields from the QuikSCAT and ASCAT satellite microwave sensors provided valuable information on the aerial extent of critical wind speeds. Additional microwave imagery from polar orbiting satellites, such as the 85 GHz and 37 GHz channels, provided valuable information to RSMC Honolulu Hurricane Specialists on storm structure. Wind shear analysis through the University of Wisconsin Cooperative Institute for Meteorological Satellite Studies (CIMSS) was ported directly to RSMC Honolulu, and used by Hurricane Specialists for both intensity and track forecasts.

c. Interaction with users, other Members, and/or other components.

- IWTC VI. The RSMC Honolulu Deputy Director participated in the WMO International Workshop on Tropical Cyclones held in San Jose Costa Rica 21-30 November, 2006.

d. Training Progress

- International Pacific Desk Training Internship. The WMO Regional Association (RA) V Pacific

Desk Internship program trained 6 students from Solomon Islands, Kiribati, Tonga, Philippines, Samoa, and Niue.

- Dvorak Training. RSMC Honolulu conducted its annual internal Dvorak Satellite Analysts' Training on 31 July.
- Annual CPHC Training. RSMC Honolulu conducted its annual training on 25 May and 7 June. Major topics included discussion of technical advances in tropical cyclone observations and forecasting from the WMO IWTC VI.
- Regional Assimilation System. RSMC Honolulu attended an online training workshop on the University of Wisconsin's Cooperative Institute for Meteorological Satellite Studies (CIMSS) Regional Assimilation System on 25 January.

e. Research Progress

- Storm Inundation. RSMC Honolulu identified specific requirements for enhancements to storm inundation modeling in the Hawaiian Islands. This effort will focus on very high resolution storm inundation modeling for island environments. The RSMC and the University of Hawaii secured preliminary funding for detailed numerical modeling of storm inundation for a portion of the densely populated south shore of Oahu.
- American Meteorological Society Paper. RSMC Honolulu submitted an abstract which was accepted for presentation at the Tropical Meteorology Special Symposium of the 88th Annual Meeting of the American Meteorological Society. The paper is titled "Building Capacity to Forecast and Respond to Storm Inundation in Hawaii".

f. Other Cooperative/RCPIP Progress.

NTR

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress.

NTR.

b. Implications to Operational Progress.

NTR.

c. Interaction with users, other Members, and/or other components.

NTR.

d. Training Progress.

NTR.

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

NTR.

3. Opportunities for Further Enhancement of Regional Cooperation (including identification of other meteorological-related topics and opportunities, possible further exchange of information and priority needs for assistance).

- WMO Fact Finding Mission to RSMC Nadi. The RSMC Honolulu Deputy Director was a member of a WMO fact-finding mission to Nadi, Fiji. The WMO fact-finding mission to Fiji was carried out from 9 to 13 July 2007 with the purpose of: (a) finding out the status of RSMC Nadi-TCC operation and services; and (b) discussing and finding ways to assist FMS/RSMC Nadi with the aim of sustaining and enhancing national and regional meteorological services and dissemination of information and warnings to users in the region. The final report was presented to the WMO in August.

In Vietnam

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and Software Progress

a.1 Observation network: NIL

a.2 Technical advancement

- Visible and other imageries from MTSAT (JMA) were used in operational forecasting.
- Microwave imagery from the US Naval Research Laboratory website was used to support forecasters in locating the TC intensity and position

a.3 Data exchange: NIL

a.4 Numerical Weather Prediction

- The High Resolution Model (HRM) is operationally running with the increased horizontal resolution of 14km x 14km with the initial and boundary conditions interpolated from the DWD's global model GME. From 24 October, 2007, the multi-layer soil model comprises seven active layers for the heat (energy) and six for the soil moisture (water) budget has been used in GME.

a.5 The use of ensemble products

- Multi-model ensemble and consensus forecasts of tropical cyclone tracks are used during the course of producing tropical cyclone warnings. The picture below illustrates probability forecast 24h and 48h conducted from forecasts system of kilo-members ensemble based on WBAR model.

b. Implication to Operational Progress

- The outputs of the higher resolution version of HRM model, especially its rainfall forecasts (for the cases when typhoons affect our coastal areas) showed a good guidance in indicating the regions of heavy rainfall. It is especially true for the central part of Vietnam where high mountains are very close to the sea, and thus, the detailed topography of the model are helpful in representing the precipitating effects of the tropical cyclone circulation. The picture below demonstrates the

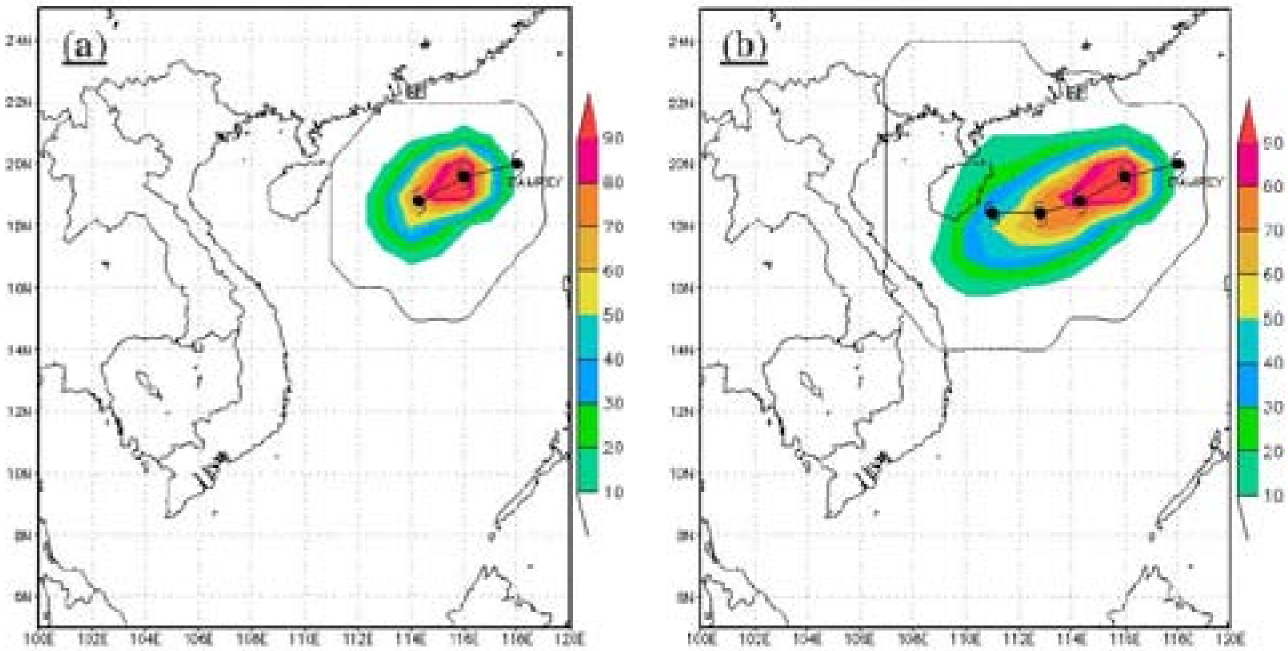


Fig 4: Example of accumulated probability forecast 24h and 48h conducted from forecasts system of kilo-members ensemble based on WBAR model

accumulated 72h rainfall forecast from HRM model with the new seven layer soil model of GME.

- With the intensive utilization of numerical guidance and multi-model consensus forecasts from different NWP models as well as subjective TC advisories, operational predictions and warnings of TC tracks performed quite well. The main statistics of 24h forecast errors are illustrated below.
- Interaction with users, other Members: NIL

d. Training Progress

- 1 staff from NHMS attended the WMO's Training course on Tropical storms' damage reduction in China from 26 to 31 March 2006.
- 1 staff from NHMS attended the Training program on Disaster Prevention and Preparedness in Taiwan from 5 – 11 May, 2007.
- 1 staff from NHMS attended Climate Prediction and application in Asia -Pacific at Singapore, from 21 to 31 May 2007.
- 2 staffs from NHMS attended Integrated Workshop on Social – Economic Impacts of Extreme Typhoon – related Events in Thailand from 10 – 14 Sep 2007.
- 1 staff from NHMS attended to work on the project "Using ensemble prediction system (EPS) information in tropical cyclone forecasting: under the fellowship scheme in Hong Kong Observatory from Sep to Nov 2007.
- 3 staffs attended The Typhoon Committee Roving Seminar 2007: Doppler radar analysis (rain and wind), Satellite Analysis (Quikscat and Microwave Imageries), Interaction of Tropical Cyclones with Monsoon Systems in Philippines from 5 – 8 Sep 2007
- Research Progress: NIL
- Other Cooperative Progress: NIL

2. Progress in Member's Important, High-Priority Goals and Objectives

a. Hardware and Software Progress

a.1 Observation network

- Complement 47 Young wind measurement for coastal and island stations.
- Installed 3 barometers for island stations

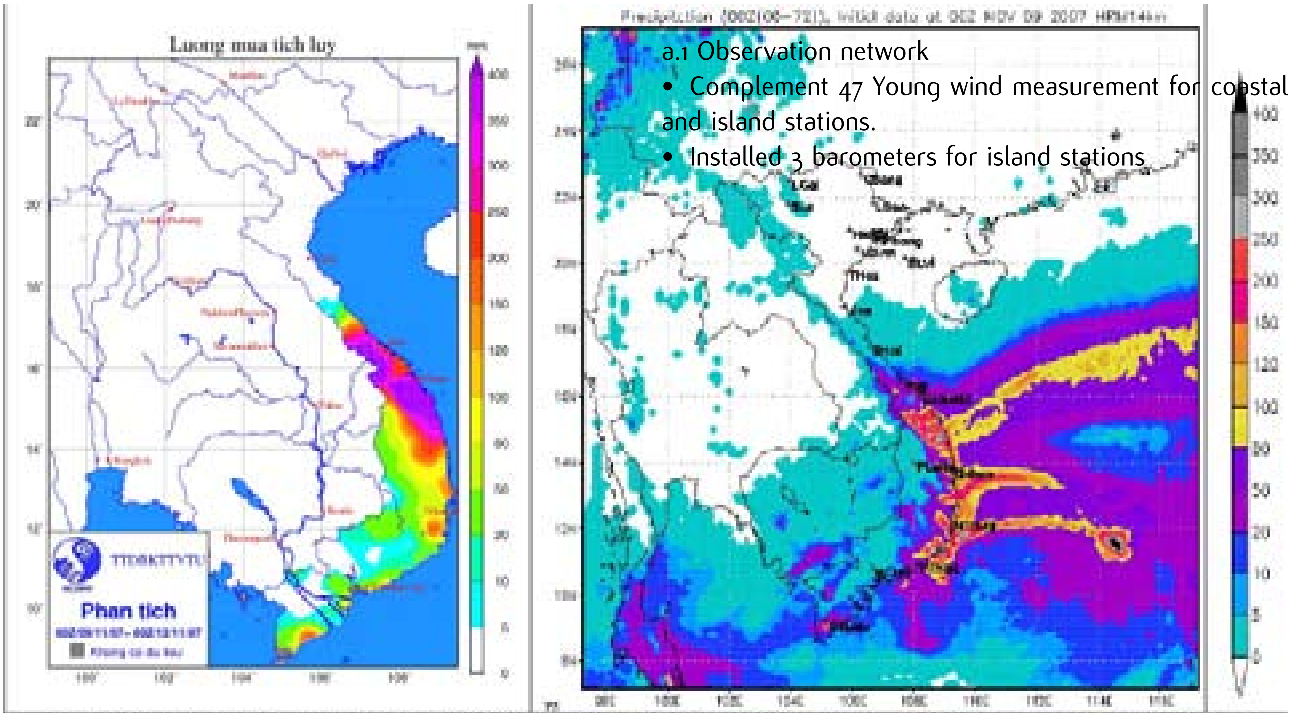


Fig 5: Accumulated precipitation (72h) from 00UTC 9 to 12 November 2007, observation (left) and forecasted from HRM model (right)

	Mean Error (km)	
	24h	48h
DPE	135.4	281.2
No.Cases	128	53

- Add 11 flow measurements for 11 stations in the whole country

a.2 Software for interactive operational forecasting

- The GEMPAK/N-AWIPS package from UNIDATA/UCAR has been installed, studied and undergone the adaptation to be used with the data feed from local sources at NCHMF.
- New tropical storms forecast supporting software, TCAids, was designed and installed for operational works.

b. Implication to Operational Progress

• Establishing a good relationship with the national television channels to improve the weather forecast programs' contents and quality. Forecasted parameters, fields and forecast discussions are automatically sent to the TV and the Central Committee for Flood and Storm Control (CCFSC).

• In the case of extreme weathers such as tropical

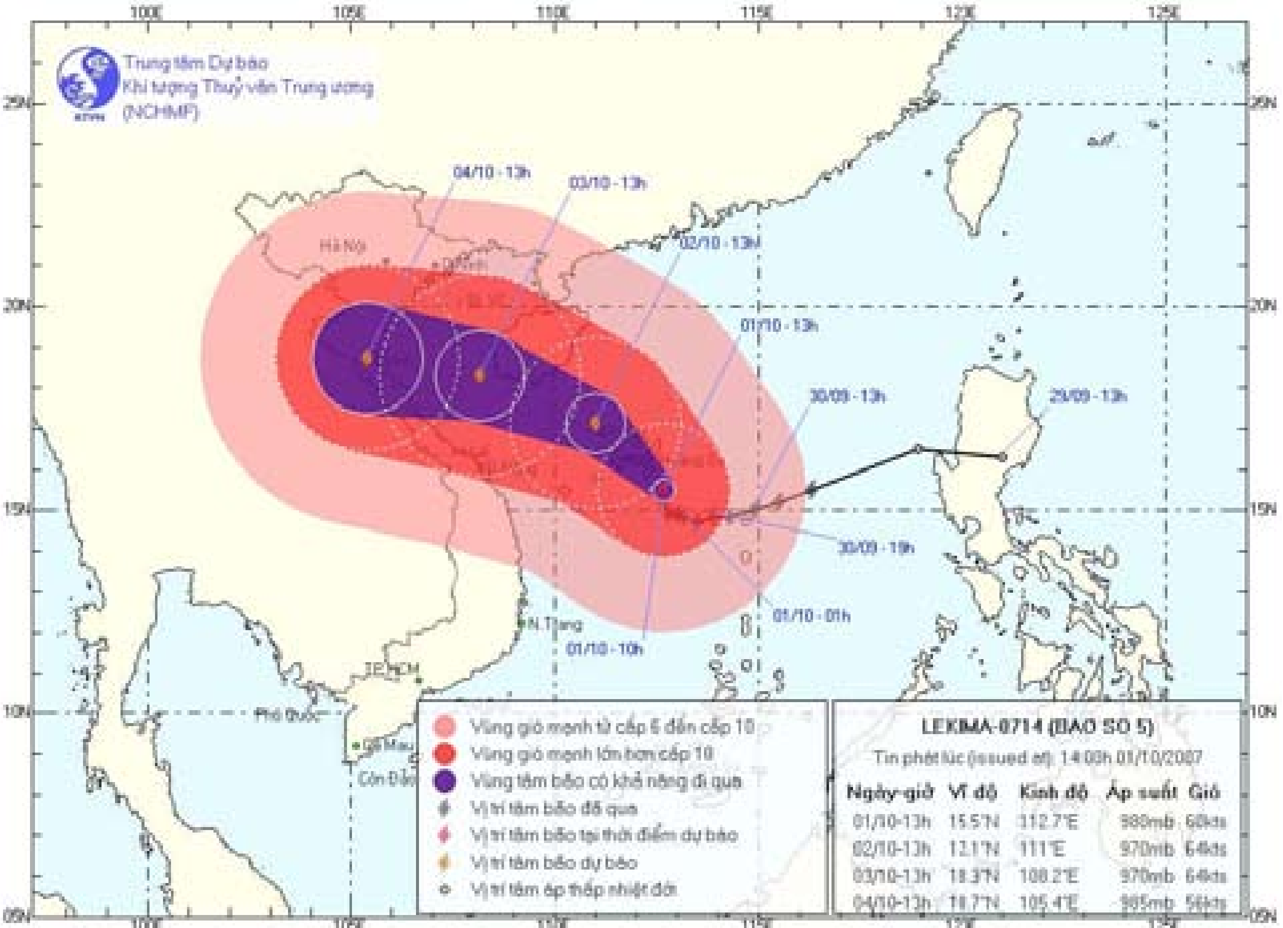


Fig 6: Example of new forecaster supporting software, TCAids

cyclone, more details are provided to the TV weather interpreters so that the weather situations can be better explained to the public. As a result, the weather forecasts as well as tropical cyclone warnings have become more popular and understandable to the public.

• PC-Linux Cluster system (8 nodes, 16CPUs, RAM 16GB (2x8) has been put into operation at NCHMF since May, 2007. This system has replaced the old one (4 nodes, 8CPUs that had been out of service in May.

• The numerical model MM5 was applied to tropical cyclone track and intensity forecasts. The figure below shows the graphic map based on MM5's output

c. Training Progress

d. Research Progress

• • Research on the implementation of 3D-VAR data assimilation scheme for HRM model using conventional observations is being carry-out and will be put into operation in the 1st quarter, 2008. The picture bellows illustrates analyzed mean sea level pressure (MSLP) from original GME model (left) and after applying 3D-VAR assimilation

Fig 7: Example of MM5's TC track forecast

scheme (right)

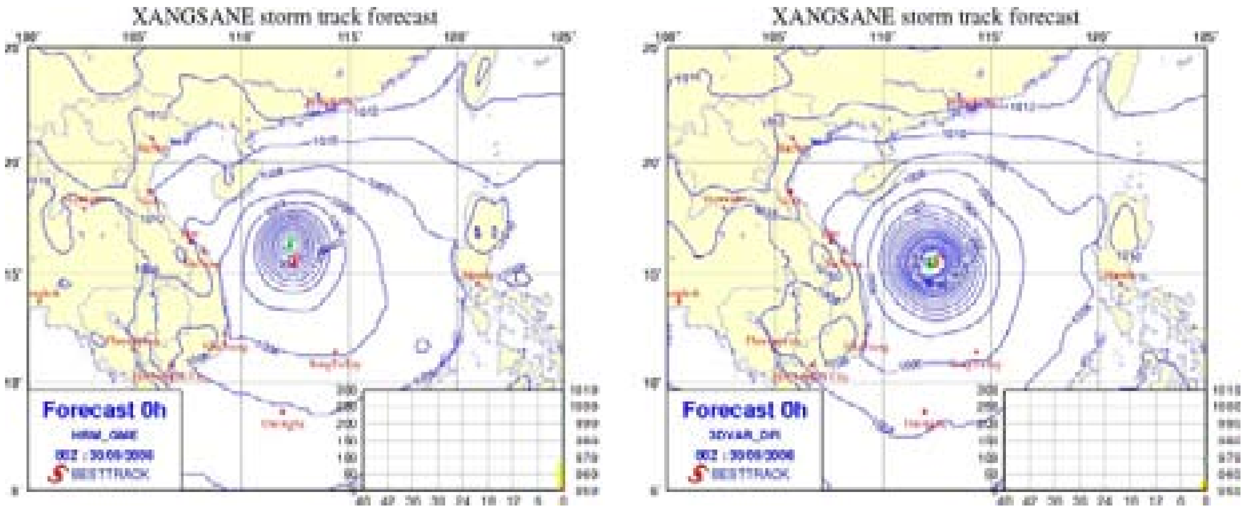


Fig 8: MSLP at 00UTC-30/09/2006 during TYP. XANGSANE (0615) (112.3 E, 15.5 N, observed pressure was 955 hPa) from original HRM model (HRM_GME, left) and after applying 3DVAR scheme (3DVAR_DFI, right)

- Research on applying Weather and Research Forecasting (WRF) model for tropical storm track forecasts.

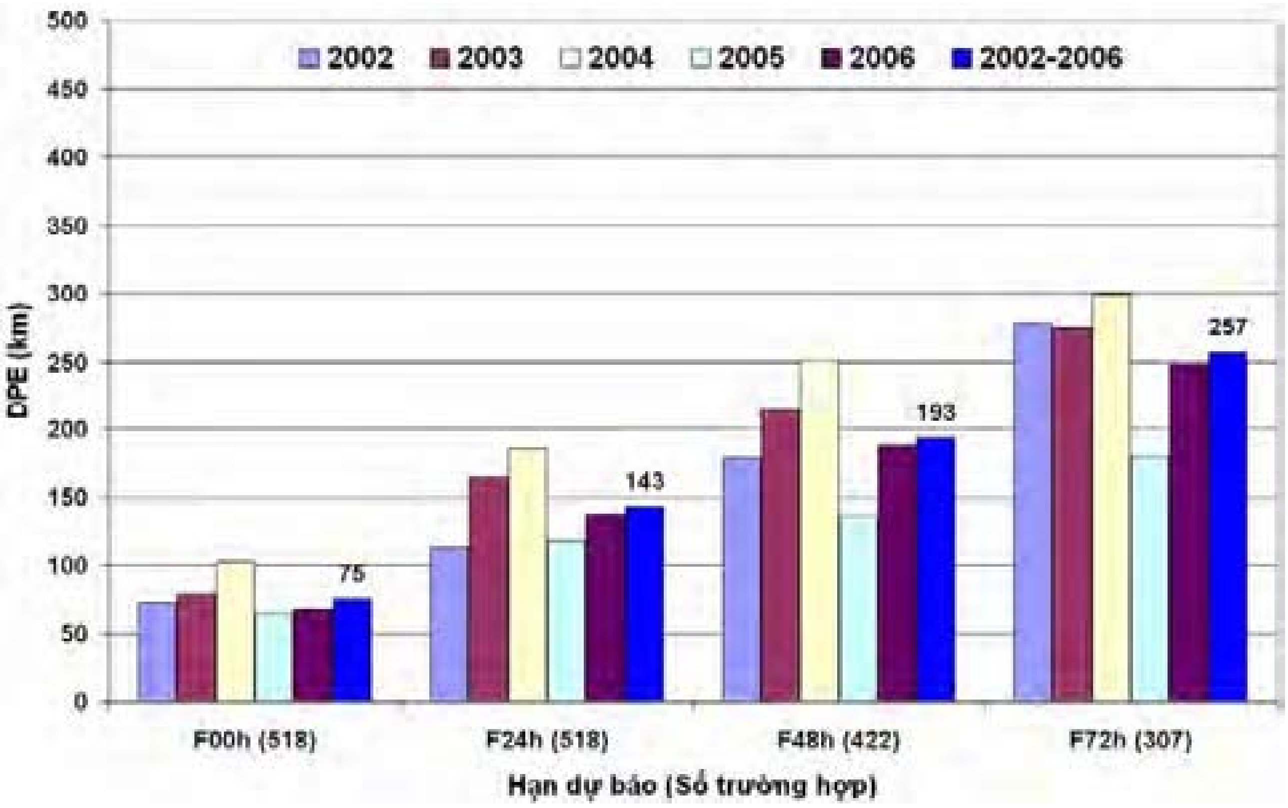


Fig 9: Direct Position Error (DPE) for 5 typhoon seasons (2003-2006) and averaged over whole period based on the analyzed data (518 cases of 31 TS)

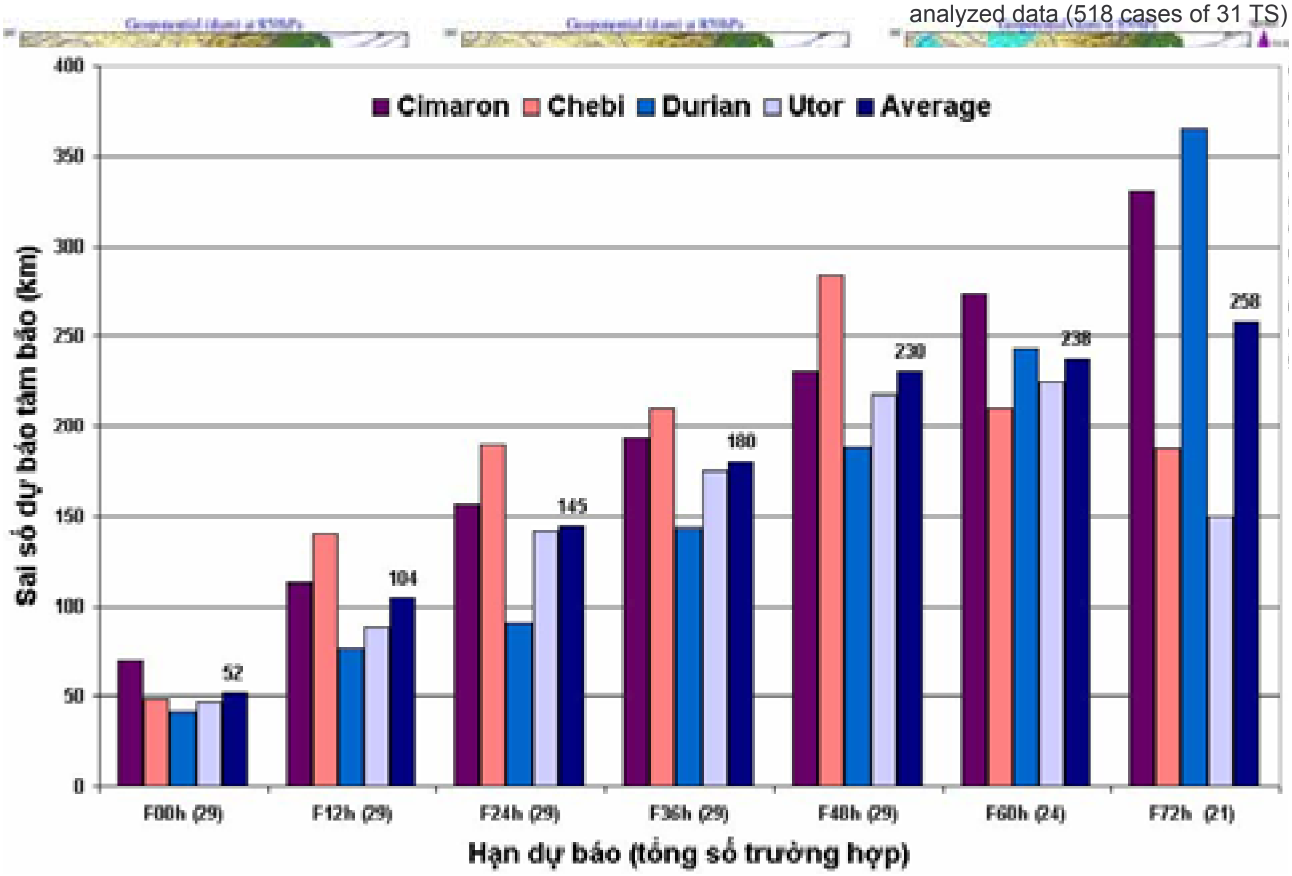
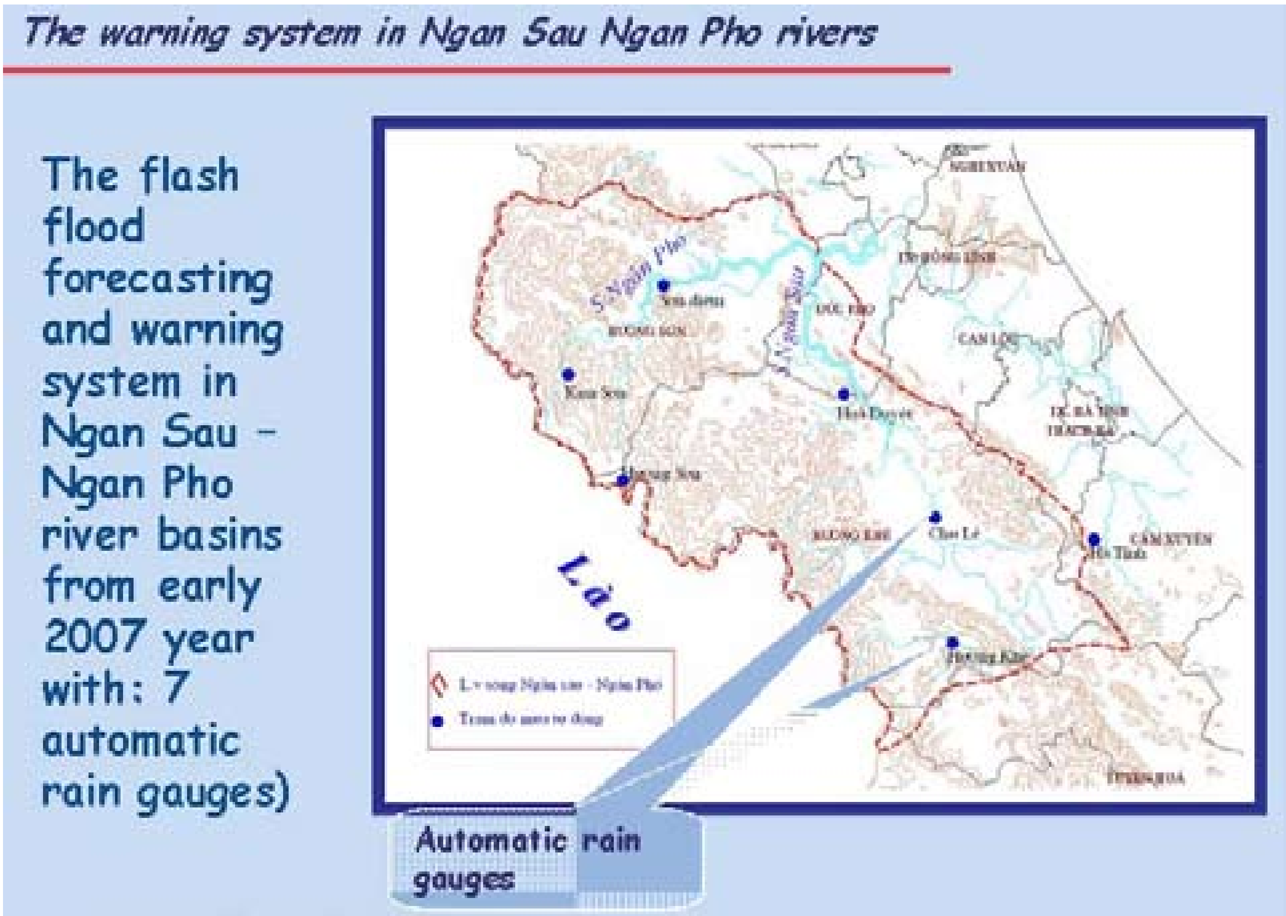
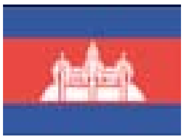


Fig 10. Direct Position Error (DPE) for typhoon season 2006 for 4 TC Cimaron,Chebi, Durian, Utor and averaged over 4 TCs (real-time forecast)

Fig 11: STAMP maps of the geopotential height at 850hPa valid at 00UTC 2 August 2005 (Initial time at 00UTC-30 July 2005) from multi-models and the ensemble result (bottom, right) after removing bias



1.2 Hydrology



In Cambodia

1- General situation

In Cambodia conditions of flood season during the 2007 were under average in terms of volume.
In general we face on two kinds of flood.

-Firstly flood by overflow of the mekong river and river tributaries.

-Secondly flood local/flash flood by rainfall. The major causes relevant to the series weather phenomenon such as strong mansson wind, ITCZ and especially tropical storms.

2-Flood in the year 2007

cambodia facing on two seriouesly flood.
-The firsrt flood occured in 1-4 June was in one province in the Northwestern part of country and causes effected of Inter-Tropical Convergence Zone, there was heavy rain in several day.
-The second flash flood occured in 4-6 August was in three provinces in the Central and Norteastern part of country causes effected by Tropical Storm, It's tracks along the central coastal line of Viet nam, there was heavy rain and overflow of tributaries.

REPORT OF FLOOD VICTIMS IN 2007

Flood Affected Areas	Affected people			Rice field (Ha)		Livestock
Province	Evacuation		Death	flooded	demaged	Buffalo dead
	Family	Person				
Battey Manchey				16000	16000	
Preah Vihear			2	3000	2400	100
Kompong Thom	3000	15000		15000	12000	
Rattanakiri				1660	1328	
Total	3000	15000	2	35660	31728	100

Amongst threcorded over the last 80 or more years. The maximum discharge for the year occurred in mid August, after which water levels decreased considerably until early October and the passage across the region of Severe Tropical Storm Xangsane. This weather system generated a slightly lower second peak in mid October, an uncommon feature of the annual hydrograph. As a result of these below normal seasonal flows no significant crop losses were reported, with the exception of the fact that the unseasonally late second peak led to the inundation of some low lying areas. Some early flood recession rice plantings were lost and a second replanting was required.
No flood damage to infrastructure was recorded for the year.

4.2 Lessons learnt from a field trip to Kampong Cham, Kratie and Stung Treng—24th to 26th October 2006

- Kampong Cham: The major flood related issues here are river bank erosion, the regular loss of crops and damage to property, domestic and commercial disruption, low levels of social awareness of the flood hazard, inadequate institutional capacity to receive and disseminate flood warnings and inadequate investment in flood mitigation and rehabilitation measures.

• Kampong Cham: The present warning flood stage of the Mekong at Kampong Cham needs urgent review since in the recent past, during 2000, 2001, 2002, parts of the city were flooded despite the fact that the flood stage of 16.20 masl had not been reached. Frequency analyses of long term annual maximum water levels between 1930 and 2006 indicate that the flood warning stage of 15.20 masl has a return period of less than 4 years.

• Kratie: The western part of the town was flooded at a Mekong River level of 22.05 masl, noting that the flood level at the hydrometric gauge is 21.9 masl. (Appendix 2). The 2006 maximum flood did not reach the warning level at any of the villages equipped with flood referencing facilities. It would be useful to establish the flood marks from the most recent 2000–2002 floods at each village as reference levels for issuing flood warning.

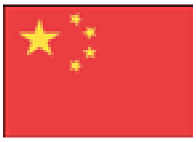
• Kratie: The province has identified a total of 97 safe areas. Some provide emergency living accommodation during floods while others provide refuge for farm stock, which is generally the major family asset. Accessibility can be difficult during the dry season since access roads can be very poor. During the flood season, however, they are easily accessible by boat. One pilot site with an area of 55 ha has been identified and will be equipped with facilities such as water supply, sanitation and proper access roads.

• Stung Treng: The town has no protection from flood inundation, which is mainly caused by high water levels in the Mekong mainstream and backwater in three major local tributaries.

• Stung Treng:The strategic location of the Stung Treng hydrometric station at the head of the major part of the Cambodian floodplain downstream is a key element within the regional flood forecasting network. The reliability of the station is not, however, what it should be under these circumstances. Forecasting accuracy could be improved in conjunction with data observed at Siem Pang and Chant Ngoy on the Sekong, at Andaung Meas, Veun Sai and Ban Kamphun on the Se San and at the Lumphat on the Sre Pok. Some of these stations, however, have ceased to operate and transmit data due to poor maintenance schedules and a lack of investment

• Stung Treng. The reference levels used by the Regional Flood Management and Mitigation Centre at the Stung Treng are 10.7 masl for the alarm stage and 12.0 masl for the flood stage. These correspond to annual return periods of two and slightly less than fifteen years, which appears to be inconsistent and illogical.

• Stung Treng: Provincially, 116 flood refuges have been identified, though only a few are equipped with even basic facilities such as water supply and toilets. Effective evacuation to them during a flood emergency is a village responsibility, though the capacity to organise and coordinate the process is not well developed. Nor are the means in place to transmit prompt flood warnings to vulnerable villages.



In China

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives

a. Hardware and Software Progress

b. Project of Flood Risk Mapping and System of Mud-Rock Flow Warning and Forecasting

China took active part in all the 11 cooperative projects, especially took part in the local experiments of Flood Risk Mapping and System of Mud-Rock Flow Warning and Forecasting, of which Japan was in charge. Chinese representative introduced their task in flood risk maps and mountain heavy rain disaster prevention. As for the local experiments of Manual of Reservoir Operation and Evaluation of Flood Forecasting Model, of which the Public of Korea was in charge, China made its contribution.

In recent years, China has continuously has worked on flood risk maps and has achieved some success. In 2005, the State Headquarters of Flood Control and Drought Relief requested various river basin authorities to select 2-3 provinces as experimental areas to prepare flood risk maps. The graphic information is important for managements of rivers, reservoirs and flooding plains. The Guidance of Flood Risk Mapping was issued and the project for developing Flood Risk Mapping & Management Platform Software was initiated by the State Headquarters of Flood Control and Drought Relief. Meanwhile, a specific website has been set up as a platform for studying, discussing and exchanging experience in flood risk mapping. Based on the experience from this pilot project, the Guidance on Flood Risk Mapping was revised. Now, the universal flood risk mapping & management software, the platform and the technical standards & methods for flood risk mapping are still under research and preparation.

China continuously made progress in monitoring mud-rock flow. Ministry of Water Resources, China Meteorological Administration, Ministry of Land and Resources, Ministry of Construction and State Environmental Protection Administration have together prepared the plan and design for the study on mud-rock flow & landslide monitoring techniques, with the main objectives include creation of a monitoring system with high and new technologies, development of both hydrostatic & dynamic models for detecting mud-rock flows & landslides, their forecasting, and offering preventive measures to avoid or reduce the losses from these events. The plan is involved with the mountainous and hilly areas in the 29 provinces, focusing on smaller basins of less than 200 km^2 as the main targets, involving 32753 small river basins. The investment is about 25 billion USD. Now, the plan of disaster prevention has been approved by the Chinese government.

- International Activities

China takes active part in the cooperation with the international hydrological organizations, neighboring countries and Members of Typhoon Committee. China has being exchanging and sharing the hydrologic data with other countries and organizations including Russia, Korea, Vietnam, India, Kazakhstan and Mekong Committee.

c. Implications to Operational Progress

Nil.

d. Interaction with users, other Members, and/or other components

Since the workshop on "Living with Risk: Dealing with Typhoon-related Disasters as Part of the Integrated Water Resources Management", held in Seoul, the Public of Korea in September 2004, China has taken active part in such projects as RCPIP (Regional Cooperative Programme Implementation Plan) and DPP (Disaster Prevention and Preparedness).

In 2007, China sent 7 representatives to Bangkok, Thailand attending the Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Events, and 4 representatives actively joined in the discussions of working group on hydrology and work group on disaster prevention and mitigation.

e. Training Progress

- International Training Class on the Flood Forecasting

System and Application

In order to quicken the project of application of flood forecasting system to the selected river basins, to promote Chinese flood forecasting system, and to increase technical exchanges and cooperation between the members of Typhoon Committee, Bureau of Hydrology, Ministry of Water Resources, PRC, would hold an international training class of the flood forecasting system and application in Beijing. Typhoon Committee will sponsor 5000 Dollars as the international traveling expenses for the trainees, while China will sponsor 25000 US Dollars as the training and board/dodging expenses for the foreign trainees in Beijing.

After discussing with Secretariat of Typhoon Committee, Bureau of Hydrology, Ministry of Water Resources, PRC, decided to hold the international training class of the flood forecasting system and application in Beijing from 15 to 21 October 2007, where the trainees would study the basic theory and knowledge in flood forecasting, especially the technology and experience of flood forecasting system. Through lectures and exchanging experience, the trainees would learn some theoretical and practical knowledge of the flood forecasting systems, which could be put in their future operational forecasting.

The 10 foreign trainees are from 7 countries of Korea, Laos, Malaysia, Philippines, Thailand, Vietnam and Singapore while the Chinese trainees were from the Yellow River Water Resources Commission and the provinces of Sichuan, Shaanxi, Shandong and Guangdong. Mr. Olavo Rasquinho, Secretary of Typhoon Committee, Mr. Liu Jinping, Vice Chair of the Working Group on Hydrology and the leaders from China Meteorological Administration, Bureau of Hydrology and the Department of International Cooperation and Science Technology of Ministry of Water Resources of China would attend the opening ceremony.

In the training, there would be 1-2 day lectures, and 3-day hand-on practices and summaries. The foreign trainees would study the Xianjiang flood forecasting model and application software of flood forecasting system of China, set up the flood forecasting schemes of their test basins with the Chinese flood forecasting system, and simulate operational flood forecasting.

The teaching materials were prepared for the trainees, including CD of China"s flood forecasting system, the technical report and manual of the Chinese National Flood Forecasting System (in English). The experts and professors from IWHR, Qinghua University and Bureau of Hydrology were invited to give lectures and tutorship.

f. Research Progress

Nil.

g. Other Cooperative/RCPIP Progress

Nil.

2. Progress in Member's Important, High-Priority Goals and Objectives (Towards the goals and objectives of the Typhoon Committee)

a. Hardware and Software Progress

- National Flood Control Commanding System (NFCCS)

After substantial efforts made in the past 50 years, general floods for large rivers could be controlled. In order to ensure the sustainable development of China's national economy, a nationwide flood control & management as well as flood disaster reduction system need to be established. Therefore, the Chinese government decided to develop the National Flood Control Commanding System (NFCCS).

The system is divided into 4 sub-systems: information collecting, telecommunication, computer network and decision-making support. The target and strategy of the NFCCS are to be:

- A capacity of monitoring observed maximum historic floods shall be built for the hydrological stations that are mandated to report/release hydrological information to the State Flood Control and Drought Relief Headquarters (SFCDRH).

- Hydrological information shall be transmitted from local stations to the SFCDRH within 30 minutes.

- Information collection for flood, drought and flood-control water projects shall be carried out on the basis of standardization, normalization, and digitization.

- Real-time or near real-time monitoring hydrological, engineering and disaster information on the key river stretches of 7 major rivers and for the key flood control areas, shall improve the accuracy in predicting floods or droughts, which provides scientific basis and technical support for decision-making and flood commanding.

In the first stage, NFCCS will be completed by 2008. China is planning to construct 224 sub-centers of hydrological information. 125 sub-centers will have been set up under the National Flood Control Commanding System by the end of 2007.

- Wide Band Network

By 2005, a wide band network of 2 Mbps connecting the Ministry of Water Resources, river basins authorities and provincial hydrological departments has been constructed and put into operation, which significantly improved the time efficiency of information transmission. At present, about 40% of the 3200 central flood-reporting stations measure and report information in an automatic way, over 80% of the hydrological information from the 3200 central flood reporting stations can be transmitted to Bureau of Hydrology, MWR, within 30 minutes on the WRN of real time flood information.

- Developments of Operational Systems

Currently, 1,134 hydrometric stations are involved for hydrological forecasting. Flood forecasting schemes are made for major flood control stations along the mainstream and tributaries of the 7 major rivers, reservoirs and flood storage and detention areas. Operational systems developed by the Bureau of Hydrology such as Comprehensive Hydrolo-Meteorological System for Flood Control and Drought Relief, WEB-based Hydrological Information Inquiry System for Flood Control and Drought Relief, China National Flood Forecasting System, Hydrological Consultation System for Flood Control and Drought Relief, Information Release System have been put into full use, achieving noticeable benefits in terms of flood control and drought relief over the years.

b. Implications to Operational Progress

Nil.

c. Training Progress

Nil.

d. Research Progress

Nil.

e. Other Cooperative/RCPIP Progress

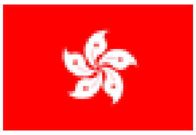
Nil

3. Opportunities for Further Enhancement of Regional Cooperation

- China sponsored Typhoon Committee's international training class on the flood forecasting system and application in October, 2007. If the members of Typhoon Committee want to use the flood forecasting system of China, technical support could be provided. China would send experts to assist Malaysia in the training class in Jan., 2008.

- China will continue to take active part in the regional cooperation under the plan of the Typhoon Committee, such as regional pilot projects on flood risk mapping, heavy rain & mud-rock flow forecasting, reservoir forecasting & regulation, flood forecasting model verification & improvement and disaster information system. China will provide the available information both at home and abroad. Meanwhile, China will exchange relevant information on typhoon prevention with other countries to improve the database.

- The urban typhoon disaster risk management project led by China has been endorsed by the Typhoon Committee as the cooperative project with its various working groups. The results of the project will be submitted to the Water Conference and Water Forum of Asia and Pacific Region.



In Hong Kong

1. Progress in Member's Regional Co-operation and Selected Strategic Plan Goals and Objectives

Nil.

2. Progress in Member's Important, High-Priority Goals and Objectives

a. Hardware and Software Progress

Hong Kong is often affected by flooding induced by rainstorms associated with tropical cyclones and other severe weather systems.

Since 1997, about HK$8 billion worth of major river-training works and flood-control projects have been completed in the New Territories (NT) over the northern part of Hong Kong. As a result, the flooding situation in NT had improved significantly.

To alleviate flooding in low-lying villages, the Hong Kong Special Administrative Region (HKSAR) Government had already completed 27 village flood pumping stations to protect 35 villages where river-training works could not be effectively undertaken due to low ground topography.

For the rural areas, the construction of 26 km of drainage channels and 23 km of stormwater drains were in progress. Major flood prevention works under planning and design include 16 km of drainage channels and 1 km of stormwater drains.

For the urban area in West Kowloon, 45 km of stormwater drains had been completed. Plan is also in hand to construct another 4-km drainage tunnel.

For other urban areas, the construction of 22 km of stormwater drains was underway. Further major flood prevention works under planning and design include 9 km of stormwater drains and 16 km of drainage tunnels.

b. Implications to Operational Progress

Based on outputs generated by the nowcasting system SWIRLS (Short-range Warning of Intense Rainstorms in Localized Systems), HKO provided the Drainage Services Department (DSD) with 1-hour rainfall forecast in graphical form starting 2006 to facilitate their flood control operations.

Data from raingauges operated by the DSD and Geotechnical Engineering Office of the HKSAR Government are relayed to HKO to support the operation of the Rainstorm Warning System, the Special Announcement on Flooding in the northern New Territories and the Landslip Warning System. Saving in operational cost was achieved by using the government-wide data network instead of commercial leased lines. The General Packet Radio Services (GPRS) mobile network and solar panels were used for data acquisition in some out-stations where land-based telemetry and electricity supply were unreliable. Over 65 automated gauging stations have been installed at major river channels in the territory to provide round-the-clock real-time monitoring of water depth, flow velocity and video surveillance.

The rainfall threshold criteria for the issuance of the Special Announcement on Flooding in the northern New Territories were revised in March 2006 and continued in use in 2007, taking into account the improvement work of the drainage systems in flood prone areas. The time taken for flood water to recede would also be considered in canceling the Special Announcement. Operation of the announcement under the new criteria was satisfactory.

Over 2,400 km of drains, engineered channels, culverts and watercourses were inspected and maintained in 2006 (updates to be available at end of 2007). At locations where flooding might cause high risks to the local residents, local flood warning systems were installed to monitor the flooding situations and to alert them about the arrival of floodwater. To effectively and precisely alert the residents and shop-keepers in a local low-lying urban district in the heart of Hong Kong Island for possible flooding due to coincidence of high tide and heavy rainstorm, an automated flooding information dissemination system has been implemented since the 2006 wet season. When the forecast or recorded hydrological data reach the triggering criteria, advisory flood alerts would be sent to registered users via mobile phone SMS messages or pre-recorded voice phone calls. A list of flooding blackspots was also compiled to facilitate the deployment of resources to carry out immediate relief measures during adverse weather situations.

c. Interaction with users, other Members, and/or other components

DSD liaised closely with other relevant Government departments and personnel in charge of construction sites to avoid flooding due to blockage of roadside gullies, drains or watercourses by rubbish or construction waste. A television announcement was broadcast from time to time soliciting the support of the public to keep the drainage system from blockage.

DSD had set up a 24-hour hotline to facilitate reception of flooding complaints and to mobilize DSD's labour force and contractors. Complaints received by DSD were recorded by a computerized Drainage Complaints Information System so that data could be retrieved and analyzed later. When the situation warranted, an Emergency Control Centre under the charge of senior professionals would be activated.

d. Training Progress

Staff of DSD attended various training classes, workshops and conferences (both local and overseas) to acquire the latest knowledge on advanced technology relating to flood prevention, including flooding caused by tropical cyclones. Overseas experts were also invited to Hong Kong to provide in-house training to DSD staff on the advanced hydraulic modelling techniques for the drainage systems.

e. Research Progress

Dynamic hydrological and hydraulic computer models for the drainage systems in Hong Kong managed by DSD were developed to provide quantitative information on the risk of flooding, impacts of development and the performance of various flood loss mitigation options. In particular, all the trunk and major branch river channels in the most flood-prone river basins in the northern part of Hong Kong had been digitized into the MIKE11 model which was used for the review of the hydrological criteria for the release of basin-wide flood warning in the region. A computerized stormwater drainage asset inventory and maintenance system has also been developed. In the past year, DSD had completed several research studies including a review on the triggering criteria for the Special Announcement on Flooding in the northern New Territories, a sensitivity analysis of the hydraulic effect of mangrove growth in river estuary and an analysis of effects of climate change on stormwater drainage system. A project to derive the 2-hour Probable Maximum Precipitation (PMP) for Hong Kong to support flood risk assessment has also been completed in collaboration with HKO.

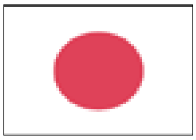
A study to identify the critical input parameters of the MIKE11 model and assess the significance of their uncertainties and the effects on the flood risk assessment is being carried out.

f. Other Co-operative/Strategic Plan Progress

Nil.

3. Opportunities for Further Enhancement of Regional Co-operation

Nil.



In Japan

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives

1.1 Flood Hazard Mapping Project

In the Flood Hazard Mapping Project, the Typhoon Committee member countries have been called on to make efforts to reduce damage, particularly harm to humans, from flood disasters inflicted by typhoons. To do this, it is essential that flood forecasts and warnings and evacuation advisories and directives be made functional and effective. Therefore improving the accuracy and the dissemination of flood forecasts and warnings is of extreme importance, as is the creation of flood hazard maps providing knowledge of flood risks and when evacuation would be needed. It is expected that the synergetic effect of these efforts will lead to voluntary and rapid evacuation when necessary.

The year 2007 is the first year of a three-year extension of this effort. The WS, which was held in Bangkok, Thailand, from September 10 to 15, 2007, confirmed the activities undertaken in the past year and also discussed the action plan for 2008. The Flood Hazard Map (FHM) session of the WS invited, in addition to members of the Typhoon Committee, five persons (China, Malaysia, the Philippines, Thailand, and Vietnam) who have completed the FHM training course conducted by JICA/PWRI-ICHARM. Examples of efforts with FHM are introduced here.

Initially, Japan, which has provided leadership in this project, gave a detailed presentation on (1) FHM activities, (2) the history and recent trends in the use of FHM in Japan, and (3) the next steps to be taken. Specifically, (1) included providing a help desk and uploading good practices; (2) outlining the history of FHM utilization up to now and the "Ubiquitous Flood Hazard Maps" program; and (3) while discussing future activities, proposing that the relationship between TC members and those who have completed JICA FHM training be strengthened.

The Japanese presentation was followed by reports from various countries on their efforts related to FHM. China and Malaysia reported that large-scale FHM projects had been approved and would begin this year.

In 2008, a project undertaken by China and Malaysia, as described above, will be promoted. In addition, the Philippines will proceed with preparation and utilization of community-based FHM. The Philippines, Thailand, and Vietnam also plan to prepare FHM for specific areas. Japan also intends to introduce a manual and good practices for the Ubiquitous Flood Hazard Maps program. Finally, it was decided to proceed with these activities by promoting FHM through cooperation between the TC members and those who have completed the JICA FHM course.

1.2 Project to establish a flash flood warning system, including debris flow and landslide warnings

Japan is a leading participant in the project to "establish a flash flood warning system, including debris flow and landslide warnings." At the 39th general assembly in Manila, members agreed on the following actions: (a) Establishing a Technical Help Desk in Japan. and starting technical consultation; (b) Implementing Critical Line utilization in the pilot area selected in the Philippines; (c) Implementing Critical Line use in at least one additional Member's selected area; and (d) Collecting data from pilot areas and analyzing use of critical lines.

At the 2007 Workshop in Bangkok, China, Malaysia, the Philippines, Thailand, Viet Nam and Japan reported on their progress. Regarding progress made on action (a),

Fig. 1 Web-page of the Technical Help Desk

Japan reported that it had opened a technical help desk with access provided at the following web-page address: http://www.sabo-int.org/index.html. Figure 1 provides an image of the technical help desk. The web-page space is provided by the International Sabo Network in Japan. The technical help desk has just started, so the contents were only electrical data of the guideline that was distributed at the previous TC workshop. In the future, Japan will improve the contents to make the technical help desk more functional. The Philippines reported that the pilot area to be selected will be near Mayon Volcano, the area struck by Typhoon Durian which caused flash floods and landslides in November, 2006. Viet Nam reported that the two pilot areas it selected were in the Ngoi Lao River and Ngoi Pha River, areas. Rainfall data-collecting systems have been installed and activated. Viet Nam also plans to add some pilot areas. China, Malaysia and Thailand reported on the progress they have made and the results of the collection of rainfall data. Noteworthy was China reporting that it had developed three useful methods: a Critical Rainfall Method, a Maximum Rainfall Method, and a Return Period Method. China also reported on the results achieved so far by applying them. The 2007 Bangkok workshop also confirmed that members have made progress on the four actions.

1.3 Disaster Management Policy Program: Water-related Risk Management Course

Water-related disasters such as floods occur all over the world. This year alone, major flood events have inflicted severe damage on different parts of the world, including southern China, Britain, India, Nepal, and parts of Africa. To cope with this growing threat, there is an urgent need to build a community of experts and professionals to deal with water-related disasters, particularly in developing countries that have proven to be more vulnerable to natural disasters. Such experts are expected to acquire a broad understanding of all facets of disaster management so that, from the professional engineering and social scientific standpoints, they can contribute to improving disaster preparedness and recovery and rehabilitation in times of crisis.

To respond to this need, ICHARM has launched a new Master's Degree Program called the "Water-related Risk Management Course in Disaster Management Policy Program," which started on October 9, 2007. The date for launching this course was chosen to coincide closely with International Disaster Prevention Day on October 10.

It is a one-year program jointly organized by ICHARM and the National Graduate Institute for Policy Studies (GRIPS) with the support of the Japan International Cooperation Agency (JICA). Ten students from Bangladesh, China, India, Nepal, the Philippines and Japan are currently studying in the program.

The inauguration ceremony for the program was held

1.4 Implementation of a JICA group training program, "Rivers and Dam Engineering"

The River Bureau of the Ministry of Land, Infrastructure and Transport (MLIT) and the National Institute for Land and Infrastructure Management, PWRI, and JICA have served as implementing agencies in the JICA group training program, "Rivers and Dam Engineering" that began in 1973.
They have provided engineers working on flood control administration and water resource development plans all over the world to give lectures on how the Japanese Government has addressed flood disaster prevention. They have also conducted exercises related to hydrological statistics and runoff analysis, lectures and exercises on dam design and construction, and on-the-spot visits to relevant facilities. As of 2007, engineers have been invited from Cambodia, China, Georgia, Myanmar, Nepal, Sri Lanka and Sudan during the period from August to November for training.

1.5 "Flood Hazard Mapping" training course in PWRI (ICHARM)

The "Flood Hazard Mapping" training course in the PWRI (ICHARM) is implemented as a five-year plan from 2004 in cooperation with JICA. The target countries are Cambodia, China, Indonesia, Lao Republic, Malaysia, the Philippines, Thailand, and Viet Nam. As of November 2007, this ongoing training course had 18 participants from 8 countries and 2 other others from Sri Lanka and Thailand have been invited. Further, as mentioned above, 11 students in the master course have been sharing the curriculum with this training course.
The curriculum of the course consists of Getting the knowledge and technique of (1) making Flood Hazard Map through lectures and exercises, and (2) utilization and dissemination of Flood Hazard Maps through exercises named "Town Watching" and discussion.
In addition, ICHARM conducted a seminar as a follow-up to the FHM training course in cooperation with DID of Malaysia in February 2007. Attending were 17 ex-trainees from the eight countries, 15 Malaysian government engineers, 7 secretariat members from Japan and two invited lecturers from AIT and ICIMOD.
Information on Flood Hazard Mapping and map dissemination was shared. The discussions also covered what should be done to promote FHM. Through this seminar, the information network among FHM-related organizations was strengthened and everyone was encouraged to make further progress toward FHM.
Five ex-FHM trainees from China, Malaysia, the Philippines, Thailand and Vietnam participated in the Integrated TC workshop in Bangkok in September 2007, where they reported on plans to contribute to developing FHMs in each country. This was highly appreciated along with the expectation that those who had gone through the FHM training course would collaborate with hydrologists involved in TC to facilitate the development of FHMs in the TC region.

2. Progress in Member's Important, High-Priority Goals and Objectives

2.1 Using aerial laser measurement to evaluate flood control safety of small- and medium-sized rivers

In recent years, climate change has led to heightened risk of flood damage. For large rivers as well as small and medium rivers, therefore, highly accurate control and highly effective maintenance needs to be implemented to maintain and improve the functions of rapid and efficient disaster-prevention facilities. However, a problem in Japan is that medium- and small-size rivers are considerably longer than large rivers. In addition, appropriate longitudinal and cross-section surveys of the channels and observations of the water level and discharge capacity have not been made for many lengths of rivers. The actual situation is therefore a lack of basic information, such as the discharge capacity, etc. of small- and medium-sized rivers. The problem has been that the safety of the river systems as a whole is not well understood.

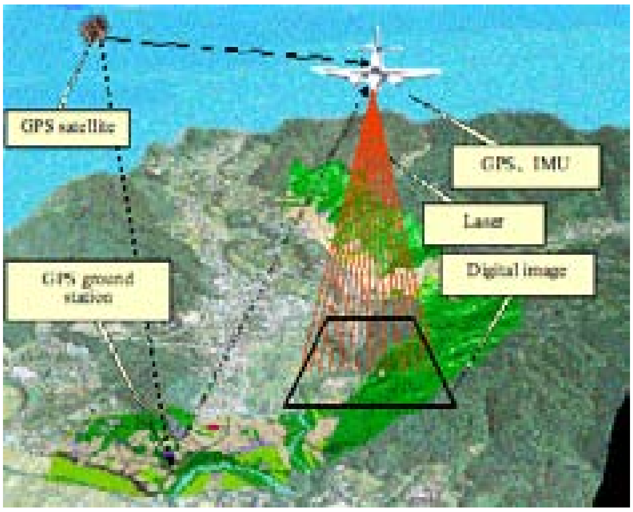


Fig. 2 Outline of aerial laser measurement

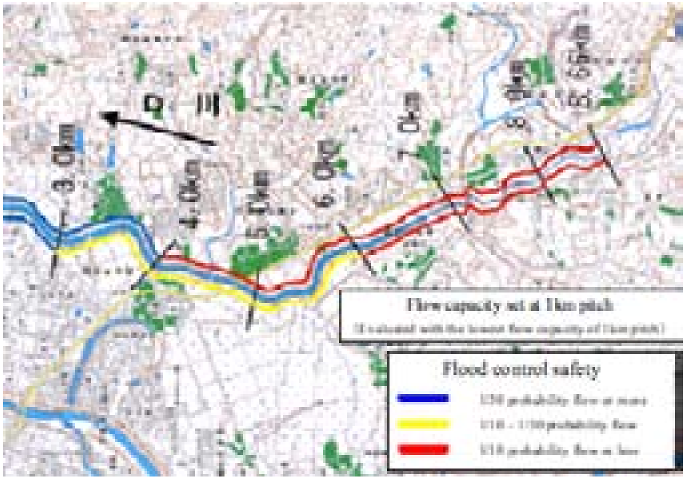


Fig. 3 Image of results of evaluation on flood safety of rivers

In Japan, this issue is being addressed by utilizing aerial laser measurement that can capture wide-area terrain data simply with high density. With these measurements, the channel cross-section of medium- and small-size rivers is grasped, followed by calculation of flow capacity, which in turn contributes to surveys and evaluations of the flood safety of rivers.

Aerial laser measurement is a technology to obtain the three-dimensional terrain data on the basis of the distance to the ground determined from the time difference between the laser irradiation from the air-borne laser scanner to the ground and the laser reflection from the ground as well as the location data of aircraft obtained with GPS locators and IMU (Inertia Measurement Unit). In turn, the three-dimensional data leads to a channel cross-section profile or topographical condition of floodplains, which makes evaluation of the flow capacity possible.

To evaluate the flood safety of medium- and small-size rivers by using aerial laser measurement, measurement of about 50,000 km² was made in 2005 on model rivers. In 2006 and after, aerial laser measurement was made of about 120,000 km² (of 380,000 km² of the national land) for all Class-A rivers. As of July 2007, aerial laser measurement was nearly done, and a primary evaluation of the flow capacity was completed for 72 river systems (of a total 109). Future plans include surveys, evaluations, and official announcements of flood control safety, which are scheduled for all Class-A rivers by the end of fiscal 2007.

2.2 Publication of "Guideline on Warning and Evacuation for Sediment-Related Disaster Prevention"

It is necessary to mitigate Sediment-Related (S.R.) Disaster damage by dispensing information warning people about the degree of risk of S.R. Disasters occurring. Early evacuation of local residents is a key use of the warning information. For that purpose, the Sabo Department of the MLIT, Japan formulated a "Guideline on Warning and Evacuation for Sediment-related Disaster Prevention," which was issued in April 2007. Additionally, most prefectural governments in Japan began issuing warning and evacuation information this year.

With a focus on lessons learned from recent problems in warnings and evacuations related to S.R. Disasters, the Guideline was produced to establish preparedness in cities, governments and communities at the local level.

The main ideas the Guideline puts forward is that communities and governments should have a common understanding of the characteristics of S.R. Disasters and their role sharing and that they must cooperate to promote community preparedness. Based on these ideas, practical procedures involved in "Information Communication," "Issuing an Evacuation Advice," "the Creation and Operation of an Evacuation Center," "Support for the Weak," and "Raising Disaster-Prevention Awareness" are covered in the Guideline.

Today, each city in Japan has begun promoting community preparedness as recommended by the Guideline. Also, an English version will be uploaded to the "International Sabo Network" Web site by the end this year.

"An S.R. Disaster Warning" is issued to support the judgment of the head of the local authority that officially announces an evacuation advice and voluntary evacuation of inhabitants when an S.R. Disaster caused by heavy rain is likely. Detailed information is also provided through the homepage. It combines distribution of hazard-level information and S.R. Disaster hazard maps to promote an understanding of which areas need to be evacuated.

Warning services were available in 38 prefectures as of September 30, 2007, and will be available in all 47

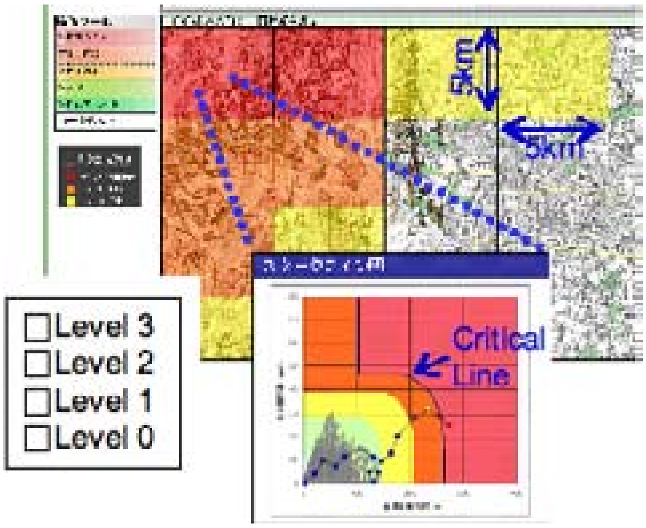


Fig. 4 Hazard distribution displayed

prefectures in Japan by March, 2008.

2.3 Review of measures to adapt to climate changes

As described in the fourth report of the Inter-Governmental Panel on Climate Change (IPCC), global warming is a threat to the safety of human beings. It is also expected that water-related disasters will be aggravated along with climate change due to global warming. According to the fourth report of the IPCC, even the most aggressive efforts to alleviate this trend cannot help avoid the effects of climate change in the coming decades. In this context, adaptation is said to be particularly indispensable to coping with the short-term effects. The importance of the measures to adapt is a well-known fact.

Japan recognizes that the government has the basic obligation to assure the safety and security of the people. It is also necessary to implement, from an early stage and from a long-term perspective, adaptive measures, specifically, the development of preventive facilities to cope with the impact of climate change. In this context, the Minister of Land, Infrastructure and Transport requested recommendations from the chairman of Council for Social Infrastructure in July 2007 on the theme, "How flood control efforts to adapt to climate change should proceed." In response to the request, the River Subcommittee of the Council for Social Infrastructure established a "Review Subcommittee on Flood Control Measures Adaptive to Climate Change" (chaired by Professor S. Fukuoka, Research and Development Mechanism, Chuo University). This subcommittee is conducting analyses and evaluations of the changes in such characteristics as the frequency or scale of flood damage, sediment disaster, and storm surge disasters caused by climate change, as well as their effects on society. The subcommittee is also reviewing adaptive measures to cope with these factors.

3. Opportunities for Further Enhancement of Regional Cooperation

3.1 International Centre for Water Hazard and Risk Management (ICHARM) under the auspices of UNESCO

On 3 March 2006, agreements between the Japanese government, UNESCO, and the Public Works Research Institute were reached to establish ICHARM, which was officially established on 6 March 2006.

ICHARM currently has three research teams: the International Technical Exchange Team, the Disaster Prevention Research Team, and the Hydrologic Engineering Research Team. The International Technical Exchange Team is primarily responsible for planning and implementing training programs and following up on such programs. It is also responsible for the overall adjustment of the Centre's information networking activities. The Disaster Prevention Research Team is responsible for research activities related to risk assessment and risk management of water-related

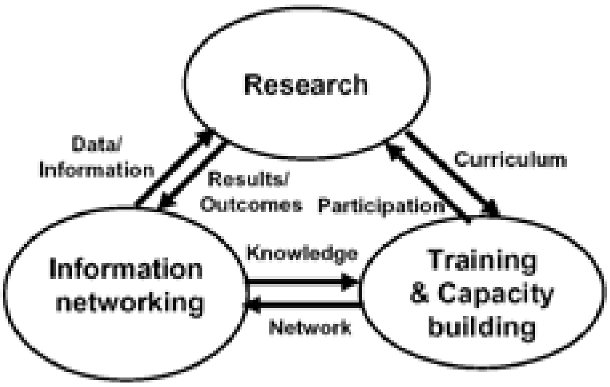


Fig. 5 Three pillars of ICHARM

disasters. The Hydrologic Engineering Research Team is responsible for research activities in the field of hydrological observation, hydrological forecasting, and hydrological analysis, which form the base of the Centre's research activities.

ICHARM initially places its priority on risk management in relation to flood-related disasters. Research, training and information networking are the three pillars of ICHARM activities to produce the best practicable strategies for diverse localities worldwide and to assist in their implementation. ICHARM integrates and carries out these activities in alliance with a large number of relevant organizations all over the world. ICHARM calls for an "Alliance for Localism" to reduce the risk of water-related disasters.

3.2 Approach of the International Flood Network (IFNet) and Global Flood Alert System (GFAS)

IFNet is operating a Global Flood Alert System (GFAS), which is a project offering the information needed to rank the risk of flood occurrence by utilizing satellite observation of rainfall amounts. GFAS started automatic distribution of information in June 2006. GFAS consists of supplying, via IFNet, rainfall information and flood occurrence probability (flood possibility) based on global rainfall data observed every three hours by multiple earth observation satellites. This is expected to provide valuable information for flood forecasting and warnings in areas along large rivers where it takes several days for data on rainfall in upstream areas to reach downstream areas, where telemeter systems have not been developed, or in international rivers where it is difficult to transmit information on upstream areas to downstream areas. GFAS has two types of services. One is providing basic information. The other is providing customized information.

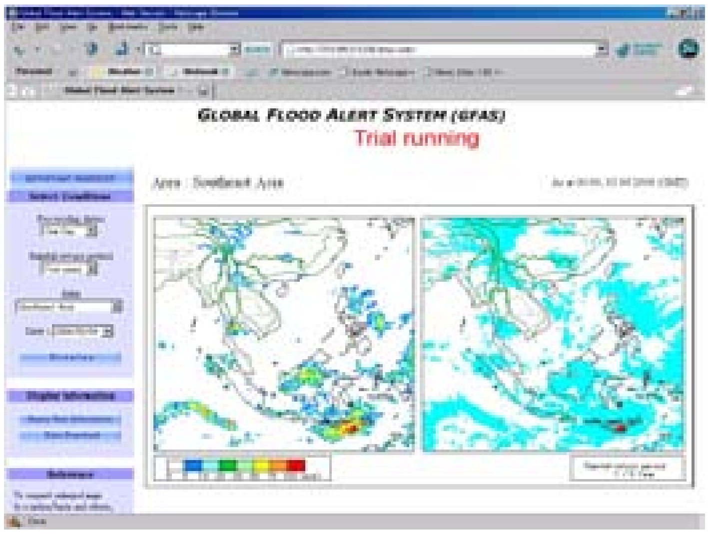
(1) Basic Information

The following types of basic information is posted on GFAS on the IFNet Web site for free access: http://www.internationalfloodnetwork.org/index.html

- Global map of daily and three-day rainfall, and areas with heavy rain, etc.
- Nine regional maps of daily and three-day rainfall, heavy rain areas, etc.
- Text data of global daily rainfall (1,440 x 480 meshes) and others

Figure 6 is an example of a regional map for the Southeast Asia Region. The left side is a daily rainfall, and on the right, displays of rainfall areas in blue, and heavy rain areas exceeding the five-year return period, in this case, in red.

Fig. 6 Example of a regional map (Southeast Asia)



(2) Customized Information

Customized information includes single river basin maps, e-mail notification of heavy rainfall, etc., which is prepared on request from hydrological services/river authorities of registered IFNet members. The operation of the e-mail notification system enables e-mails to be automatically sent to the registered address when the mean basin rainfall of registered river basins exceeds a predetermined threshold (5-year or 10-year return periods).

A sample e-mail is shown below.

(3) Prospects for further system development

> Sample:
> Heavy rain information for ZZ basin.
> Mean basin rainfall of YY mm/day exceeding 5 year return period rain was observed on (date).
> Please check on http://xxxxxxxxxxxxxxxxxxxxxx

To improve the newly launched system and further explore the possibility of satellite rainfall reports/ forecasts in flood forecasting, the following activities, through the delivery of GFAS information and users' needs/feedback, shall be continued:

- Satellite data verification in foreign rivers,
- Addition of a GFAS menu,
- Project finding and formulation to apply GFAS information to flood forecasting using suitable run-off models.

A runoff calculation is performed using satellite rainfall data through GPM and the basin model based on global

At the beginning of last year, preparation of a "Flood Disaster Alleviation Action Report" was started to support wide sharing of lessons learned from flood measures in countries or regions. This report was presented at the 4th World Water Forum held in Mexico in March 2006, and it was disseminated for utilization.

The First Asia-Pacific Water Summit will be held in December 2007 in Beppu City, Japan. IFNet will be holding a session there as well to provide a venue for reports on efforts in the area of flood countermeasures and to exchange information in other areas of concern.

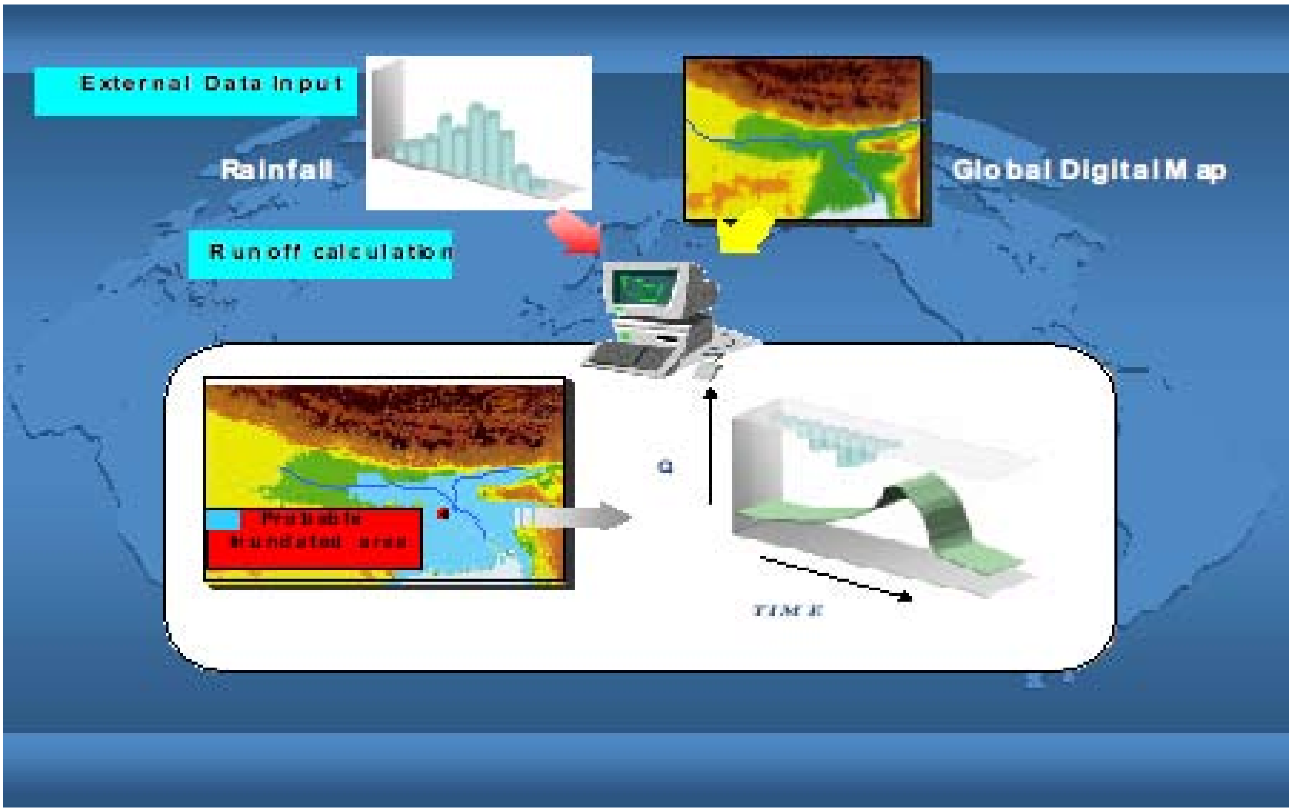


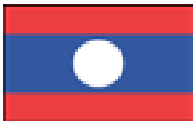
Figure 7 shows a concept of a flood runoff calculation model.

mapping data is used. This calculation makes it possible to forecast not only discharge, but also the inundation state at arbitrary spots.

The forecasting result obtained through runoff calculation is used by the flood alert system as well as various water management groups such as flood control and water resources agencies.

To make the information service more valuable and useful, the Flood Runoff Model will be used to improve the system on the basis of users' opinions and requests of the GFAS.

(4) Others



In Laos

II. Hydrological Component

2.1. Improvement of Facilities progress

Hydrological activities (Department of Meteorology and Hydrology) being carried out during 01 October 2006 to 31 October 2007 in Lao PDR as the following:

- Almost of 21 Hydrological stations was installed at Nam Ngum River Basin (Nam Ngum River). The real time Hydrological has been more effected for inflow forecast, under Num Ngnum River Sector Development Project (Loan Fund from ADB)

- Since April 2007 Hydrological data collection for Hydro Power of Nam Xekong 4 and Namkong 1 (tributary of Nam Xekong) was commenced, under Project of RUSSIA.

- Continue to collect of Hydrological data for Hydro Power Namtheun II, under Project of Namtheun II.

- HYMOS software has been installed at Hydrological Division (DMH) for processing and Analysis stream flow, under Project of MRC

- In cooperation with Regional Flood forecast Centre of MRC program for data exchange,

the HYMET (Hydro – meteorological) software was installed for 4 countries: Lao PDR, Thailand, Vietnam and Cambodia. Department of Meteorology are sending and getting the real time of Hydrological data from riparian countries of lower Mekong Basin by HYMET software. DMH receives Flood Forecast products from MRC by Internet.

- Under project WUP (Water Utilization Program) of MRC, the software SWAT (Soil

Water Assessment Tool), IQQM (Integrated Quantity and Quality Model), ISIS (Hydrodynamic Model) were installed at Hydrological Division (DMH). The Hydrologist could operate and provided the flood mapping for specific flood risk areas such as: Flood mapping for Num Ngum Reservoir, Flood Mapping for Mahaxay district (Xebangfay river) and Xebanghieng river. DSF Decision Support Framework Data archiving.

- Under project of TCP (Technical Cooperation Program) Grant aid from JICA. During this period JICA dispatched 2 Japanese experts on sub - project of Hydrological Measurement and Analysis and Data quality Control. The data base system that monitors all the Hydrological stations managed by DMH and achieves Hydrological observation data was developed. Although the improvement of Hydrological quality will not give direct impacts to the societies around distributaries, improvement of reliability of the Hydrological data will strengthen the accuracy of the flood forecast, and will contribute to the disaster management and agriculture development.

Implication to Operational Progress:

Hydrological network in Lao PDR

The hydrological observation network over Lao PDR consists of total Staff gauges 109 stations and Discharge 49 stations.

Hydrological data collection and Flood Forecasting:

For flood forecasting data collection, Hydrological Division receives real -time data: water level and rainfall observed at 7:00 am (00:00 UTC) from 7 major stations at the main stream (Pakbeng, Luangprabang, Vientiane, Paksane, Thakhek Savannakhet, Pakse) and main tributaries of Mekong River by High Frequency / Single Side Band (HF/SSB) and telephone. Supplementary information real-time data (water level and rainfall) observed at 7:00 am (00:00 UTC) is collected by e-mail from the two upstream stations of the Mekong River in China (Yanjinghon 92980 and Hana 92600).
DMH data exchange in form mathematically model by e-mail with the Mekong River Commission (MRC). In other hand the real – time data are sending by HYMET software between 4 countries of the lower Mekong basin and every day receive the MRC's flood forecasting products through Internet. Additional real-time rainfall, synoptic, climatic data, weather situation, satellite imageries, Radar products (Rain CAPPI for each catchment under coverage of Radar) and other information are received from the Weather Forecasting Division of DMH.
The flood forecasting at mainstream of the Mekong River in Lao PDR continuing to use method of stage correlation regression, between upstream and downstream of water levels with related a flood propagation time of one day or 2 days. All the necessary data are processed and analysed base on micro soft excel by using statistical formula
The preparation of flood forecast bulletins have be

completed at 10:00 am every day. The products of flood forecasting lead-time is 48 hours (from 07:00 am today to 07:00 am day after tomorrow) and update every day. The main contain of the forecasts are water levels and forecast includes 6 stations only (for Pakbeng Station is not working):

1. Luangprabang
2. Vientiane
3. Paksane
4. Thakhek
5. Savannakhet
6. Pakse

The capacity of providing the flash flood forecast at DMH Lao PDR is based on rainfall estimation, but we need also other criteria to forecast flash flood in the future.

The inflow forecast for Num Ngum Reservoir to control water, DMH use inflow run off model

Interaction with users:

The HF/SSB Radio transceivers network, Public telephone, Facsimile, e-mail and web site is used for delivering the Hydrological products, Warnings information to the concerned organizations and to local authorities. The flood forecast is shown in the DMH web site before 12:00 noon every day. . The products of flood forecasting lead -time has been extended from 24 hours in to 48 hours (from 07:00 am today to 07:00 am day after tomorrow) and update every day. DMH also divided the flood warning criteria, which consists as the fallowing:
Nearly warning: In case the water level forecast at that station will expect below 0.50 m below to Warning level. DMH have to provide the warnings and timely delivering to users.
Urgent warning: In case the water level exceeds the warning level, DMH have to provide the urgent warning and rapidly sent to focus areas. Almost the remote areas people can be received flood and warning information trough local authority.

2.2 Training progress:

- The local technical seminar concerning of the data base that is utilized for the management of the Hydrological stations and the Observation data was held at Hydrological division of DMH on 18 th June 2007. At the seminar, the Hydrological Data base with Microsoft visual basic was developed.

- Training on PC architecture course computer network and management at DMH head office on 5 th July 2007.

- Hydrologists has been participated to many international Workshops, Seminars, meeting and other… Please find on the Training progress table .1

2.3 Research progress:

Nil

2.4 Other Cooperative / strategy plan Progress:

- Continue of Hydrological data collection over the country, data processing and Analysing.
- Continuous of Hydrological data exchange between riparian countries of the Lower Mekong Basin with Regional Flood Forecasting Centre of MRC program.
- Hydrological data collection at Xekong 5 (Xekong River) will be extended, under Project of RUSSIA.
- About 6 Hydrological stations will be rehabilitated, under project of Mekong Hydrological Cycle Observing System (Mekong – HYCOS) of MRC. The data will be transmitted by satellite system from remote station to National data terminal Centre for flood forecasting purpose and data will be shared between 4 countries in the Lower Mekong Basin.
- Will be rehabilitated of 4 Hydrological stations by technical Cooperation Project (JICA) and the data will be transmitted by Telemetry system for flood forecasting purpose.
- Improvement flood forecasting methodologies for Mekong River and will extend to large tributaries site in central and Southern parts of Lao PDR.
- Publish Hydrological yearbook for 2007.

- Submitted proposal: on flood hazard mapping for Vientiane plain through diplomatic Channel (Ministry of Foreign Affairs, KOREA Embassy in LAO PDR).

- Cooperate with regional and International organizations in term of Water resources development.

In Macao

1. Progress in Member's Regional Co-operation and Selected Strategic Plan Goals and Objectives:

1c. Interaction with users, other Members, and/or other components

The annual Seminar on Climate Forecasting in South China during the Rainy Seasons of 2007, with special focus on rainfall prediction, was held with neighboring meteorological bureaus at Guangzhou, China on 15-17 March.

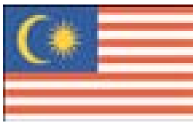
2. Progress in Member's Important, High-Priority Goals and Objectives

2c. Interaction with users, other Members, and/or other components

Local seasonal rainfall forecasts are submitted to Excellency the Secretary for Transport and Public Works as reference in monitoring and predicting the salinity of tap water and making appropriate measures and policies.

3. Opportunities for Further Enhancement of Regional Co-operation

Nil



In Malaysia

Progress in Member's Regional Cooperation, Important, High-Priority Goals and Objectives

a. Hardware and/or Software Progress

Improvement of Facilities

The Department of Irrigation and Drainage (DID) to date has installed about 375 telemetric stations in 38 river basins. A total of 405 manual river gauges and 1019 stick gauges in floods prone areas have been set up to provide additional information during the floods season. As part of the local floods warning system, about 272 automatic floods warning sirens and 147 floods warning boards are being operated. Of this a total of 44 stations have been installed this year which comprises 27 new water level telemetry stations and 32 new rainfall telemetry stations.

A web-based and online early warning system known as "The Debris and Mudflow Warning System for Cameron Highlands in the State" has been developed by the working group on hydrology under the Regional Cooperation Project and Implementation Programme (RCPIP). Similar project will be expanded to other area namely Bukit Damansara, Kuala Lumpur which is prone to land slide. The implementation of floods hazard mapping projects has been initiated for the districts of Muar and Kota Tinggi in the southern region of Peninsular Malaysia. The districts will be the target area for this pilot project (2007-2010) as they were severely hit by the recent December 2006 and January 2007 floods.

Technical Advancement

The website InfoBanjir website (http://infobanjir.water.gov.my) continues to be enhanced and improved in terms of IT technology, hardwares, procurement and network expansion as well as its contents to meet the customer's requirement.

Floods Forecasting and Warning (basin in operation)

Floods forecasting operations were carried out during the floods seasons by the respective DID state offices with technical assistance from the National Flood Forecasting Centre at DID Headquarter. The river basins which have

No	River Basin	Catchment Area (km²)	Number of Forecasting Point	Forecasting Model
1	Muda River	4,300	2	Stage Regression
2	Perak River	14,700	3	Stage Regression
3	Muar River	6,600	2	Linear Transfer Function
4	Batu Pahat River	2,600	2	Stage Correlation
5	Johor River	3,250	2	Regression Model
6	Pahang River	29,300	3	Linear Transfer Function and Stage Regression (back-up)
7	Kuantan River	2,025	1	Tank Model
8	Besut River	1,240	1	Stage Regression
9	Kelantan River	13,100	2	Tank Model and Stage Regression (back-up)
10	Golok River	2,175	1	Stage Regression
No	River Basin	Catchment Area (km²)	Number of Forecasting Point	Forecasting Model
11	Sadong River	3,640	1	Linear Transfer Function
12	Kinabatangan River	17,000	1	Linear Transfer Function
13	Sg Klang	1280	5	Flood Watch

Some of the floods forecasting models were being revised early this year with a view to evaluate their performance and subsequently to make necessary improvement where and when necessary.

b. Implications to Operational Progress

The improvement on facilities and forecasting tools and models had helped DID to enhance its an early warning system for hydrological related hazards, especially on floods. Timely and appropriate preventive and mitigation actions can be taken to reduce loss of lives and socio-economic damages.

c. Interaction with users, other Members, and/or other components

DID continue to interact with the public and mass media to improve public awareness on water related disaster as well as sustainability. Cooperation with disaster management agencies, including Malaysian Meteorological Department, is essential element in mitigating hydrological related disasters.
To improve its capacity buildings as well as national and international cooperation and collaboration, DID is actively involved in international and national seminar/workshop/meeting on hydrological related issues.

d. Training Progress

During this year, the following courses/workshops/seminars related to flood hydrology were organized:

- (ii) A course on "Flood Forecasting Application for Engineers", Kota Samarahan, Sarawak, 7 - 9 Mac 2006;
- (iii) A course on "Flood Forecasting Application for Supporting Officers" Kota Bharu, Kelantan, 22 - 24 August 2006;
- (iv) A Workshop on "Flood Hazard Mapping for Flood Hazard and Risk Management in East and Southeast Asia Regions", Kuala Lumpur, 7 - 9 February 2007;
- (v) A course on "Flood Forecasting Application for Supporting Officers" Kota Bharu, Kelantan, 3 - 5 September 2007 and
- (vi) A course on "Flood Forecasting Application for Engineers" Kota Samarahan, Sarawak, 24 - 25 July 20

e. Research Progress

The active on going projects are as follows:

- (i) Sg. Kerayong Urban Hydrology Study funded by the Intensified Research Priority Areas (IRPA);
- (ii) Flood Diversion (Keruh Diversion, Gombak Diversion etc.) and
- (iii) Detention Pond (Sri Johor, Taman Desa, Batu, Jinjang etc.)

Notably, Kuala Lumpur Stormwater and Management Road Tunnel Project (SMART) is currently 100% completed and it has been operated since 23 June 2007. It has successfully undergone a wet test where traffic was diverted for safe passage of floods water into the tunnel.

In Phillipnes

1 Progress In Member's Regional Cooperation and Selected RCPIP Goals and Objectives

The Philippines, has been actively involved in the implementation of several regional hydrological projects in line with the goals and objectives of the TC. From the establishment of the Flood Forecasting Branch of PAGASA, the Agency has progressively improved its hydrological services through the various technical assistance contributed by TC Members.

a. Flood Hazard Mapping Project

The production of flood hazard maps for two barangays of Metro Manila, i.e., San Bartolome and one locality affected by the overflowing of San Juan River, was the result of the concerted effort of PAGASA , the barangay disaster coordinating council and the Department of Public Order and Safety (DPOS) of Quezon City. The locals were introduced to the importance of these maps through public information drive and the holding of flood drills. The activity is programmed to be replicated to the other barangays of MetroManila. Negotiations with other local officials regarding this activity has been initiated by the DPOS.

b. Landslides and Debris Flow Warning Project

The Philippines has been subjected to a number of disastrous landslides due to continuous heavy downpour during the past years. Iin 2006, one of the worst landslides hit Guinsaugon village in St. Bernard, Leyte, in southern Philippines, where over 1000 people were killed. To help address these alarming consequences, the Philippines decided to join the project of Japan to seek technical assistance. As a pilot area, the locality of Santa Maria in Central Luzon was chosen. Completion of database of the pilot project has been initiated.

c. Reservoir Operation and Guidelines

Flood forecasting and warning system for dam operation is one of the major functions of the Flood Forecasting Branch of PAGASA. This is in coordination with the National Power Corporation and the National Irrigation Administration. The dam authorities are responsible in the efficient operation of the dams with PAGASA as the lead agency in protecting the locals downstream of the dams through the provision of flood warning information The dam information when flooding downstream due dam release is eminent or solely due to inclement weather. The Philippines, through the TC WGH Workshops, contributed to this project of the Republic of Korea by providing dam safety practices adopted in the country..

d. Improvement of User Products in Response to Users' Needs

Preliminary consultation with WGH Members was initiated early this year regarding their respective practices in this endeavor. As a follow-up , a questionnaire is presently being finalized for the in-depth analysis of the formats adopted by the members in the production of hydrological information for various sectors. The initial draft guidelines in the production of hydrological information customized to users' needs will be circulated next year.

e. Community-based Flood Forecasting/Warning System (CBFFWS)

The draft guidelines for the CBFFWS, Philippine setting, has been distributed to the TC WGH Members for comments. The guidelines detail the comprehensive account of the Agency's experiences in this area, where the empowerment of vulnerable communities are being pushed. It include, among others, the initial steps to be undertaken which is the coordination calls for the active involvement of the local governmental units and its constituents in the process, the establishment of the system, operation and maintenance , and the proposed activities to be undertaken for its sustainability. The final guidelines to be adopted by the TC region will be made in time for the next TC WGH Workshop in 2009.

2 Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. For flood forecasting and warning operation, 108 flood bulletins were issued for the 4 telemetered river basins and 34 general flood advisories for ungaged basins of the country. b) Implemented the community-based flood warning system in several communities in the Bulacan Province d) Coordinated with dam authorities in relation to the flood forecasting activities downstream of four major dams in Luzon, including the holding of regular JOMC meetings with the dam authorities and other water agencies for the sustainability of the flood forecasting activities downstream of the dam c) Continued to conduct hydrologic researches on the applicability of several hydrologic models (physical and statistical models) to gaged basins.

b. Flood Hazard Mapping Projects

Two complementary projects on flood hazard mapping are currently being undertaken by the Agency. One project is UNDP-funded and the other is under the appropriations of the Philippine government. This endeavor is an integral part of a systematic approach to community-based disaster risk management towards the formulation of an efficient non-structural measure for flood mitigation. Based from the pooled hydrological information all over the country, 27 provinces were identified as prone to flooding incidents. Consultation with local officials, field survey, ground truthing and development of inundation maps are among the activities of the first phase of the project.

3 Hardware and software progress

3.3.1 Hardware

a) To ensure the optimum usage of the existing telemetry system, both preventive and emergency maintenance were carried out before the onset of the rainy season, i.e., a) de-clogging and de-silting of stilling type of water level stations, including the physical maintenance of all stations.

b) Conducted VHF propagation and Radio Propagation tests with the JICA Mission Study team for the new location of the Flood Forecasting Center for the Pampanga River Basin.

c) Replacement of water level gages of two stations of the Bicol river basin, shifting from the stilling well to the pressure type.

d) Continued the use of SMS technology in the retrieval of data from the three telemeterized basins in Luzon (Agno, Bicol and Cagayan river basins).

e) Entered into an agreement with Globe telecommunications re the provision of an alternate Microwave link for the Tarlac-Mt. Ampucao segment.

f) Installation of raingage and water level stations in flood-prone areas under the community-based flood early warning scheme of the READY project.

3.3.2 Software

In support of the WMO's hydrologic data rescue project , the following activities were highlighted:

a) formulation of a computer program to capture hydrologic data from over a hundred stations coded in random access format.

b) Conversion of 70% of daily rainfall strip charts into digital form through the application of AUTOCAD and Excel VBA.

3.4 Implications to operational progress

PAGASA, through the Flood Forecasting Branch , will ensure the progress on its hydrological researches for operational and structural design purposes with the availability of more hydrologic data for analysis.

3.5 Interaction with users, other Members, and/or other components

The Agency has been in constant coordination with the multi-users of hydrological information in the country. Briefings/lectures on hydro-meteorological conditions were conducted to various sectors of the society. Recipients of these lectures were the following , i.e., a) on-site: 2,186 persons b) In-house: 355 persons c) tri-media: live and taped interviews. The Agency maintained strong collaboration with the various levels of disaster coordinating councils, from the national down to the barangay levels for flood mitigation.

As part of the regional activities of the TC WGH, the Philippines took part in two separate events: the week-long evaluation of flood forecasting models in Korea and training on flood forecaditng systems in China.

3.6 Training /workshops/seminars/Scholarships

3.6.1 Foreign:

a) TC Hydrological Component WS on Evaluation of Flood Forecasting Models in Korea

b) MS in Water Resources - Netherlands

c) WMO/SOPAC Pacific HYCOS WS – Australia

d) Disaster Risk Reduction in Taipei – Taiwan

e) Hydro-Infra Reservoir development and Management – Korea

f) TC WS on Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Events - Thailand

3.6.2 Local

a) National Workshop on Coastal Hazards Mgmt Program

b) Workshop on the Result of Multi-Hazard Mapping & Early Warning System

3.7 Research Progress

a) Continued researches on the applicability of physical and statistical hydrologic models for the telemeterized basins

b) To explore the applicability of the High resolution model (HRM) to forecast rainfall amounts as input to hydrologic models.

In Republic of Korea

1. Progress in Regional Cooperation and Selected Strategic Plan Goals and Objectives of the Republic of Korea:

a. Hardware and Software Progress
Nil.

b. Implications in Operational Progress
Nil.

c. Interaction with users, other Members, and/or other components
Nil.

d. Education and training
2007 Typhoon Committee WGH Seoul Workshop

As a part of ongoing project about application of improvement technique in 'Evaluation and Improvement of Operational Flood Forecasting System Focusing on Model Performance', UNESCAP Typhoon committee workshop was held in Seoul, Korea from February 5 to 7 2007. This workshop was held under the joint auspices of MOCT and KICT and several representatives participated from 6 countries among the 14 member countries except Republic of Korea. The main objectives are as follows:

1 - Information exchange about present state of Flood forecasting system management
2 - Promote member countries to apply the assessment system of national flood forecasting system
3 - Master the basic data for the application to optimum technique of model
0 - Collect the national reports related to Flood forecasting systems
1 And the main subjects of workshop are :
4 - Introduce the present state of flood forecasting system in each member countries
5 - Introduce and apply the improvement technique for input data of the flood forecasting model
6 - Introduce and apply the improvement technique for output data of the flood forecasting model
7 - Training for assessment of Flood forecasting model in each countries 43
8 - Select the basic items for preparing guidelines

At the beginning of the workshop, Kim Hyung-Ryul director of river management department from MOCT gave a address of welcome and Dr. Le Huu Ti, the representative of UNESCAP and Dr. Katshhito Miyake, director of hydrological department of Typhoon Committee delivered congratulatory addresses. And Wang Guangsheng from China, Kazuhiko Fukami from Japan, Dang Thanh Mai from Vietnam, Pichaid Varoonchotikul from Thailand, Rosa T. Perez from Philippine and Somphanh Vithaya from Lao PDR presented about flood forecasting system in each countries.
And Prof. Lee Joo-Heon of Joongbu University and Prof. Kang Boo-Sik of Dankook University presented Measure of Flood Forecasting System (MOFFS). Moreover, participants were trained and practiced MOFF to apply it in each member countries and they encouraged to present, compare and examine the results. Researcher Kim Sang-Ug, Park Yong-Woon of KICT presented about the improvement technique for input data of the flood forecasting model and Prof. Kim Hyung-Soo of Inha University presented the improvement technique for output data of the flood forecasting model. Lastly, participants exchanged their opinion to apply MOFF and coordinated the issues arose during the workshop.
Through the workshop, it was able to realize the fundamental aim to transfer the techniques by participants training for applying MOFF in member countries as well as to collect the national reports and the hydrological documents of member countries for the progress of the project about 'Evaluation and Improvement of Operational Flood Forecasting System Focusing on Model Performance'.

e. Research Progress
Nil.

f. Other Cooperative/RCPIP Progress
Nil.

Figure 1.1 Participants of 2007 Seoul Workshop

2. Progress in Important, High-Priority Goals and Objectives of the Republic of Korea

a. Hardware and Software Progress

Improvement of stage & rainfall gauging stations

Starting with Hangang Riv. in 1974, the Ministry of Construction and Transportation (MOCT) have installed telemetry monitoring facilities at five major rivers (Hangang, Nakdonggang, Geumgang, Youngsangang, and Somjingang). To expand the flood forecasting system, MOCT have installed additional telemetry monitoring facilities at eight small and medium sized rivers (Imjingang, Anseongcheon, Sapgyocheon, Mangyeonggang, Hyoungsangang, Dongjingang, Taewhagang and Tamjingang) since 1996.
Table 2.1 shows the status of the gauging system of water stage and rainfall for the five large river basins.

Improvement with Raingauge Radar Observatory

The Ministry of Construction and Transportation has measured the rainfall in the northern region of the Imjingang Riv., which was hardly possible before, issuing the flood forecasting in this area. To minimize flood damages in this area, the ministry installed a radar raingauge of Korea in Kanghwa-Do Province, in July 2000 for the first time and has been continually upgrading the system. The future strategy for radar raingauge is as follows:

1 - 2004 ~ 2005 yr: Completion of execution planning (Nakdonggang Riv.)
2 - 2005 ~ 2006 yr: Completion of execution planning (Seomjingang & Youngsangang Riv.)
3 - 2006 ~ 2007 yr: Installation (Nakdonggang Riv.)
4 - 2007 ~ 2011 yr: Installation (Hangang Riv., Geumgang Riv. and etc.)
5 - 2011 yr: Completion of radar rainfall observatory system

The main purpose of the radar system is improvement of accuracy in the flash flood forecasting caused by localized torrential rainfall. Figure 2.1 and Table 2.2 show the present state of installed radar rainguage and future strategy. The Large size radar is 6 and the small size radar is 5. They are 2 in Hangang basin, 2 in Nakdonggang basin, 1 in Geumgang basin, 1 in Younsangang basin (above-mentioned 6 is the large size radar), 1 in North Hangang upstream basin, 1 in north of East Sea, 2 in midsection of East Sea and 1 in south of East Sea(above-mentioned 5 is the small size radar).

Table 2.1 Description of the rainfall and stage gauging stations (Jan. 2007)

Basin		Rainfall and stage gauging stations								
		Total			Stage guage			Rainfall guage		
		Sum	Recor.	T/M	Sum	Recor.	T/M	Sum	Recor.	T/M
Total		794	53	741	348	14	334	446	39	407
5 Major river-basin	Hangang	155	23	132	60	2	58	95	21	74
	Nakdonggang	198	10	188	76	3	73	122	7	115
	Geumgang	109	13	96	55	7	48	54	6	48
	Seomjingang	46	0	46	18	0	18	28	0	28
	Yongsangang	40	0	40	26	0	26	14	0	14
Small and medium sized river-basin	Anseongcheon	20	0	20	7	0	7	13	0	13
	Imjingang	27	0	27	9	0	9	18	0	18
	Hyunsangang	17	0	17	5	0	5	12	0	12
	Sapgyocheon	26	0	26	16	0	16	10	0	10
	Mangyonggang	20	0	20	12	0	12	8	0	8
	Dongjingang	15	0	15	9	0	9	6	0	6
	Tamjingang	9	0	9	4	0	4	5	0	5
	Taehwagang	9	0	9	3	0	3	6	0	6
Tributary	Joongrangcheon	8	0	8	3	0	3	5	0	5
	Anyangcheon	9	0	9	4	0	4	5	0	5
	Tancheon	8	0	8	2	0	2	6	0	6
	Wangsookcheon	10	0	10	5	0	5	5	0	5
	Gabcheon	14	0	14	9	0	9	5	0	5
	Jiseokcheon	12	0	12	7	0	7	5	0	5
	Geumhogang	21	0	21	8	0	8	13	0	13
Other basins		21	7	14	10	2	8	11	5	6

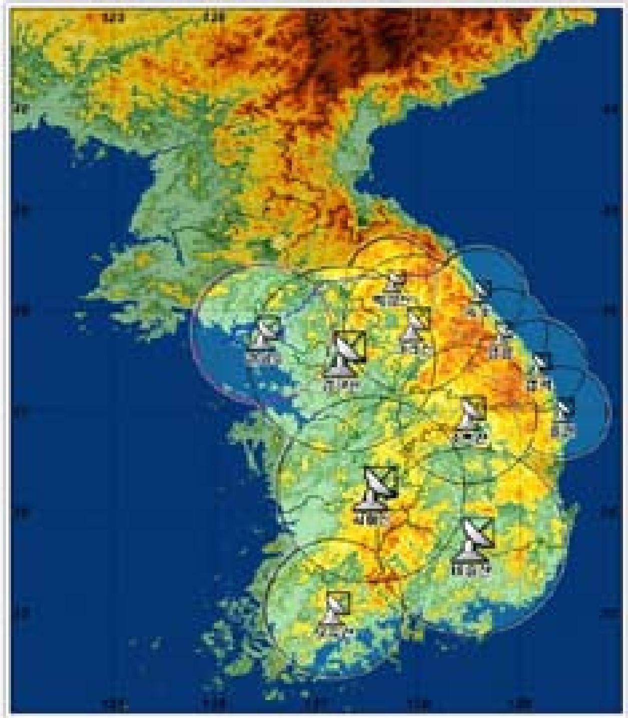


Figure 2.1 The present state of installed radar rainguage and future strategy Table 2.2 The present state of installed radar rainguage and future strategy

Topographical data of river basin which decide the spatial characteristics and the rainfall data during a flood is the most important input data. There are potentialities of missing out the data which fulfill the required period due to disorder of transmission device or poor observation instrument. So in this case, missing rainfall data should be complemented through the specific measures. Though the methods to supplement missing rainfall data are Thiessen coefficient regulation method, method of using daily rainfall data or using correlation formula by correlation analysis and RDS(Reciporical Distance Squared) method, they are traditional supplementary scheme. Characteristic of parameter depends on distance between guages and they have a weak point that doesn't have spatial continuity.

The method of CCWM(Correlation Coefficient Weighting Method) and Kriging were applied and the final results were compared with RDS. In the majority of case of the result about missing data, it is proposed that use more than two complementary methods rather than one. Geumgang river basin was selected to target area and it was divided into the upstream and the downstream basin for correlation analysis for complement of missing data of flux observation post. After select the voluntary missing time of flood event, to verify the each of the

Proposed Site	Basin	Band	Location	Proposed Site	Basin	Band	Location
Mt. Biseul	Nakdonggang (main stream)	S	Yooga, Dalseong, Daegu	Mt. Baegam	North Hangang (upstream)	C,X	Naechon, Hongcheon, Gangwon
Mt. Mohoo	Yongsangang (main stream)	S	Nam, Hwasoon, Jeonnam	Sokcho	East Sea(north)	C,X	Daepo, Sokcho, Gangwon
Mt. Gari	Hangang (upstream)	S	Doochon, Hongcheon, Gangwon	Gangneung	East Sea (midsection)	C,X	Seongsan, Gangneung, Gangwon
Mt. Geomdan	Hangang (main stream)	S	Changwoo, Hanam, Gyeonggi	Samcheok	East Sea (midsection)	C,X	Namyang, Samcheok, Gangwon
Mt. Sobaek	South Hangang, Nakdonggang upstream	S	Gagok, Danyang, Chungbuk	Uljin	East Sea (south)	C,X	Uljin, Uljin, Gyeongbuk
Mt. Seodae	Geumgang (main stream)	S	Chubu, Geumsan, Chungnam				

Improvements of software in data processing and analysis

1) Improvement of method to supplement the rainfall data

methods, the target data were estimated and compared with practically observed rainfall data. And the rainfall data related to missing time were complemented with the selected method ahead and the rainfall events, also selected two method which have the most approximate

value with the actual observation values of each rainfall event.
According to the result, Kriging and CCWM for the upper Guemgang river basin, Kringing and RDS for lower basin proved better outcomes.

Table 2.3 Result of method to supplement the missing data

<table>
<tr><th rowspan="2">Basin</th><th rowspan="2">Rainfall events</th><th rowspan="2">Observation post</th><th colspan="2">complementary method for missing data</th><th rowspan="2">Basin</th><th rowspan="2">Rainfall events</th><th rowspan="2">Observation post</th><th colspan="2">Complementary method for missing data</th></tr>
<tr><th>rank 1</th><th>rank 2</th><th>Rank 1</th><th>Rank 2</th></tr>
<tr><td rowspan="8">Upstream
of Geumgang river basin</td><td rowspan="2">No.1</td><td>Moopung</td><td>CCWM</td><td>Kriging</td><td rowspan="8">Downstream
of Geumgang riverbasin</td><td rowspan="2">No.1</td><td>kanggyung</td><td>RDS</td><td>CCWM</td></tr>
<tr><td>Sinham</td><td>RDS</td><td>Kriging</td><td>Cheongju</td><td>Kriging</td><td>RDS</td></tr>
<tr><td rowspan="2">No.2</td><td>Mooju</td><td>Kriging</td><td>RDS</td><td rowspan="2">No.2</td><td>Jochiwon</td><td>Kriging</td><td>RDS</td></tr>
<tr><td>Boeun</td><td>Kriging</td><td>RDS</td><td>Cheongyang</td><td>RDS</td><td>CCWM</td></tr>
<tr><td rowspan="2">No.3</td><td>Moopung</td><td>CCWM</td><td>Kriging</td><td rowspan="2">No.3</td><td rowspan="2">BokryongHoeideok</td><td rowspan="2">CCWM
CCWM</td><td rowspan="2">Kriging
Kriging</td></tr>
<tr><td>Cheongsung</td><td>Kriging</td><td>CCWM</td></tr>
<tr><td rowspan="2">No.4</td><td>Boeun</td><td>Kriging</td><td>CCWM</td><td rowspan="2">No.4</td><td rowspan="2">YangchonJeungpyung</td><td rowspan="2">RDS
Kriging</td><td rowspan="2">Kriging
CCWM</td></tr>
<tr><td>Choobu</td><td>CCWM</td><td>RDS</td></tr>
<tr><td colspan="3">Suggested Method</td><td colspan="2">Kriging, CCWM</td><td colspan="3">Suggested Method</td><td colspan="2">Kriging, RDS</td></tr>
</table>

2) Improvement of method to supplement the parameters

To select the suitable revision methods about Flood forecasting models of member countries, the result were computed and analyzed with application to revision methods which conducted comparative analysis up to 3rd year in the target basin of member countries. As a basic task to perform this work, the result was calculated by applying to the target area with the revision method and the models applied to national basins and also the target basin was built take advantage of the data which offered from researchers of member countries.
For this work, the revision method and the models were applied to the existing Vietnam basins. But the outcome of the basins by the subbasin rainfall about 6 hours represented a little difference in the outcomes from Miho-stream basin in Korea. (While there are minute differences between objective function of SSR and WSSR in Miho-stream basin, there is a big gap in Vietnam basin) Therefore, the revision method and the models were applied to the Japan basins which is similar to Korea in the aspects of rainfalls per hours, and the result were compared with Vietnam basins.
To improve parameter of flood forecasting model, it is evaluated application and valuation function for making out selection guide and evaluation guide which apply to external and internal under the applied result at home and abroad. although we evaluated model, selection conditions of object function on a membership nation included internal area, a characteristic of phase is more important than that of model because the deviation of regional difference and idea is larger than difference of models.
As a result of applying it seems to be different that object function and model which having a high application on Japan and Vietnam basin because of difference of water material's a variation. In a similar applying way to internal, difference between SSR and WSSR isn't large in case of Japan, but application of WSSR is higher than that of SSR in Vietnam.

b. Implications in Operational Progress

Quality control system for Hydrological data

The hydrological data such as rainfall data and stage data is basic and important data to grasp and manage the national wide water resources. Therefore, it is necessary to construct infra structure which provides high quality hydrological data, quality management system, and improvement of the related technology.

In the quality control system, it is impossible to construct the fully perfect automatic system by mathematical algorithms or methods. Although the fully perfect automatic system is constructed, it can be undesirable because this system can not treat all outlier data. Therefore, it is required that quality control system should include the manual procedure and treatment procedure. Also, before the construction of the system, all guideline which deals with outlier data and its treatment procedure should be determined. Figure 2.2 shows the procedure of quality control system. Figure 2.3 and 2.4 represents graphic user interface of the quality system for rainfall data and stage data.

It is very important to confirm and check out the hydrological data because the hydrological data have many margins occurred error caused by environmental change in the field, miss-operation of observation instrument, mistake of person observing in field and any other factor. Therefore observed record(original data) that is acquired from field observation, magnetic record, data logger, telemeter and so on must be confirmed and checked out to use it.

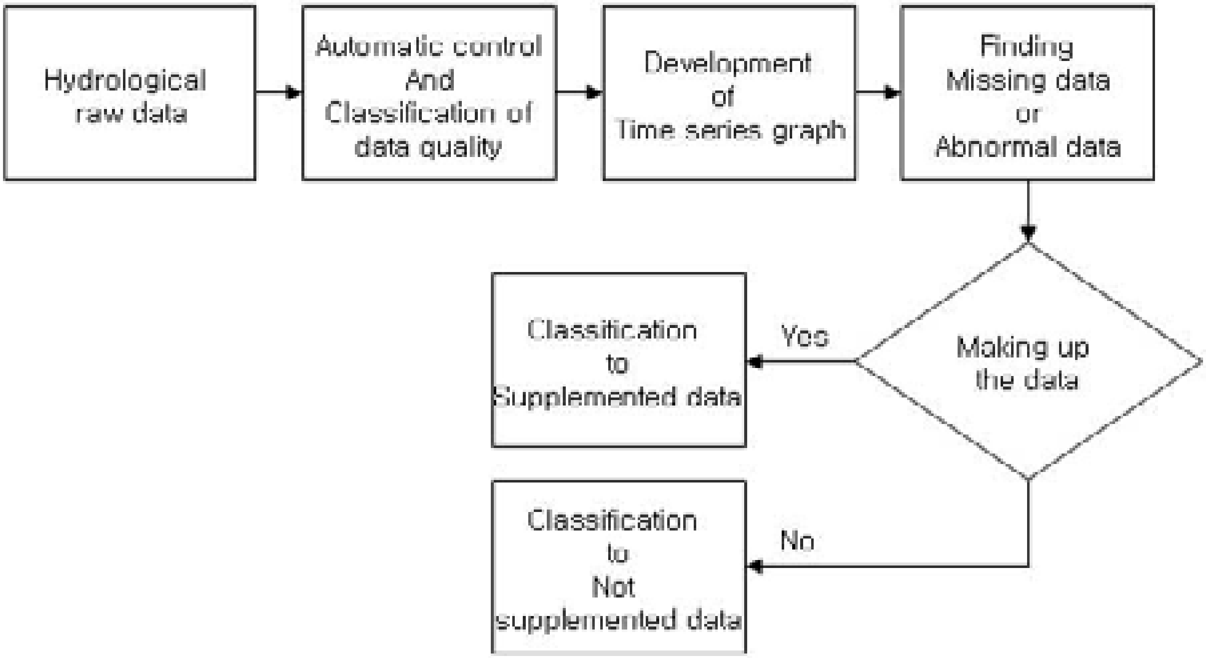
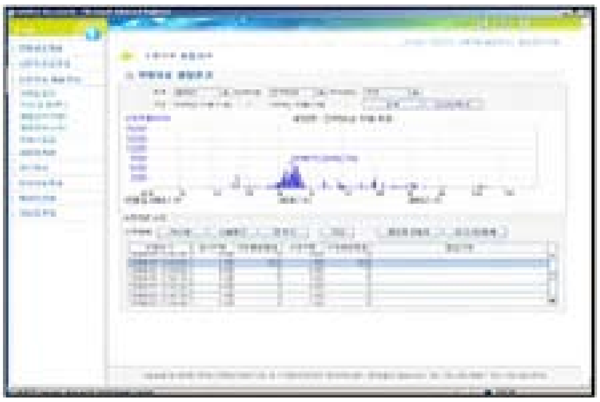


Figure 2.2 Procedure of quality control system Figure 2.3 Quality control of rainfall data Figure 2.4 Quality control of stage data



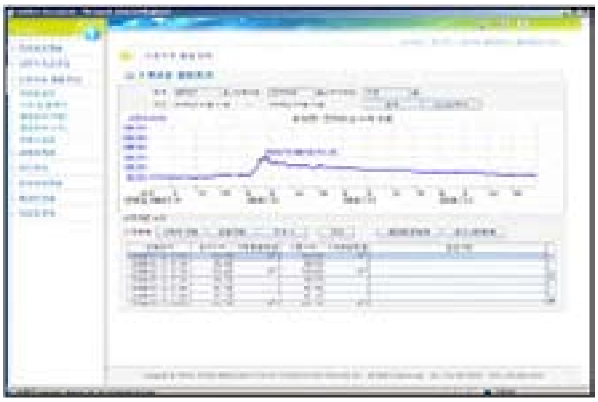


Table 2.4 Process and management method of hydrological data

Division	Contents		
	Rainfall		Stage
missing data / check abnormal data (automatic)	-Check the abnormal data and missing data (excessive data, too big difference with RDS, CCWM)	-Check the abnormal data and missing data (comparison with slope, same water level, past data)	
missing data / process abnormal data (passivity)	- Modification by normal observed data - Modification of missing data and abnormal data by using the close guage data (the arithmetic mean, RDS weighted mean, using the close guage data) -A person in charge could judge and modify (need for judgement base and record of modification method)	- Modification by normal observed data - Modification by linear interpolation - Modification by French curve method - Modification by using the relational expression with close guage data -A person in charge could judge and modify (need for judgement base and record of modification method)	- first process / complement - second check
grant of quality level	- Grant of quality level by modification method for data that is available modification and supplementation - Grant of quality level by data condition for the other data	- Grant of quality level by modification method for data that is available modification and supplementation - Grant of quality level by data condition for the other data	- last grant of quality level
The others	- Quality level for data condition by the first automatic check and quality level for data condition by the last passive modification and supplementation - Record of reference item for data condition		

Magnetic record method

Digital logger method

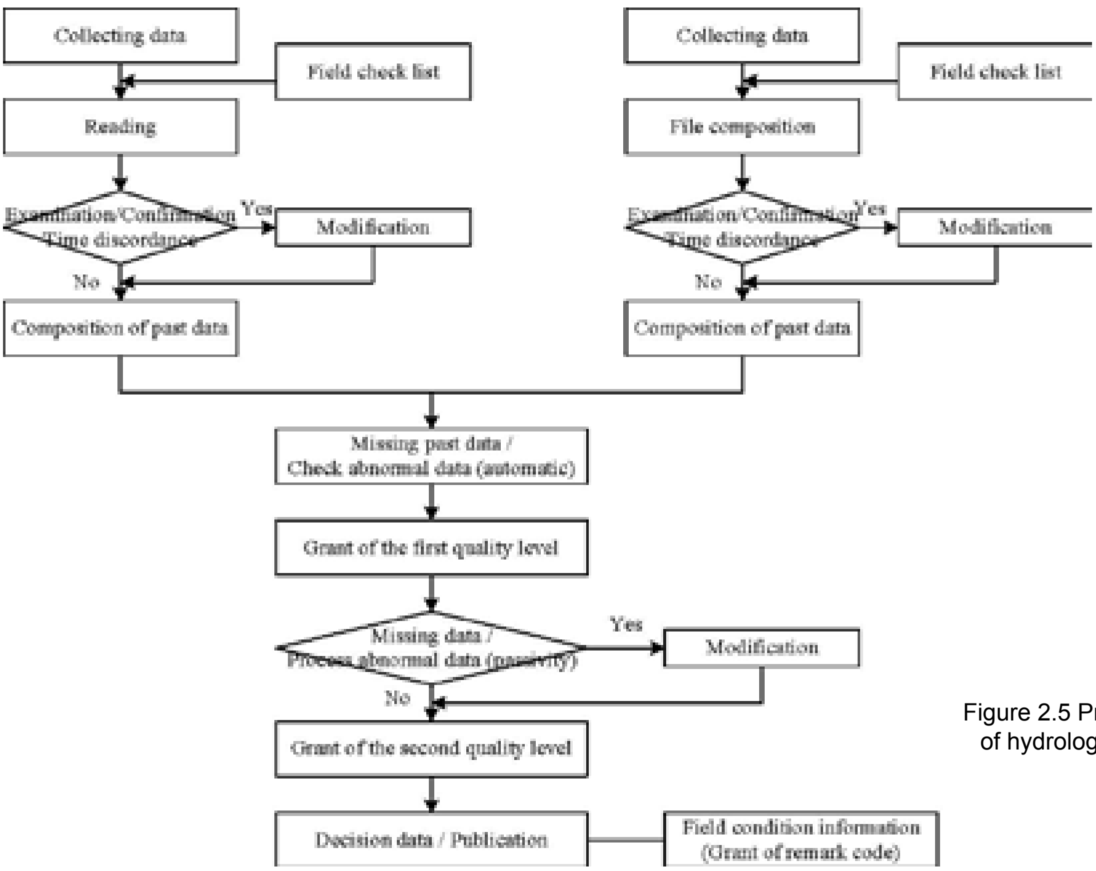


Figure 2.5 Procedure of hydrological data control

Flash flood monitoring and prediction system

This study introduced flash flood prediction system to the country for the improvement of severe weather prediction and the measure to minimize the damage by a short period and localized torrential rainfall. And this study developed flash flood estimation model to use practically radar rainfall data through a connecting project with 'Rainfall radar system project'. Also applicability and validity is examined by means of applying the developed flash flood model to the study area and web-based flash flood prediction system is constructed for the study area. The main contents are as follow.

1 (1) The method to correction real-time radar rainfall data and development of module to use by hydrological data that is radar rainfall data observed from Injingang radar.

2 (2) Development of Korean style flash flood estimation model(F2MAP) that is suitable within the country basin by considering meteorological data, hydrological data and GIS data useable within the country basin.

3 (3) Analysis of the past flood event after developing the Korean style flash flood index to classify preexistent flood and flash flood.

4 (4) Development of web-based flash flood monitoring and prediction system connecting with real-time Injingang radar rainfall observation system.

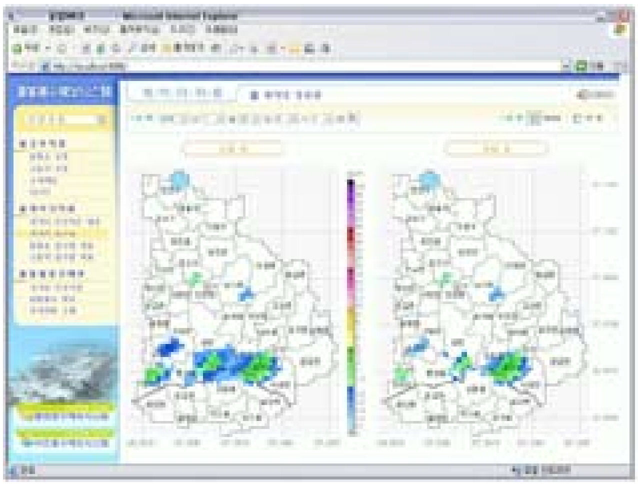
Flood control of seomjin River in 2007

1) Meteorological characteristics

From July to September, heavy rain due to Typhoon and Monsoon has produced a lot of flood in southwest area of Korea. Particularly between 13th and 16th of September, high atmospheric pressure of the North Pacific, which had gone out to the east in the beginning of September, expanded its strength and stayed near the Korean Peninsula. As well, the atmosphere near the Korean Peninsula was unstable due to the inflow of cold air caused by cold high atmospheric pressure of the Chinese continent. Moreover, a tropical cyclone and Typhoon 11 and 12, 'Nari' and 'Wipha' moved northward in succession from the southern sea between two high atmospheric pressure. They brought about a big torrential rainfall around Jeju island and the southern coast. By this condition of the atmosphere, record-breaking rainfall was concentrated in the southern region. Severe rainfall was concentrated in Seomjin River basin. During this period, the total rainfalls of 317mm and 160mm in Juam and Seomjingang Dam basin located in Seomjin River basin were recorded respectively. As a result of this event, 225MCM(million cubic meter) and 108MCM of flood water flowed into each Dam.

2) Reservoir Operation

During the flood season, Juam and Seomjingang dams played a major role to decrease flood damage in Seomjin River basin, which located in the Southwest region of Korea. Before the rainfall began, water level



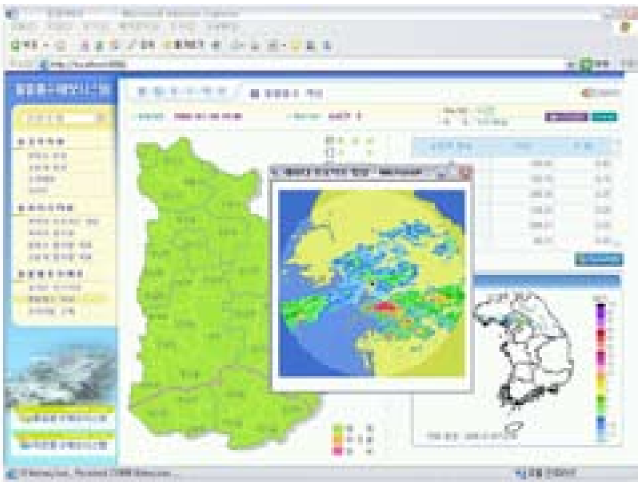
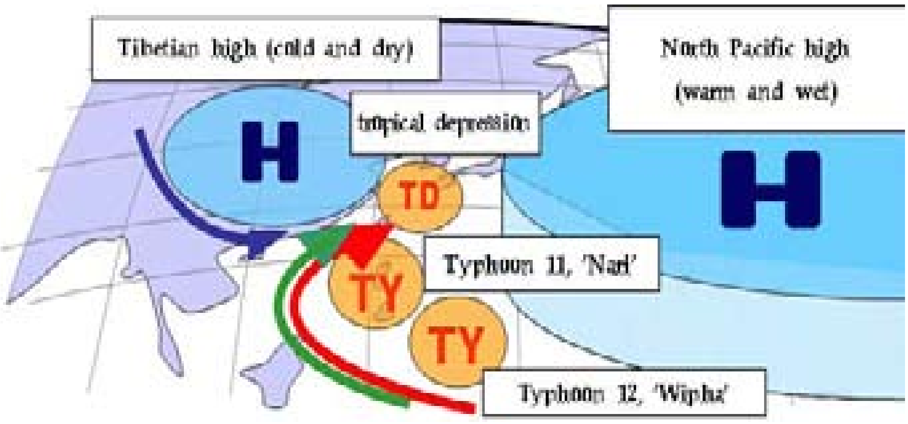


Figure 2.6 Web-based radar rainfall observation Figure 2.7 Web-based real-time monitoring



of Juam Dam had been lowered to EL.107.55m that is decreased in 0.95m comparing with RWL, Restricted Water Level, EL.108.5m and that of Seomjingang Dam had been lowered to EL.193.24m that is decreased to 3.26m in RWL, EL.196.5m.

After a rainfall of 317mm and 106mm had occurred in each Dam basin since September 13, Water Resources Operations Center analyzed a tough realtime rainfall-runoff forecast for each Dam's flood control in this basin. On the rainfall-runoff forecasting results, suitable release magnitude and timing of the dam were decided to control downstream rising stage and to minimize flood damage.

The maximum peak flow of 3,362m3/s flowed into Juam Dam, and dam release through the gate attained to 1,982m3/s, 48% of maximum design release 4,154m3/s on September 15. As a result of the flood control, water level of Juam Dam was reached to EL.109.73m which is 0.77m lower than Design Flood Water Level 110.5m.

Also the maximum peak flow of Seomjingang Dam, 640m3/s occurred and spillway release of the dam attained to 413m3/s, 22% of maximum design release 1,868m3/s on September 17. As a result of the flood control, water level of Juam Dam was reached to EL.194.07m which is 3.63m lower than Design Flood Water Level 197.70m.

3) Analysis of Flood Control Effect

Table 2.5 shows the effect evaluation method of flood control in multupurpose dam. Flood control effect of the dam is that how much is reduced the release magnitude of dam about given inflow condition. Also, downstream flood control evaluation is that how much is reduced the downstream stage or flood flow under given constraint condition.

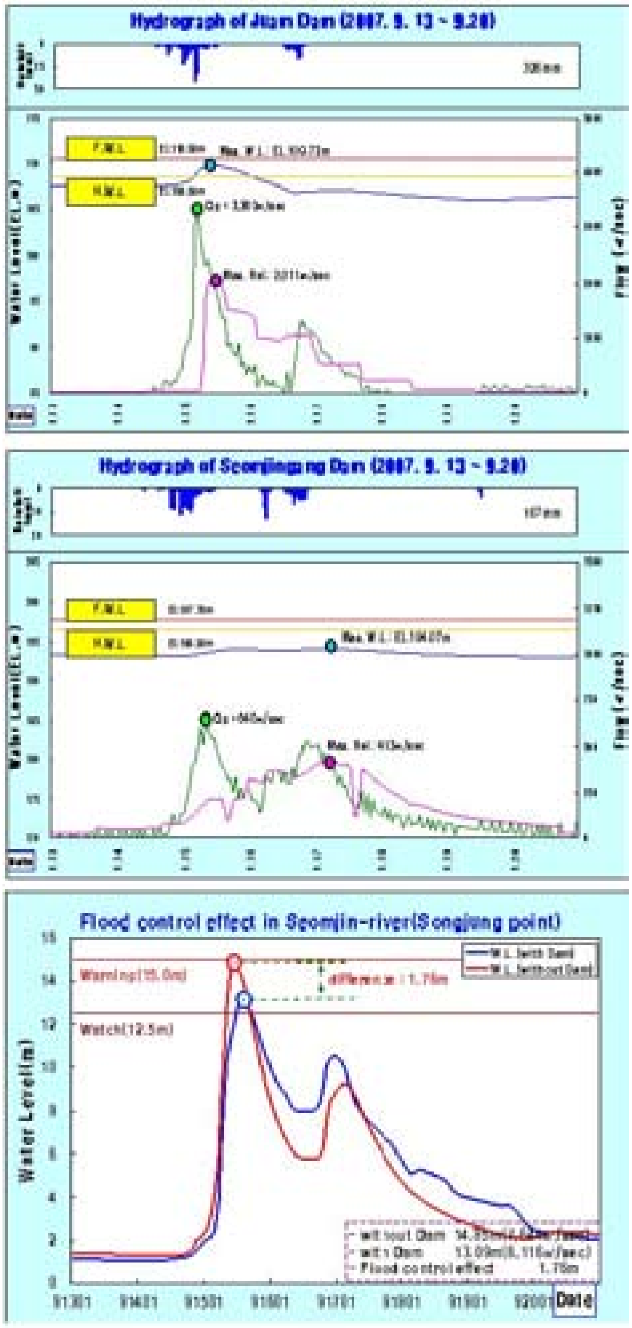


Fig. 2.9 Juam and Seomjingang dam's flood control

Table 2.5 Flood Control Effect Evaluation of Dam

Items	Evaluation Method
Control rate of peak inflow	(peak inflow - max. outflow) / peak inflow
Downstream flood control	water level difference without and with dam or flow difference without and with dam

Table 2.6 Flood Control Result of Each Dam

Items		Juam Dam	Seomjingang Dam	Sum
Rainfall(mm)		317	160	
Dam Storage (106m3)		105	22	127
Dam's flood control ratio	Max. Inflow	3,362	640	
	Max. release	1,982	413	
	Control rate(%)	40	36	
Design flood(m3/s)		4,154	1,868	

During this flood event, a storage for two dams attained to 127MCM Due to this volume stored in Juam and Seomjingang Dam, flood damage at up- and down-stream sites of two dams was very largely mitigated. Also the water level of Songjung point in downstream site of two dams was lowered to 1.76m from EL14.85m without Dam to EL13.09m with Dam along with this flood control.

4) Conclusion and Recommendation

During this heavy rain periods, flood control at two dams and downstream major points was performed successfully by reasonable reservoir operation in Seomjin River basin. Recently abnormal weather and typhoon have induced severe tropical storm or flash flood. The flood damage has been increased by progressing urbanization and industrialization. On the other hand, water resources facilities such as multipurpose dam for flood regulation is difficult to build for the antagonism of residents. According as scientifically flood control system between stream and flood regulation structures is able to maximize flood control ability and the reliable meteorological/hydrological analysis system can reduce flood damage, the more scientific flood control management system have to be developed consecutively.

c. Interaction with users, other Members, and/or other components

Use of integrated data service system

The Water and Management Information System(WAMIS; Water Management Information System) is a integrated system which can service the discharge, water quality, meteorological data, etc.
This system was based on the cooperation with three organizations(Ministry of Construction and Transportation, Ministry of Government Administration and Home Affairs and Ministry of Environment) related to water and environment. Figure 2.10 shows the service interface to the stage data.

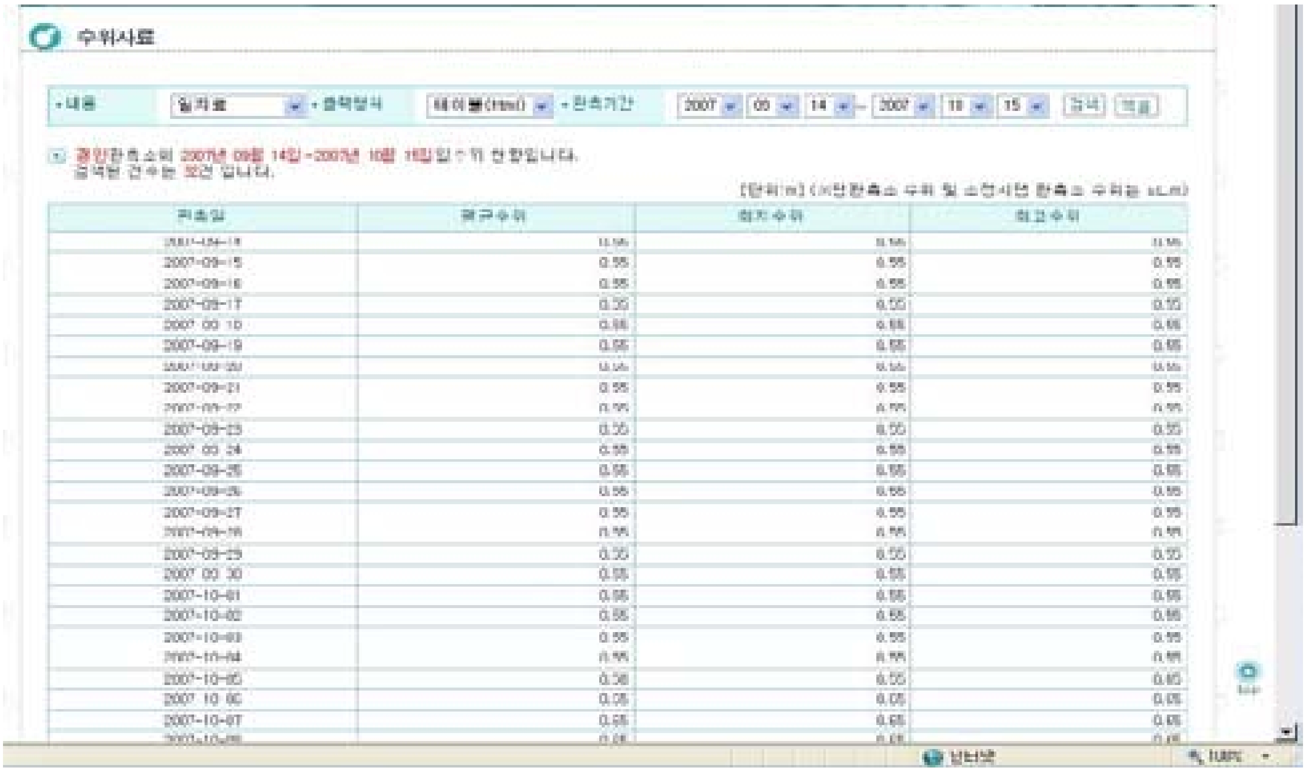


Figure 2.10 Service interface to stage data

d. Education and training

The four Flood Control Centers under the MOCT have held the annual workshops for the operators engaged in the hydrological observations. In particular, prior to the rainy season, commanding post exercise (CPX) was carried out for the flood forecasting services.

e. Research Progress

Urban Flood Disaster Management Research

As a recent large scale flood disaster in urban area, it is a very immediate problem to improve and develop the plan, design and management technique in urban stream. Therefore MOCT organized research center by adopting ‘Urban Flood Disaster Management Techniques’ as a prior research project of ‘The Core Construction Technology Development Project’ .

The objectives of this research are to develop algorithms for solving the various urban flood problems and to support the theory and technology for establishment of urban flood control and management planning. The algorithms and technologies include urban flood analysis, urban flood forecasting and inundation analysis system development, structural and nonstructural urban flood disaster mitigation and management methods.

1 -Development of technique for disaster analysis of urban flood -Development of technique for flood forecast and warning system, and for the prediction of inundated area

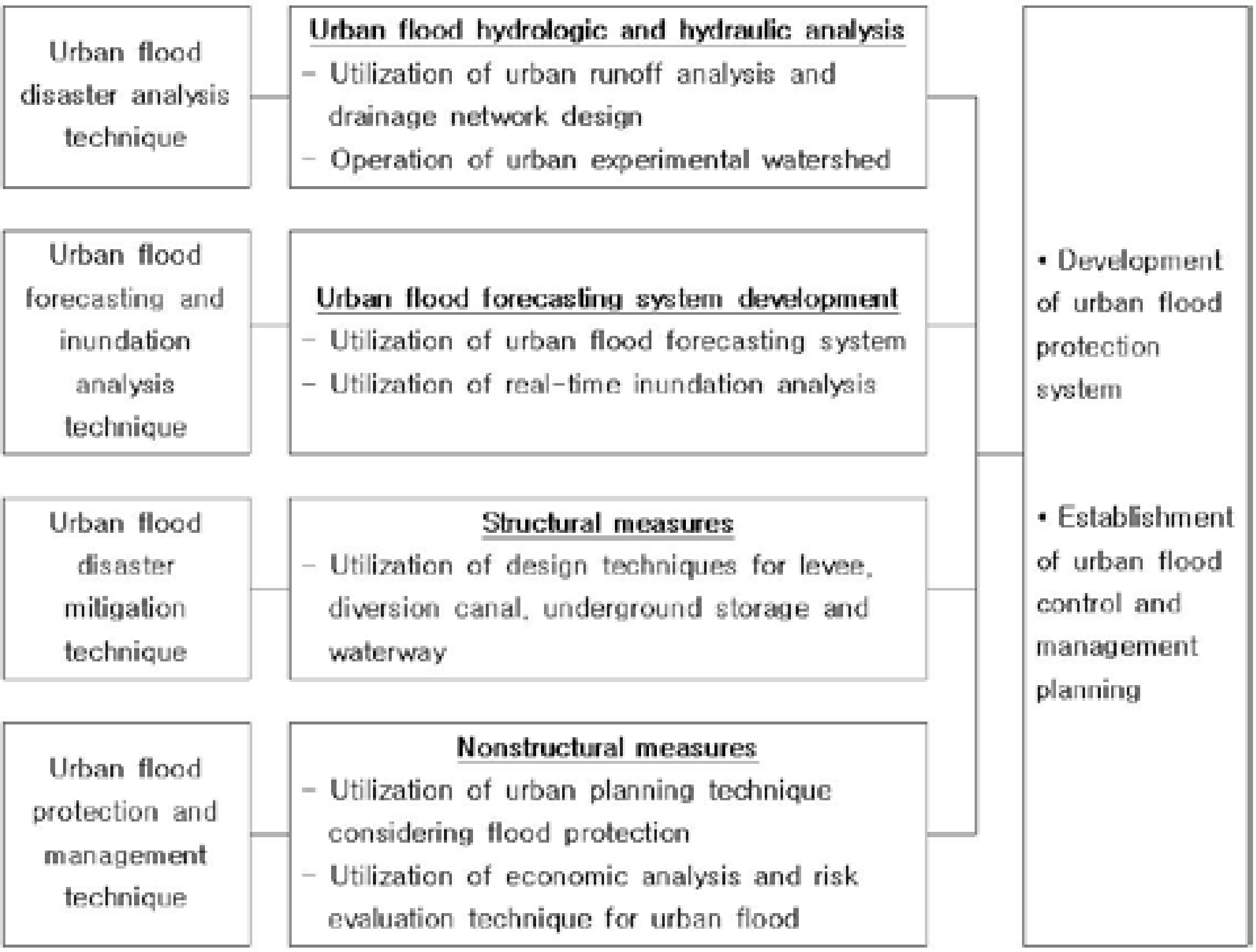
2 - Development of technique to mitigate urban flood disaster

3 - Development of technique for defense plan and management for urban flood

As a result of research, the fundamental theory and the previous investigation concerning the urban flood problems such as flood runoff analysis, drainage network design, rainfall forecasting and inundation analysis, structural flood damage reduction measures(levee, diversion canal, underground storage etc), operation of flood forecasting system and management of urban drainage system are investigated. All these results are used for the field application to urban flood control, management planning and stream design. In addition, the establishment of fundamental theory for urban flood forecasting and inundation analysis system can be useful for the practical applications of hydraulic structure design and flood prevention planning.

Table 2.7 Result of urban flood disaster management research
Figure 2.11 Application plan of result

Division	Contents	Result
Research	Development of technique for disaster analysis of urban flood	- Development of design technique for runoff analysis and river design in urban river basin - Development of design technic for urban river drainage system - Development of design technic for urban river structures - Development of technique for ecological hydraulic analysis and restoration in urban river basin -Establishment and Operation of representative urban river basin
	Development of technique for flood forecast and warning system, and for the prediction of inundated area	- Development of technique for rainfall analysis and forecasting in urban basin - Development of technique for practical use of urban flood forecast and warning system - Development of technique for the bank failure characteristics and hydraulic analysis at urban river - Development of technique for the forecast of inundation at urban area
	Development of technique to mitigate urban flood disaster	- Development of design technique for urban river bank - Development of design technique for underground outlet and diversion channel - Development of design technique for underground multi-purpose detention pond - Development of design technique for the mitigation facilities of urban flood discharge
Center (generalization)	Development of technique for defense plan and management for urban flood	- Development of technique to set up comprehensive urban river basin flood control plan -Development of operation and maintenance technique for urban internal drainage system -Development of evaluation technique for potential risk and the damage due to urban flood - Development of technique for urban disaster prevention plan and non-structural flood defense



Improvement of the accuracy of flow measurement using Automatic gauge

A difficult of the hydrological measurement is caused by natural randomness. As the stage and flow velocity are changed by the boundary condition such as bed condition, the parameters become unknown. Therefore, hydrological measurement includes the more uncertainties. In spite of high cost to improve the hydrological measurement, the sufficient accuracy has not yet been insured by due to of uncertainties.

In recently, automatic measurement technologies are developed to improve the accuracy of the hydrological data. To keep pace with the developed information technology, many instruments to measure the hydrological data have been applied in hydrological measurement field.

In this study, the variety of the improved hydrological measurement such as ADCP(Acoustic Doppler Current Profiler), stage gauge using CCTV, LSPIV (Large Scale Particle Image Velocimetry), ultrasonic velocity meter and ADVM(Acoustic Doppler Velocity Meter) are applied to the many gauge station.

Figure 2.12 show the conception of the LSPIV. Also, Figure 2.13 shows the installation of the ultrasonic discharge guage.

Figure 2.13 Installation of the ultrasonic discharge gauge

Development of the ubiquitous river buoy (R2V2; River Robot for Velocity & Volume) for the measurement of water depth, velocity and environment

The purpose of this research is to develop a remote-controlled river boat system for the data acquisition of river information (depth, velocity and environment). It can be substituted as a new measurement system for exist manual methods in river or reservoir. The manual methods are that some man carried on the measurement in the river or used a motor boat, but that was grossly inefficient, dangerous and uneconomic methods.

Developed ubiquitous river buoy (R2V2; River Robot for Velocity & Volume) is gathering river information with freely moving in field and transmit to computer through wireless RF (Radio Frequency) or CDMA (Code Division Multiple Access). So this system has meaning that begin home production of the measurement system for river data acquisition and has led to a possible gathering the river information economically and safely.

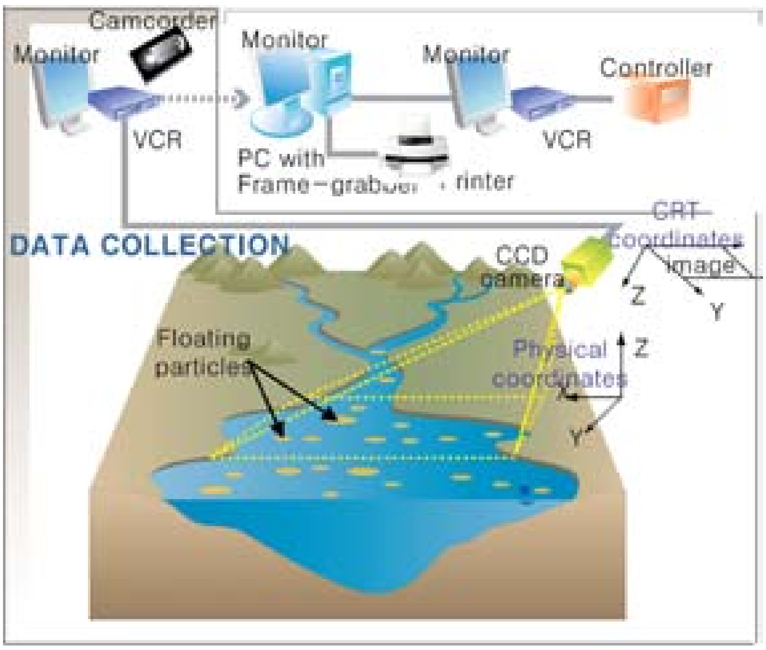


Figure 2.12 Conception of the LSPIV

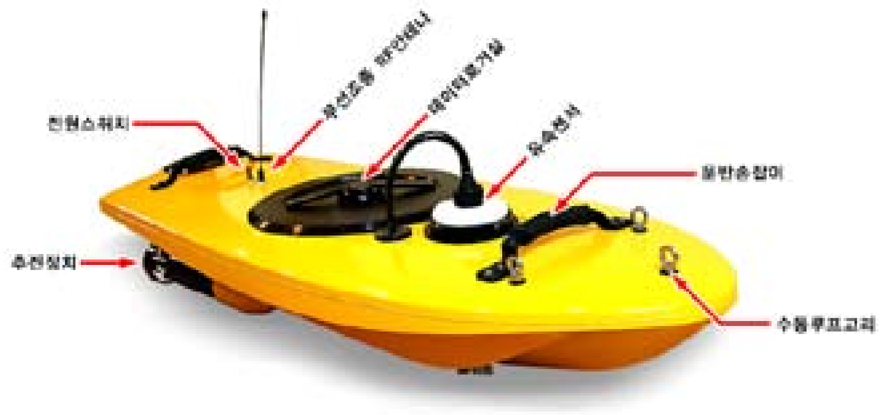


Figure 2.14 The structure of the ubiquitous river buoy (R2V2)

Figure 2.15 River information measurement using R2V2

f. Other Cooperative/RCPIP Progress

Nil.

In Singapore

Hydrology

(Hydrology matters are handled the Public Utilities Board (PUB) in Singapore. The activities will not reported here)

In Thailand

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress

+ The Royal Irrigation Department (RID) installed the upper Chao Phraya telemetering projects in the Chao Phraya river basin to link with the lower part that started from Ayuthaya province down to the gulf of Thailand. The real-time in situ and remotely sensed data collection is on hourly basis.

+ Department of Water Resources (DWR) has cooperation with Mekong River Commission Secretariat (MRCS) and other Mekong River Country (Lao's PDR, Cambodia and Vietnam) to improve the hydro-meteorological monitoring network in Mekong Mainstream under the Appropriate Hydrological Network Improvement Project (AHNIP), Basin development plan, Water utilization program, Environment program, Flood mitigation management program and drought management program, Mekong HYCOS and start up integrated knowledge management program.

+ Department of Water Resources as the National Committee of Thailand for the International Hydrology Program (IHP) held the 14th meeting of Regional Steering Committee at Bangkok, Thailand. Moreover, we support the proposal framework for IHP-VII and prepare the Catalog River of Bangpakong basin. Some specific highlighted issues are as follows;

- Methodologies for integrated river basin management.
- Promotion of public awareness rising on water management.
- Institutional development and networking for WET.
- Guidelines on the sustainable and integrated water management with due consideration to public's living quality and participation.

- Increasing the available sources water by improving both existing natural and man-made sources.
- Flood and drought management

b. Implications to Operational Progress

Many telemetering projects of RID starting in the past few years were reported to be adequate in warning people in those commanded areas. There are flood defense committees in the area to work accordingly to the situations happened at that moment.

c. Interaction with users, other Members, and/or other components

+At this moment, RID disseminated the forecasted results and warning to the concerned agency via internet, radios and televisions.

+At present, Department of Water Resources has cooperation with Mekong River Commission Secretariat in the hydro-meteorological monitoring network in Mekong Mainstream and linkage hydrological data (automatic water level).

d. Training Progress

+ RID's training programs are regularly scheduled only to the concern local staff and will be provided to other in the future.

+ DWR has 3 overseas training activities of which cooperated with MRCS as follows;

1. Training in HYMOS software in August, 2007 at Cambodia.
2. Training program Mike 11 for modeler in July – September, 2007, Thailand and Laos.
3. Training in decision support framework in Mae Kok basin and Nam Songkhram basin, June 25-29, 2007, Thailand and Laos

e. Research Progress.

Nil

f. Other Cooperative/Strategic Plan Progress.

Nil

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and Software Progress

+ RID expanded area of coverage in case of Chao Phraya river basin by installing the upper Chao Phraya telemetering system to strengthen the forecasting results in Chao Phraya river basin which is the largest basin in Thailand.

+Department of Water Resources (DWR) has developed and improved in the hydrological and meteorological monitoring network in Bangpakong river basin and Prachup Khirikhan, located at Eastern of Thailand for water resources management, including flood forecasting and management. Moreover, telemetering hydro-meteorological stations was established in Mun and Chi river basin for flood forecasting and management. This project aimed to set up the hydro-meteorological stations network and early warning system.

+Department of Water Resources (DWR) has been setting up Early Warning System since 2005. At present, it continues to develop and set up a flood and landslide warning system in mountain and upland area cover 53 risky villages, dealing with system alerts activated heavy rainfall and rising of river levels to monitor at appropriated site. Early warning signal were sent in advance to subscribers and communities in real time of the impact of disasters, provided time for people to take response actions.

+Improving the hydrological database system for water resources management, planning, construction, and maintenance of hydraulic structures and for scientific research, called HYDRO WEBBASE which established at Department of Water Resources (DWR) and continued for more effectives useful.

+Providing E-Service Hydrological data, called IS Hydro, via Department of Water Resources' website.

+Department of Water Resources (DWR) set up a master national plan of Flood mitigation for short and long term.

b. Implications to Operational Progress

Exchange of the RID 's in situ and remotely sensed data and uses can be easily done in the future via the internet. The information gains during this period will improve forecasted results.

c. Interaction with users, other Members, and/or other components

+The interaction among members will be increased which will improve the hydrological products of RID to meet our requirement. The integrated meteorological products and services are essential in better flood forecasting.

+At present, Department of Water Resources has cooperation with Mekong River Commission Secretariat in the hydro-meteorological monitoring network in Mekong Mainstream and linkage hydrological data (automatic water level). The forecasted results in the risky area from early warning system and water crisis will be transmitted to the related/concerned department and the outside concerned departments via internet, SMS, television, radio, mobile telephone and facsimile by Water Crisis Prevention Center, Department of Water Resources.

d. Training Progress

The training in flood forecasting will be carried out in Beijing, China this year. The outcome will be fruitful to those participants who join the programme. The result will be reported in next year.

+For DWR, there are 7 training activities as follows;

1. Training in research training for new researcher, August 30-31, 2007, Bangkok.
2. Training in decision support framework in Mae Kok basin and Nam Songkhram basin, June 25-29, 2007, Bangkok.
3. Training in applied GIS for water resources management, June 25-26, 2007, Bangkok.
4. Train the trainer in the Integrated Water Resources Management in June, 2007.
5. Training in hydrology and applied hydrology, May 14-18, 2007, Kanchanaburi province.
6. Training in telemetry and MIKE II model, January 22-26, 2007, Bangkok.
7. Training in Hydro database, January 2207, Bangkok

e. Research Progress.

+Department of Water Resources had been done 7 researches as listed bellows

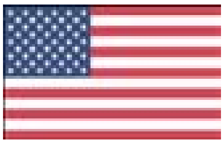
1.The Delineation of River Basin Boundaries (25 Major river basins including 254 sub-river basins).
2.Integrated Water Resources Management: Case study in lower Loei basin.
3. NDVI (Normalize Differential Vegetable Index) for drought forecasting.
4. API application in flash flood and landslide.
5. Application of local wisdom in water resources management.
6. The development of participatory process to empower local community in water resources management: Case study in Mun basin.
7. The study in the risk factors and community livelihood in flood and landslide hazard area: Case study in upper Ping river basin.

f. Other Cooperative/ Strategic Plan Progress.

Nil

3. Opportunities for Further Enhancement of Regional Cooperation

Nil



In USA

I. Weather Forecast Office (WFO) Guam, Micronesia, Western North Pacific

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and Software Progress

NTR

b. Implications to Operational Progress.

- Hydrologic Outlook. A Hydrologic Outlook was issued on 5 February for Guam and the Marianas, indicating that the Mariana Islands could expect significantly drier than normal conditions for the next several months. A new Outlook was subsequently sent out weekly until 30 April, when the threat of drought no longer existed. The Hydrologic Outlook and the release of the 4th Intergovernmental Panel Report on Climate Change triggered several newspaper and TV interviews with the Guam WCM.

c. Interaction with users, other Members, and/or other components.

NTR

d. Training Progress.

- Fire Weather Workshop. A Fire Weather Workshop was held on 22 February and included members of the Guam Forest Service, Guam Fire Departments, and military counterparts. The Workshop discussed such topics as the causes of drought in the region, key meteorological parameters that are critical to drought assessment and fire danger ratings, and the specific fire weather products produced by the WFO Guam.
- The WFO Guam Hydrological Focal Point attended a workshop at the NWS Training Center in Kansas City on the WFO Hydrologic Forecast System (WHFS). The objective of the workshop was to improve operational understanding of the various types of software available in assisting in the hydrologic forecast and warning decision process, specifically within the Advanced Weather Interactive Processing Systems (AWIPS). The Workshop focused on WHFS applications, and provided an overall understanding of how the databases are organized and maintained. At another Workshop, the Focal Point also received training on Advanced Hydrological Applications. This training provided detailed instruction on the management of the many hydrologic applications located in AWIPS with emphasis on the WHFS database. While WHFS software consists of various programs, at present, the Hydroview program is probably the most useful for Micronesia. This program can monitor hydro-meteorological data, such as stream-gage readings and precipitation amounts. While no stream gages are presently monitored in real-time, precipitation amounts from across Micronesia are monitored in near real-time. This will assist forecasters in tracking precipitation rates and accumulations for forecasting flood and mudslide events.

e. Research Progress.

- Coordination efforts are underway with the U.S. Geological Survey (USGS) to transmit real-time data from their stream gage and rain gage networks on Guam. Although this telemetry process is commonly used in the United States using the GOES satellite, GOES satellite coverage is unavailable for the area west of the International Date Line. Therefore, USGS plans to telemeter the rain- and stream-gage data via radio or cell phone to WFO Guam, where it will be placed on a server for transmission to the US. The data will also be available for flash flood and mudslide forecasting at WFO Guam.

f. Other Cooperative/RCPIP Progress.

- Guidance to Republic of the Marshall Islands. Guidance from the WFO Guam on drought conditions for the Republic of the Marshall Islands helped the local government initiate water conservation efforts early enough to avoid a major drought crisis. The government deployed reverse osmosis units to strategic areas in Majuro so that the general public can get drinking water and water for preparing food. The government also conducted water conservation education and public service announcements through government radio broadcasts and the Marshall Islands Journal newspaper. Finally, the Government shipped drinking water to several of the northern islands, where water resources were even scarcer than on Majuro.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and Software Progress.

NTR

b. Implications to Operational Progress.

NTR.

c. Interaction with users, other Members, and/or other components.

NTR.

d. Training Progress.

NTR

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

NTR.

3. Opportunities for Further Enhancement of Regional Cooperation (including identification of other hydrological-related topics and opportunities, possible further exchange of information and priority needs for assistance).

NTR.

II. Regional Specialized Meteorological Centre (RSMC) Honolulu / Weather Forecast Office (WFO) Honolulu

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and Software Progress.

- RSMC Honolulu implemented software tools within the Gridded Forecast Editor (GFE) system to facilitate easier quantitative precipitation forecast (QPF) production. The tools, also known as "Smart Tools", allow for the adjustment of forecasted physical parameters to determine precipitation totals quickly for all 2.5 x 2.5 km grid points in the Honolulu Forecast Office's domain. Production of experimental QPF grids started in late 2006 and continues through 2007. Grids cover all the main Hawaiian Islands through at least the 3-day forecast though forecasts are often available through 7-days.

b. Implications to Operational Progress.

- The Honolulu Forecast Office will start operational QPF grids by the end of 2007. Forecasts will also cover anticipated precipitation from tropical cyclones and remnants of tropical cyclones.

c. Interaction with users, other Members, and/or other components.

NTR

d. Training Progress.

- RSMC Honolulu conducted in-house training for QPF production in late-2006 and into early-2007.

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

NTR.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and Software Progress

NTR

b. Implications to Operational Progress.

NTR

c. Interaction with users, other Members, and/or other components.

NTR.

d. Training Progress.

NTR

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

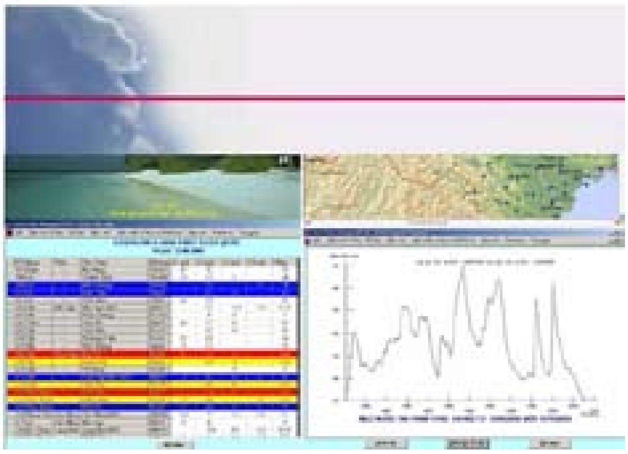
NTR.

3. Opportunities for Further Enhancement of Regional Cooperation (including identification of other hydrological-related topics and opportunities, possible further exchange of information and priority needs for assistance).

NTR.

in Regional Cooperation and Selected RCPIP Goals and 1. Progress in Regional Cooperation and Selected RCPIP Goals and Objectives:

NIL



2. Progress in Member's Important, High-Priority Goals and Objectives:

a.1 Observation network

- Established the flash flood warning system with 7 automatic rainfall gauges in Ngan Sau and Ngan Pho rivers of Ha Tinh province.

Thewarning system in NganSau NganPho rivers

The flash flood forecasting and warning system in Ngan Sau – N gan Pho river basins from early 2007 year with: 7 automatic rain gauges)
A utomatic rain gauges

- Established the flash flood warning system with 2 automatic rainfall gauges in Ngoi Lao and Ngan Pha rivers of Yen Bai province.

Ngoi Lao River Basin: 49.3 km
Ngoi Pha RiverBasin:A rea : 54.5 km²
River Length: 26.2 km

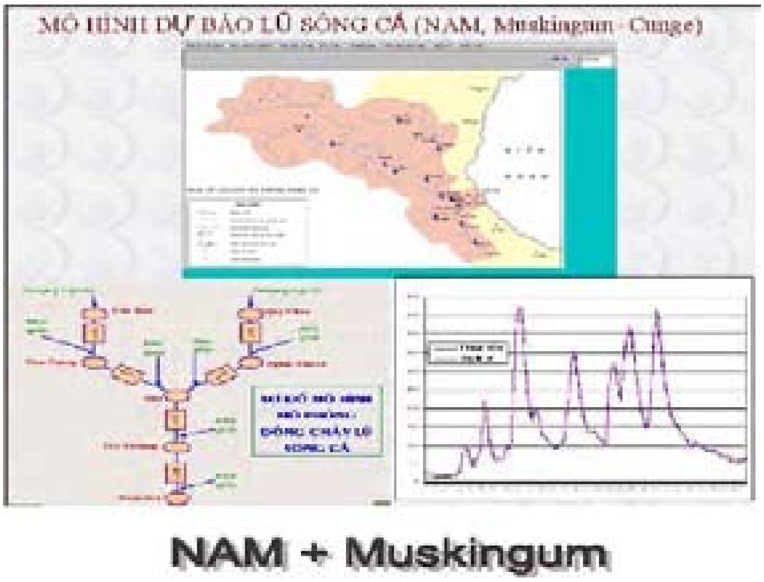
a.2 Technical advancement

-Improvements of software in data processing and analysis: Continued to develop the software for the preservation of hydro-meteorological database, for hydrological data collection, processing and timely transmitting hydrological information and forecasts to end-users.

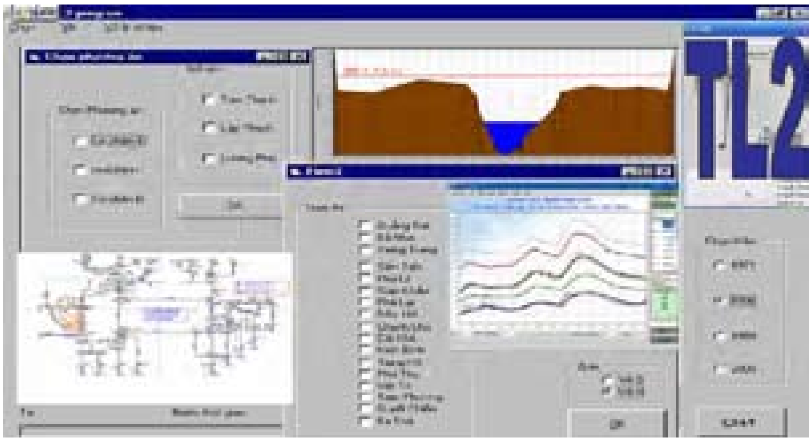
-Develop some software for automatically input and output of the new hydrological models MARINE, FIRR, Hydraulic model and model for reservoir's regulation.

-Improvements in hydrological forecast models:

Empirical method	For all rivers
Mike-11 model (Danish model)	Lower Red river
Marine model (French)	Da river
TANK model (Japanese)+Muskingum+Cung (Vietnamese)	For Short-range and for medium flood forecasting in most rivers of the North Viet Nam
NAM model (Danish model)+ Muskingum	Ca River in the Central Vietnam
1-D Hydraulic model (TL2) (Vietnamese)	Lower Red river
Reservoir Flood Routing (Vietnamese)	For Hoabinh Reservoir operation
HydroGIS (Vietnamese)	Lower Mekong river
WETSPA (Belgium model)	Thu Bon – Vu Gia river in the Central Vietnam

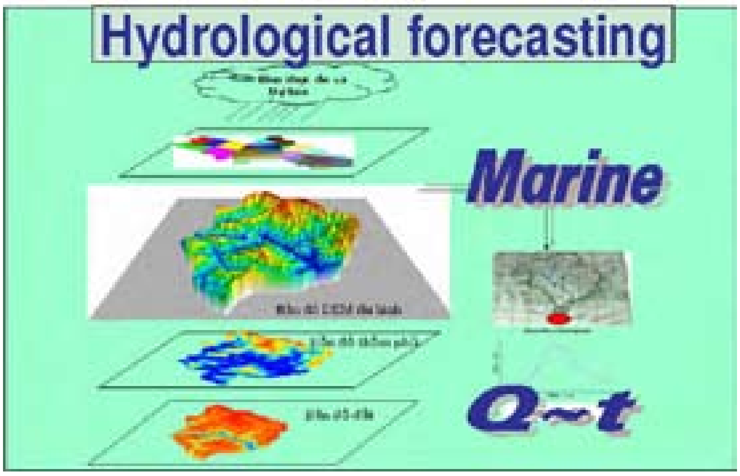


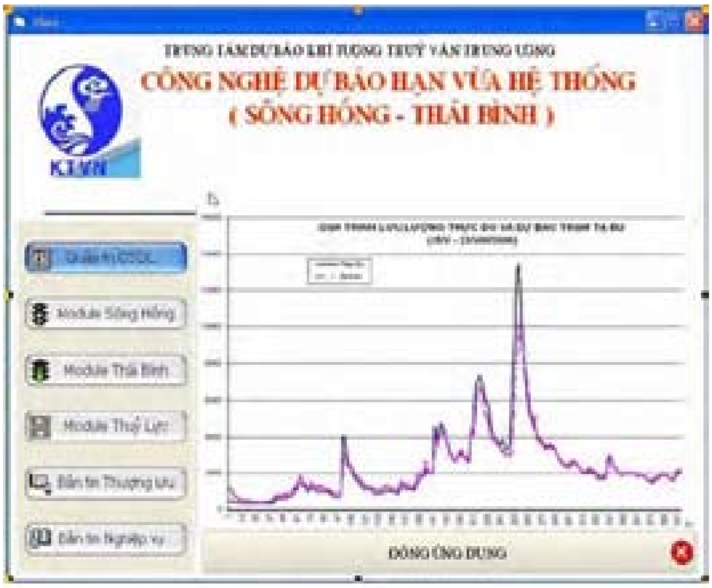
Hydrological model for Ca River in the Central Viet Nam Hydraulic model for lower Red River



1 Employ the MARINE and FIRR models to forecast flow in upstream area of Da, Thao, Lo rivers, Reservoir Flood Routing model for reservoir's regulation in Da river and create the input for the Hydraulic model TL2 in lower stream of Red river.

2 Developing the TANK Model for flood forecasting with lead time 120h and time step of 6h since flood season of 2005

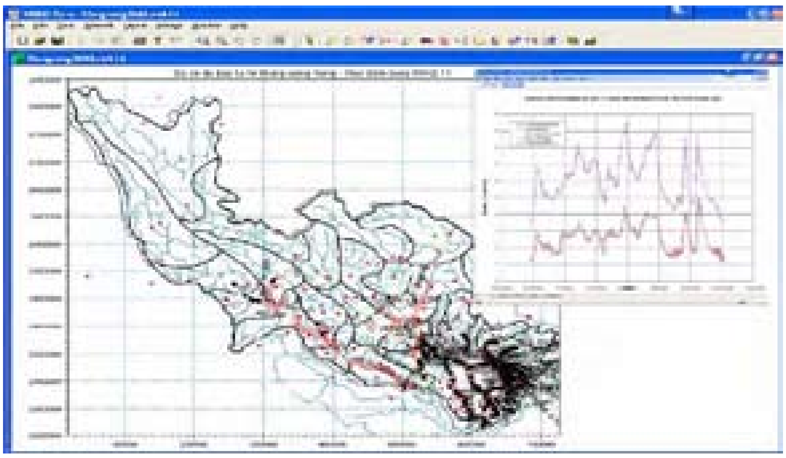


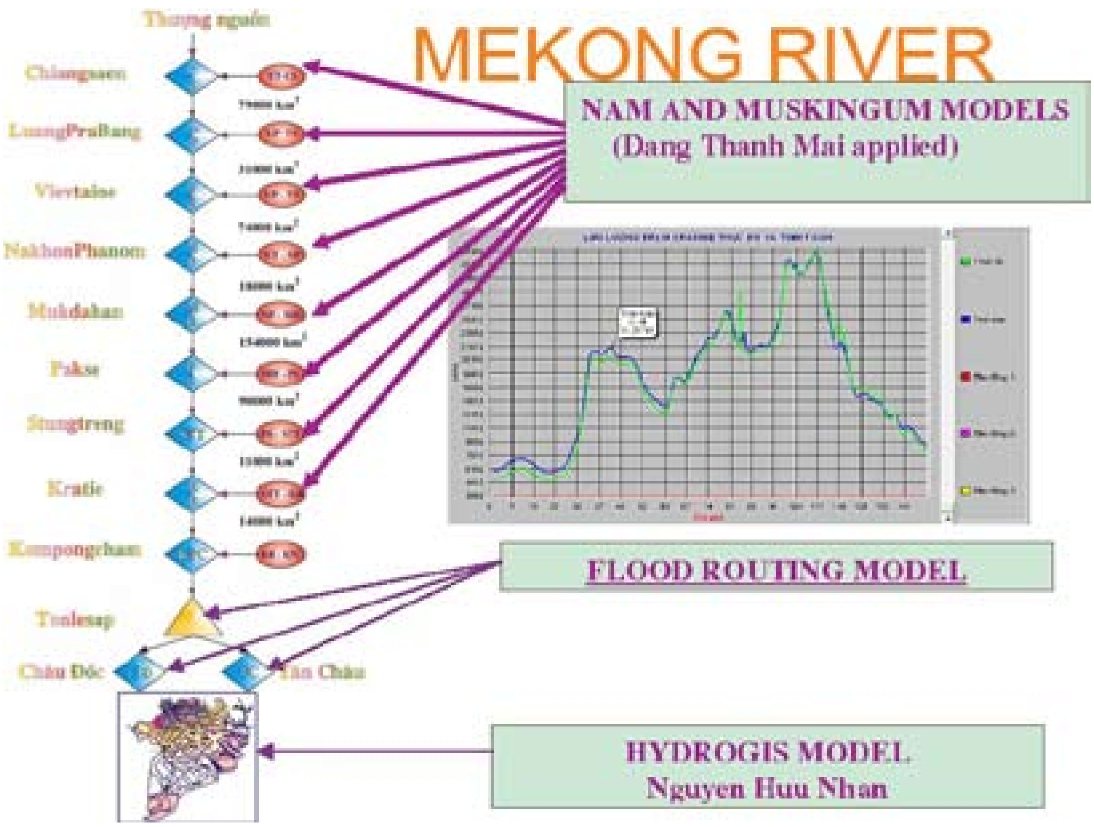


TANK + Muskingum + Cunge

for flood forecasting with lead time 120h

1 Developing MIKE-11 Model for flow forecasting with lead time 48h in the lower Red river.
2 Developing the HydroGIS model for flood forecasting with lead time 5 days in lower Mekong River.





b. Implications to Operational Progress

-In 1 June 2007 year, the Prime Minister promulgated the guideline for operation 3 reservoirs: Hoa Binh, Thac Ba, Tuyen Quang. It is implemented for flood season of this year (2007).

c. Interaction with users, other Members, and/or other components

-Improvement of hydrological products to meet users' requirements and expectation:

1 Improvement of hydrological forecasting products for Hoa Binh (in Da River) and Tuyen Quang hydro-electric power regulation and Tuyen Quang (in Gam River).

2 Improvement of hydrological forecasting products for the building of new hydro-electric power Son La in Da River and Huoi Quang, Ban Chat reservoirs in Nam Mu river.

d.Training Progress

1 One staff attended the International workshop on technologies of assessment and improvement operation of flood forecasting system, Seoul, Korea from 05th to 07th February 2007.

2 One staff attended the International Conference on Every five year flood reports in the Mekong River commission in Cambodia at 12th February 2007.

3 One staff attended the Technical Training course on Flood forecasting and data management of Hydro-meteorological observation system in Cambodia from 28th May to 5th June 2007.

4 One staff attended the training program for mitigation of flood, typhoon-related natural disaster in Taiwan from 7th to 11th May, 2007

5 One staff attended the training workshop on Flood forecasting system in Beijing, China from 15th to 21st October, 2007

6 Three staffs attended the 3 months -training course on using of Mike -11 model in DHI, Denmark, from 2nd November 2007 to 2nd January 2008.

7 One staff attended the training course on Flood control and management in Berlin, Germany from 18th October to 08th November 2007.

8 One staff attended the training course on River environment control in Sweden from 05th to 23rd November 2007

e. Research Progress.

- Continued project "The guideline for the operation 4 hydropower in Da and Lo rivers". Its deadline is expected to be by the end of March 2007.

Currently, in Vietnam were being built 30 hydropower dams at upstream of the main rivers, especially the multipurpose ones such as:

-Son La Reservoir in Da River is expected to be commissioned by the year 2008.
-Ban Trac, Quang in Da River, Na Le (Chay River), Bao Lac (Gam River), Lai Chau (Da River) reservoirs (2013).

- 2 projects are continuous executing:

-Flash flood mapping Project with purposes: drawing up of flash flood map and establishing flash flood warning system in the North Viet Nam (the first phase 2006-2008 in Ha Giang provinces with more than 70 automatically rainfall stations)
- Establish the alerts system of water level in Vietnam.

On-going National Project: Development and application of the American NWSRFS Model for Flood and inundation forecasting and warning in Hong – Thai Binh river system.
On-going Ministry Project: Development of flood prediction and inundation warning technology in Ve – Tra Khuc river system, the technological experiment and transfer.
On-going Ministry Project: Development of 5-day flow prediction technology to large reservoirs in Da and Lo river system.
On-going Ministry Project: Development and application of the WETSPA and HECRAS for flood simulation and prediction in Thu Bon – Vu Gia river system.

Other Cooperative/RCPIP Progress.

Existing agreements between China Government, Mekong committee and Vietnam NHMS for exchanging the hydrological data from China, Thailand, Laos and Cambodia.
Existing cooperation between HMS Vietnam and DHI for using Mike-11 model to flood forecasting.

3. Opportunities for Further Enhancement of Regional Cooperation

NIL

1.3 Disaster Prevention and Preparedness

In China

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives

a. Hardware and/or Software Progress

b. Implications to Operational Progress

Nil.

b. Interaction with users, other Members, and/or other components

On September 25, 2007, the participants who took part in Administrator Seminar of Emerge Disasters over Developing Countries visited CMA. They listened to the report of CMA's work on meteorological disaster prevention & mitigation system and got an overview of observations, forecasts for preventing meteorological disaster in China.

Fig. 4.1 The participants of Seminar on Emerge Disasters for Directors from the Developing Countries visited CMA

c. Training Progress

- The international training workshop on tropical cyclone disaster reduction

The international training workshop on tropical cyclone disaster reduction was held in Guangzhou, China in 26-31 March 2007. It was organized by WMO and CMA and hosted by Chinese Academy of Meteorological Science and Guangdong Meteorological Bureau. 60 participants coming from 11 countries attended the workshop, and 45 were operational forecasters from the five tropical cyclone regional bodies while the workshop lecturers were leading experts in the field of tropical cyclone research and forecasting which included Russell Elsberry, Peter Black, Chen Lianshou, and Charles Guard, et al.

This research-oriented international training workshop provided training and experience on new knowledge gained from recent advances on tropical cyclone research and how best to apply these to operational prediction activities in order to enhance the accuracy and usefulness of tropical cyclone forecasts and warnings. It also enabled participants to be aware of the issues associated with disaster mitigation, such as factors contributing to human and economic losses, conveying forecasting and warning information to stakeholders, users and the general public, evaluating the effectiveness of warning systems, mitigation strategies and community capacity-building for disaster reduction. The abstracts of the nine lectures were printed in a booklet and distributed to all the participants before the workshop.

The meeting will provide opportunities for further enhancement of regional cooperation in future.

- The Training Seminar on Meteorological Disasters Forecast, Prevention and Mitigation

From May 21 to June 8, 2007, CMATC held Training Seminar on Meteorological Disasters Forecast, Prevention and Mitigation with 45 foreign participants from 25 counties. Professor Chen Lianshou from the Chinese Academy of Meteorological Sciences, an Academician of the Chinese Academy of Engineering Sciences, was invited to give a lecture to the participants. The main theme of his lecture was the prediction and prevention of typhoon which covered the typhoon types, analysis of typhoon tracks, its moving speed, destructiveness and some effective measures for the prediction and prevention.

- The International Training Course on Coastal Zone Natural Disaster Prevention and Warning

From July 25 to August 8, 2007, CMATC sponsored another International Training Course on Coastal Zone Natural Disaster Prevention and Warning with 10 participants from 8 countries in the class. Professor Chen Lianshou, one Academician of CEA, gave the participants a lecture on the Natural Disaster and Scientific Issues for Landfall Tropical Cyclones, which includes scientific issues of track turns with the abrupt change of structure and intensity, storm surge, heavy rainfall, dissipating and sustaining as well as the monitoring, forecasting and warning Systems.

Professor Jiang Jixi, Senior researcher of National Satellite Meteorological Centre, also was invited to give a lecture on the monitoring, analysis, and techniques for the tropical weather systems based on satellite observation, which included tropical cyclogenesis, locating tropical cyclone centre, tropical cyclone intensity analysis, tropical cyclone thermal structure, tropical cyclone motion forecasting, Intertropical Convergence Zone (ITCZ), upper tropspheric cold vortex, easterly wave, an operational auto-monitoring for the EL Nino episodes and a primary study for summer monsoon index over the South China Sea and East Asia based on satellite observation.

e. Research Progress

f. Other Cooperative/RCPIP Progress

Nil.

2. Progress in Member's Important, High-Priority Goals and Objectives (Towards the goals and objectives of the Typhoon Committee)

a. Hardware and/or Software Progress

- Reference Standard for Severity of Tropical Cyclone

On June 2007, CMA set the reference standards for severity of tropical cyclones. This standard gives different severities of tropical cyclones, including the potential impacts & damages on vessels and building, etc. The new standard serves as a platform for providing effective meteorological services for prevention of tropical cyclone-induced disasters. It provides for government and relevant agencies to take effective measure.

- Warning Signal of Meteorological Disasters

On June 2007, in order to make a unified system for issuing warning signal of the meteorological disasters, CMA amended and published the Methods for Issuing and Broadcasting the Warning Signals of Meteorological Disaster. The warning signals on potential disasters will be broadcasted on a timely basis according to the new methods. By so doing, the warning signals of potential disasters such as typhoon can reach to public more quickly and effectively.

- Atlas of China Disastrous Weather and Climate

Atlas of China Disastrous Weather and Climate was published at September 2007. The content includes typhoon and temporal and spatial varieties of its disasters. The book provides an important reference for government decision and academic research, and offers a textbook for occasional people to know the disaster of typhoon and timely prevent the disasters.

Implications to Operational Progress

- Investigations on landing typhoon-induced disasters

There are several typhoons choose to land on China each year. Investigations on landing typhoon-induced disasters may help to better understand variations of typhoon strength, impact area, associated disasters and losses, etc. The investigations may also give reference information for preventing and mitigating typhoon-induced disasters. This year, before the landing of some strong tropical storms, CMA had sent teams to coastal provinces. They arranged preparatory work in advance and carried out post event investigations.

- Meteorological Disasters Yearbook of China

In 2007, CMA also continued to publish Meteorological Disasters Yearbook of China. It compiles the main meteorological disasters took place in China in the year. The Yearbook also includes the information about severe meteorological disastrous events in the world during the previous year.

- Disseminations of Messages of Typhoon Warning

Technological methods were used to issue messages of typhoon warnings. The public may get warning messages in time and take relevant prevent measure. The systems to issue message includes mobile phone message, TV, radio, newspaper, websites, electronic display screen, serving station of messages at villages, 96121 phone line. People can get warning messages from different message sending systems. All levels of meteorological bureaus had sent 48,000 pieces of free warning messages from January 2007 to August 2007. There were about 1,200,000,000 times and persons who had got these messages.

During the typhoon season, more than 900 pieces of news on typhoon have been published by new website (http://www.nmc.gov.cn/typhoon.php?code=722) for typhoon and service; symbols on the topic of typhoon changed for 17 times, the satellite cloud pictures, the radar echoes composite maps, the latest forecast of typhoon and other relevant information were issued in real time. 7 experts-online and 2 specialized websites on typhoon were created. Some information on typhoon and as how to prevent typhoon was sent out.

Fig. 4.2 In 2007, mobile telephone short messages were added to routine typhoon forecast and service.

Fig. 4.3 new website for typhoon and service.

Fig. 4.3 The National Meteorological Disaster Prevention and Mitigation Conference was held in Beijing in Sept. 2007

c. Interaction with users, other Members, and/or other components

Chinese government attaches great importance to prevention and reduction of typhoon disasters. Governments at all levels request the relevant agencies to take the preventive measures when they received warning message of typhoon. When information is received, the relevant agencies shall monitor typhoon's motions and coordinate their actions in preventing typhoon disasters. These preparations reduce casualties of people as result of typhoon landing. During the invasion of Typhoon SEPAT and VIPA, authorities in the coastal provinces timely organized evacuations of 4.65 million people into some safety area against strong wind. These measures effectively reduced casualties and loss of properties.

In September 2007, the National Meteorological Disaster Prevention and Mitigation Conference was hold at Beijing. Its' main topic is to prevent and mitigate meteorological disasters. At the conference, Vice Premier Hui Liangyu pointed out that it was a top priority to prevent and mitigate meteorological disasters in this new period. The leaders of some relevant provinces and major agencies and meteorologists discussed the topic and exchanged the experiences in meteorological disasters prevention at the conference. The national program for preventing meteorological disasters from 2007 to 2010 was revised at the conference. This event increased governmental and public awareness of meteorological disasters in China.

CMA cooperates with a wide range of agencies in the certification of national comprehensive disaster prevention projects for the 11th 5-year National Development Plan period and revision of the National Emergency Response to Natural Disasters. This work is an important part of the national disaster prevention & mitigation work.

d. Training Progress

Nil.

e. Research Progress

The causes of typhoon-induced disasters and their assessment methods were studied in the past year. A set of disaster economic loss indices (DELI), including disaster loss degree (DLD) and environmental instability (EI) was identified to analyze the trend of economic loss as result of typhoon disasters. The result shows that DELI is a reasonable element in making economic loss assessment, which is not limited by temporal and special factors and it is easy for comparisons. Based on disaster system theory, in combination of wind, rain, water and tide conditions, typhoon disaster chain model in Fujian was built up, including 3 continuous and simultaneous disaster chains, i.e. typhoon-winds, typhoon-storm-floods and storm surges. Analysis on typhoon Longwang showed that disaster was mostly due to the heavy precipitation induced by topographic effects and weak cold-air intrusion from the north.

f. Other Cooperative/RCPIP Progress

Nil.

3. Opportunities for Further Enhancement of Regional Cooperation

Nil

In Hong Kong

1. Progress in Member's Regional Co-operation and Selected Strategic Plan Goals and Objectives

a. Hardware and/or Software Progress

Nil.

b. Implications to Operational Progress

Hong Kong, China continued to operate the Severe Weather Information Centre (SWIC) website for WMO. The total page view amounted to about 13 million in the 12-month period since October 2006, roughly the same as compared with the previous 12 months. On 23 March 2007, a hyperlink to the Meteoalarm website was added in SWIC to provide an easy access to severe weather information in Europe.

c. Interaction with users, other Members and/or other components

Endorsed by the 13th session of the Commission for Aeronautical Meteorology of the WMO, a website on "Aviation-weather Disaster Risk Reduction" (ADRR) (http://adrr.weather.gov.hk) was developed by HKO for Members in RA II and RA V and aviation stakeholders to evaluate the benefits of extended aviation weather forecasts and warnings for tropical cyclones for 24-48 hours ahead. The website contains tropical cyclone warnings issued by China, Japan, Hong Kong-China, and the Philippines, advisories issued by the Tropical Cyclone Advisory Centre (TCAC) Tokyo of Japan, and Joint Typhoon Warning Centre (JTWC) of the USA, as well as numerical forecasts of the ECMWF. Using the HKIA as an example, forecasts of weather conditions, e.g. crosswind and turbulence, which might bring airport disruption, are also provided on the website (see sample products in Figure 4).

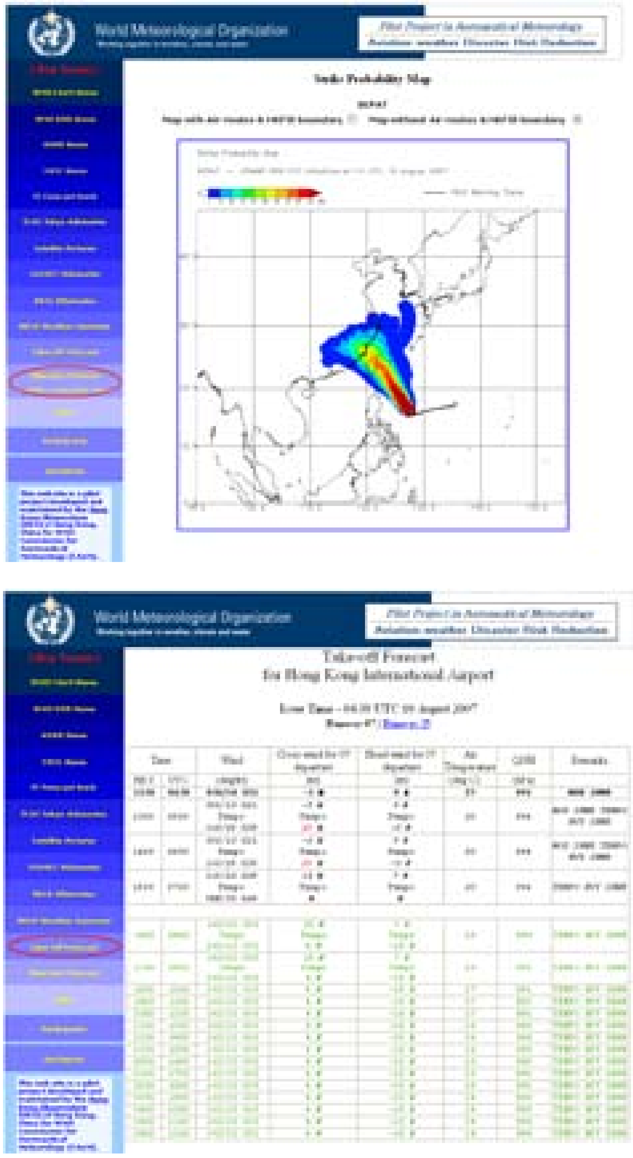


Figure 4 Sample products on the ADRR website: tropical cyclone strike probability forecast by ECMWF (left) and extended take-off forecast for HKIA (right).

d. Training Progress

One officer participated in the "International Training Workshop on Tropical Cyclone Disaster Reduction ", in Guangzhou, China from 26 to 31 March 2007. Furthermore, Mr. C.Y. Lam, Director of the HKO and Mr. S.T. Lai of the HKO served as lecturers of the Workshop.

Three meteorologists from Typhoon Committee Members were among the ten participants from overseas weather services attending the WMO Voluntary Co-operation Programme training course on "The Use and Interpretation of City-specific Numerical Weather Prediction Products" held at HKO from 31 October to 3 November 2006. Experience sharing during the course included the interpretation of numerical weather prediction product during tropical cyclone situations.

e. Research Progress

Nil.

f. Other Cooperative/Strategic Plan Progress

Nil.

2. Progress in Member's Important, High-Priority Goals and Objectives

a. Hardware and/or Software Progress

The Tropical Cyclone Information Processing System (TIPS) continued to provide support to forecasters during tropical cyclone situations (Figure 5). The program was enhanced by including tropical cyclone forecast tracks from the China Meteorological Administration numerical model and ECMWF ensemble model for reference by HKO forecasters and for generation of the ensemble track. And as a result of the recent tropical cyclone warning signal system review, new tools were built into the system for calculating key parameters such as location and timing of closest approach of the tropical cyclone, duration of strong and gale force winds and local storm surge levels and timings to aid warning decision. Furthermore, in response to comments from forecasters, quality control measures such as range checking on the tropical cyclone positions was incorporated into the data input stage to reduce the chance of human errors.

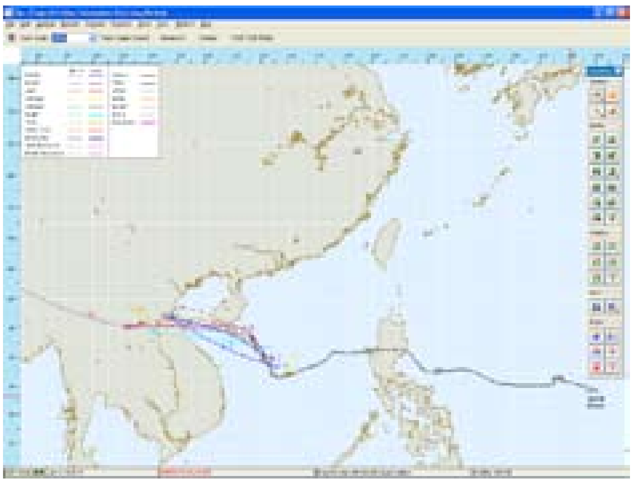


Figure 5 TIPS displays NWP forecast tracks and the multi-model ensemble track (thick black line) to support forecasting operations during Severe Tropical Storm Lekima in September-October 2007.

A warning panel on localized gales over Hong Kong would be put into trial in October 2007 for the Home Affairs Department (HAD) which provides shelter and welfare to the needy. This warning panel (Figure 6) gives easily recognizable visual and audio alerts when gales are reported at any of the 8 different districts in Hong Kong. It alerts HAD officials to make decision on the opening of temporary shelters for people affected by inclement weather during the passage of tropical cyclones.

Figure 6 Localized gales warning panel for the Home Affairs Department of Government of the Hong Kong Special Administrative Region.

Furthermore, a specialized "Weather Information for Schools" webpage was introduced in April 2007 to provide the latest weather forecasts and warnings, rainfall distribution, regional wind condition as well as other information relevant to school teachers, parents and students, to enable them to better plan their activities and take appropriate precautions against inclement weather.

b. Implications to Operational Progress

Nil.

c. Interaction with users, other Members and/or other components

As a continuing effort to promote awareness and preparedness of natural disasters, courses, lectures, briefings and visits to HKO were held for the general public. HKO also paid visits to relevant government departments and organizations to review disaster preparedness and prevention procedures for tropical cyclones and rainstorms. Briefings and visits to HKO were held for government departments, transport operators, container terminal operators, insurance sectors, parent teacher associations and fisherman associations to promote the effective use of the weather forecasting and warning services provided by HKO. A number of lectures on HKO's warning services were also given to the public, outdoor workers, district councilors, teachers and school principals. For instance, a series of public seminars on "Weather and Life" at various districts in Hong Kong was held between 19 April and 9 May 2007. The seminars elaborated weather phenomena affecting the daily life and the precautionary measures during tropical cyclones and severe weather. Attracting some 500 participants, this series of talks received very positive feedback with an overall rating of 4.26 on a 5-point scale.

Following the adoption of the new tropical cyclone names "Pakhar", "Doksuri" and "Haikui" by the 39th Session of the ESCAP/WMO Typhoon Committee, a press release was issued to publicize these new tropical cyclone names in the local community.

In response to evolving needs of the public, the HKO conducted a comprehensive review of the tropical cyclone warning system in Hong Kong in late 2006. In the process, views of the public and major stakeholders were extensively collected. Over 20 meetings were organized involving over 800 participants, representing the public, education, transport, logistics and commercial sectors etc. An advisory committee comprising local academics and scholars from different disciplines was also established to assist the Observatory in understanding and reviewing the warning system from the social, political and cultural angles. To gain further insights into the public's requirements of the warning system, a company was commissioned to independently conduct a survey through telephone interviews of over 100 families.

Having carefully considered the views collected, balanced the needs of different user sectors and made reference to scientific analyses of historical data, the HKO put forth revised criteria for the Strong Wind Signal as well as the Gale or Storm Wind Signal for implementation in the typhoon season in 2007. The revised criteria involved expanding the reference for the issue of these signals from the Victoria Harbour to a network of eight reference anemometers near sea level covering the whole of Hong Kong and the signals would be issued when half or more of the reference network register or are expected to register the respective wind speed thresholds. The revised criteria would also be complemented by a suite of service enhancement measures including highlighting to the public areas where winds would be significantly higher than the general wind condition affecting the territory, stepping up wider distribution of regional wind information and alerting the public about possible disruption of flight operations at the airport under certain weather conditions.

To familiarize the public with the new measures, the HKO organized publicity activities including public lectures, seminars with stakeholders, distribution of revised warning pamphlets, as well as broadcast of radio and TV publicity announcements.

To promote public awareness and preparedness on the threats of tropical cyclones, public announcements were produced and broadcast on local TV and radio stations. In addition, a radio meteorological series comprising episodes on tropical cyclones was broadcast on a local radio station starting from July 2007.

d. Training Progress

The annual pre-typhoon season internal seminar, highlighting the latest development in operational forecasting techniques and procedures during tropical cyclone situations, was conducted for HKO staff in June 2007. Drills were conducted before the typhoon season to reinforce participants' compatibility in carrying out relevant forecasting duties.

e. Research Progress

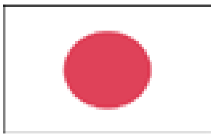
Nil.

f. Other Cooperative/Strategic Plan Progress

Nil.

3. Opportunities for Further Enhancement of Regional Cooperation

Nil.



In Japan

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

c. Interaction with users, other Members, and/or other component

c-1. Asian Conference on Disaster Reduction 2007

The Asian Conference on Disaster Reduction (ACDR) 2007 took place for the first time in Central Asia, in Astana, Republic of Kazakhstan on 25 to 27 June 2007 to review the progress made since the ACDR2006, identify the challenges still exist and propose the way forward to accelerate the implementation of the Hyogo Framework for Action (HFA) with a view to achieving its goals and ensuring sustainable social and economic development in the region.

A total of 136 participants attended the Conference. Those include dignitaries and government officials from 22 countries and representatives from 32 organizations such as UN and international organizations, NGOs, financial sector, and civil society as well as experts from academic institutions of meteorology, hydrology, geology, environment and development fields.

As a regional forum that fosters dialogue, information sharing and cooperation among member countries of the Asian Disaster Reduction Center, the Conference reported on significant accomplishments and major gaps in the implementation of the HFA in the region. It also identified and discussed critical issues and concerns as well as effective strategies to meeting challenges ahead.

Further information can be found on the webpage dedicated to the ACDR2007 (http://web.adrc.or.jp/acdr2007astana/index.html).

‹ Outline of the Conference ›

(1) Date: 25 (Mon.) – 27 (Wed.) June 2007

(2) Organizers: Government of Japan, Government of Republic of Kazakhstan, United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), World Meteorological Organization (WMO), United Nations Development Programme (UNDP), and Asian Disaster Reduction Center (ADRC)

(3) Participants: 136 (government officials from ADRC member countries, representatives of international and regional organizations and others)

(4) Venue: InterContinental Hotel, Astana, Republic of Kazakhstan

‹ Progress and challenges in implementing the HFA: Conference Summary ›

The participants conveyed their resolve to preserve and to sustain the gains in disaster risk reduction and to promote further cooperation among countries and partner stakeholders in the region. They also recognized the need for accelerating the implementation of the HFA priorities for action at various levels.

[Major concerns and challenges to be addressed]

(1) Effective governance for disaster risk reduction

(2) Education and training for effective disaster risk reduction and building a collective culture of safety

(3) Raising awareness and understanding on natural hazards and risks, climate change adaptation, and disaster risk reduction through public outreach and people-centered early warning systems

(4) Capacity development for earthquake risk mitigation and ensuring building safety

Science and advanced technology in support of disaster risk reduction

Public-private sector partnership and resource mobilization

(7) Holistic and integrated approach and innovative strategies for disaster risk reduction

In conclusion, the Conference presented and reviewed significant accomplishments, noteworthy achievements, and good practices in disaster risk reduction at local, national, regional, and international levels, including the progress of member countries in line with the implementation of the HFA priorities for action. Moreover, the participants expressed renewed commitment to move forward and to accelerate the implementation of the HFA with a view to achieving its goals and ensuring sustainable social and economic development in the region.

d. Training Progress

d-1. Activities of Disaster Reduction in ADRC Urban Search-and-Rescue Training in Singapore

The Singaporean government holds a training course every year for search and rescue officers. The course has been receiving trainees from outside Singapore for the past 7 years and providing training on search-and-rescue expertise required in urban disaster situations. The training facility complex of the Civil Defence Academy (CDA) of the Singapore Civil Defence Force (SCDF) is one of the top-notch facilities in Asia. In an effort to utilize their expertise and facilities, ADRC has been inviting relevant officers from member countries to the training course since 2001.

d-2. Visiting Researchers from ADRC's Member Countries

The ADRC has been receiving visiting researchers from member countries. To date, 34 officials from member countries have taken part in this program.

In the sixth ADRC International Meeting held in January 2004, "Networking of ADRC Visiting Researchers" was proposed by Mr. V. P. Pasrija, former visiting researcher from India. This network is expected to strengthen disaster management capacities of their countries by promoting further information sharing among the network members and ADRC.

The list of the visiting researchers in the network is attached below.

	Name	Country	Terms of the VR in ADRC	
1	Shim Kee-Oh	Republic of Korea	1999/07/23	1999/10/11
2	Ngo Van Sinh	Vietnam	1999/12/10	2000/03/17
3	Lek Nath Pokharel	Nepal	2000/01/12	2000/05/07
4	Nimal D. Hettiarachchi	Sri Lanka	2000/04/13	2000/10/12
5	M. Babul Aknter	Bangladesh	2000/05/12	2000/11/16
6	W. A. Chulananda Perera	Sri Lanka	2000/11/13	2001/04/05
7	Hiripsime Vardanyan	Armenia	2001/03/09	2001/06/04
8	Philomena Miria	Papua New Guinea	2001/06/04	2001/12/03
9	So Ban Heang	Cambodia	2001/06/04	2001/12/04
10	Md. Atikuzzaman	Bangladesh	2002/01/09	2002/06/30
11	Tigran Sayiyan	Armenia	2002/02/23	2002/08/22
12	Khun Sokha	Cambodia	2002/07/29	2002/12/25
13	V. P. Pasrija	India	2002/10/05	2002/12/25
14	Dilli Pd. Shiwakoti	Nepal	2003/01/08	2003/07/02
15	Bolormaa Borkhuu	Mongolia	2003/01/08	2003/07/05
16	Vilayphong Sisomvang	Lao PDR	2003/07/08	2003/12/25
17	Rachman Sobarna	Indonesia	2003/07/09	2003/09/30
18	Om Prakash	India	2003/10/08	2003/12/24
19	Rahmonov Suhrobsho	Tajikistan	2004/01/14	2004/06/10
20	Nguyen Thanh Phuong	Vietnam	2004/01/27	2004/06/29
21	Yuan Yi	China	2004/07/19	2004/10/15
22	Bouasy Thammasack	Lao PDR	2004/07/21	2004/12/24
23	Shyam Sunder	India	2005/10/02	2005/12/25
24	Ross Sovann	Cambodia	2005/01/23	2006/06/30
25	Bal Bahadur Malla	Nepal	2005/01/30	2006/06/29
26	Maria Matilde Limpahan Go	Philippines	2005/07/13	2005/12/27
27	Diloro Mirzovatanovna Mirova	Tajikistan	2005/07/15	2005/12/21
28	Lyudmila Harutyunyan	Armenia	2006/01/11	2006/04/10
29	G.M.J.K. Gunawardana	Sri Lanka	2006/03/01	2006/06/30
30	San-Hyeok Kang	Republic of Korea	2006/07/01	2006/12/15
31	Altanchimeg Shaazan	Mongolia	2007/01/09	2007/06/30
32	Arun Pinta	Thailand	2007/01/14	2007/06/30
33	Nwet Yin Aye	Myanmar	2007/07/06	
34	Karybai uulu Kanat	Kyrgyz Republic	2007/07/04	

2. Progress in Member's Important, High-Priority Goals and Objectives

c. Interaction with users, other Members, and/or other components

c-1. Major Disaster and Response Measures since October 2006

Since October 2006 until October 2007, Japan has suffered meteorological or hydrological disasters including a tornado in Saroma, Typhoon MAN-YI, Typhoon USAGI, Typhoon FITOW and Typhoon NARI. (Table 4-1).
In particular, with the tornado in Saroma, Hokkaido, and a tornado which occurred in September in Miyazaki, the total number of people killed by tornados in 2006 had become twelve. This was a historical record as only one person was killed by tornado in Japan in the last ten years. Bearing in mind these severe damages, an inter-ministry meeting was established in November 2006 to strengthen measures to reduce damage from tornados. The meeting convened three times, involving professors and researchers who specialize in tornados. Along with this meeting, a mission to the United States was conducted to research their countermeasures against tornados.
Based on these findings, the meeting developed and agreed on the following: 1) the content of a pamphlet which contains the characteristics of tornados in Japan and the ways on how to protect oneself against a tornado, and 2) programs by relevant ministries towards strengthening countermeasures against tornados in the next three years. The pamphlet was widely distributed through ministries and local governments to raise awareness of the population.(Figure 4-1)

Table 4-1 Major disasters of meteorological/hydrological origin since Oct. 2006

Date		Event	Casualty		Damage to Housing		
			killed / missing	injured	collapsed	half collapsed	damaged under water
2006	Oct. 6-9	Depression	1	43	1	18	293
	Nov.7	Tornado in Saroma	9	31	7	7	-
2007	Jul. 5-16	Typhoon MAN-YI (T0704) and heavy rainfall in monsoon rain front	7	79	26	26	420
	Aug. 2-4	Typhoon USAGI (T0705)	0	30	2	8	146
	Sep. 4-7	Typhoon FITOW (T0709)	3	90	10	27	415
	Sep. 15-18	Typhoon NARI (T0711) and heavy rainfall in rain front	4	7	19	239	401

Figure 4-1 Pamphlet to raise awareness against tornados (page 1 and page 8)

c-2. Technical Investigation on Large-Scale Flood Countermeasures

There has been a large reduction in terms of the area inundated by flood disasters due to improvement of weather forecasting systems and promotion of land conservation and flood control projects over many years. However, the amount of general assets damaged in flooded areas has greatly increased in recent years (Figure 4-2). Additionally, as a trend of the last thirty years, downpours whose rainfall was recorded more than 100mm/hr tend to increase throughout the country (Figure 4-3).

The increasing trend of downpours in recent years requires the strengthening of countermeasures for quick and smooth evacuation and relief activities assuming the occurrence of enormous floods. The Central Disaster Management Council* is working on the analysis of anticipated situations and the review of countermeasures against large-scale flood disasters that are supposed to cause immense damage to the capital region.

* The Central Disaster Management Council promotes comprehensive disaster countermeasures in which the Prime Minister takes the chair and other Ministers of State are members.

Figure 4-2 Amount of general assets damaged in flooded areas

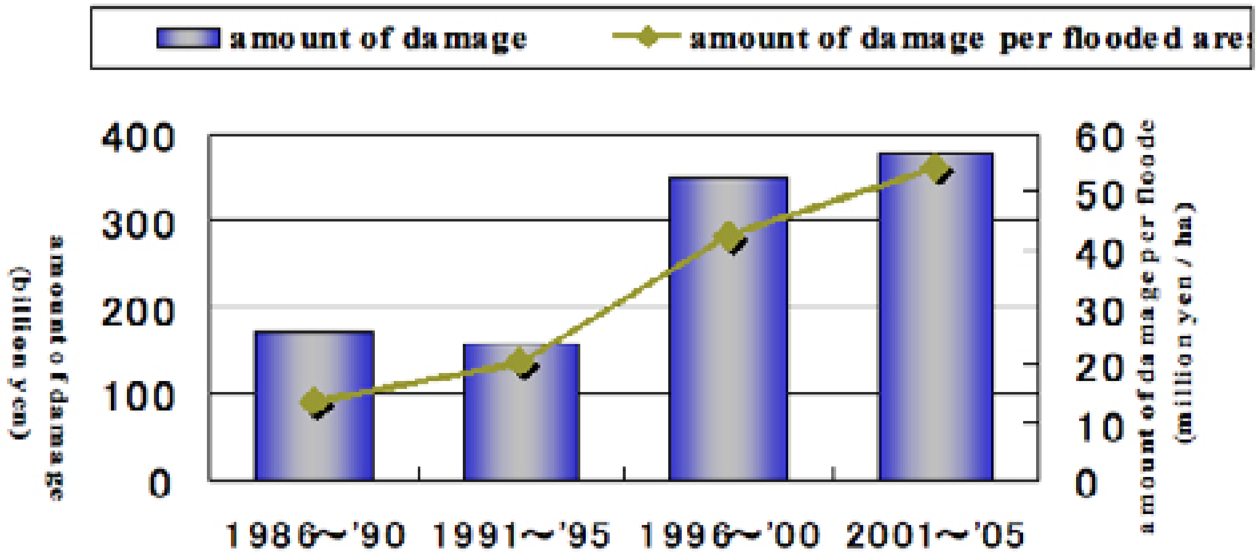


Figure 4-3 Tendency of downpours (over 100mm/hr)

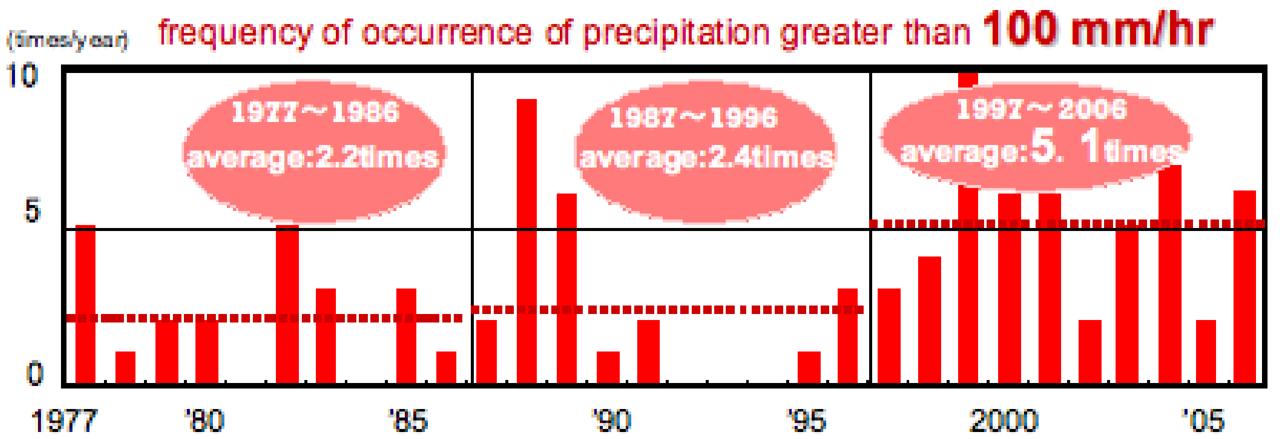
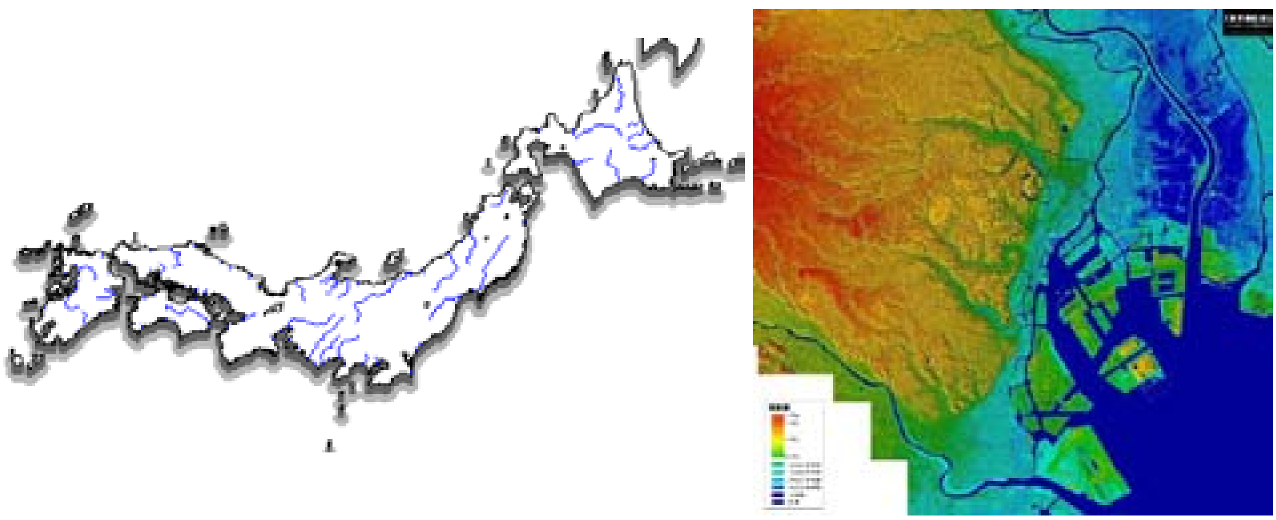
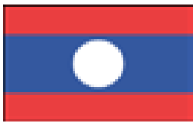


Figure 4-4 Zero-meter area in the metropolitan area





In Laos

Disaster Prevention and Preparedness (DPP) Component

1.1 Introduction

Natural Disaster prevention and mitigation is one of measures that contribute to the poverty alleviation strategy of the Lao PDR government. The strategy on disaster management of Lao PDR with the aims to:

- Safeguard sustainable development and reduce the damage of natural or manmade disasters to community, society and country economy;
- Shift strategy from relief and mitigation after disaster impact to community, society and economy of government organizations to preparedness before disaster strike emphasizing on flood, drought, landslide and fire parallel with continuing in mitigate in post disaster period;
- Turn from responsibility of only government agency to people centred in dealing with disaster by building capability for community;
- Promote forever protection of the environment and country rich such as: forest, land and water.

- **Disaster Management Institutions And main responsibility**

The NDMC consisting of representative from 12 key ministries and Lao Red Cross:

- Minister of MLSW	Chairman
- Vice-Minister of MAF	Vice–Chairman
- Chief of Cabinet of MFA	Vice-Chairman
- Chief of Cabinet of MOD	Member
- Chief of Cabinet of MOI	Member
- Chief of Cabinet of MOE	Member
- Director of Budget Dept. MOF	Member
- Director of Transport Dept. MCTPC	Member
- Director of Industry Dept. MIH	Member
- Director of Hygiene Dept. MOH	Member
- Director of Mass Media Dept. MIC	Member
- Director of Social Welfare Dept. MLSW	Member
- Chairman of Lao Red Cross	Member

The following ministries such as: WREA, LNMRC, Energy and Mine, Planning and Investment, Science and Technology ministries will be come member of NDMC.

According to the national policy of the flood management and damage mitigation, the Ministry of Communication, Transport, Post and Construction responsible for flood protection in the urban/city areas. The Ministry of Agriculture and Forestry responsible for flood protection for the agriculture land and other hand MAF provided services through DMH by issue of weather and flood warnings with higher level of accuracy and lead - time can contribute to the protection of life and property, mitigation of natural disaster.

NDMO is coordinating activities of other national and international organizations active in the field of disaster preparedness, response and mitigation. NDMO is the main government agency to implement disaster management programmes. The flood management and mitigation implementation consists as the following:

- Extend of flood management network from centre down to local level;
- Establish focal point and identify contact person on flood management;
- Establish and improve the regulation for flood preparedness;
- Establish of effective early warning system and information/ data collection
- Prepare stock or place/areas where can keep food and basic need;
- Training for communities about cause and effect of flood;
- Training for government staff and private sectors about flood management;
- Establish flood rescue and quick response teams;
- Set up data centre and data exchange;
- Organize a demonstration/ practice on flood rescue;
- Link or combine the flood management project with development activities;
- Monitoring of the implementation of the management laws: forestry, land use, water Resource and natural disasters.

- **Disaster Management Institutional Strengthening during the year**

- NDMC has met and discussed twice in annually (Before and after disaster), or call urgent Meeting in case of emergency.
- NDMC and PDMC development.
- Up to now, 139 districts had established DM committee, and there are around 100 villages were set the VDPU at disaster prone districts.
- 3 provinces (Saravan, Khammouane, and Savannakhet)

created the Provincial DM Plan.

- Partnership and Cooperation on DRM

Within the Country:
- UNDMT, IASC.
- UNDP, WFP, UNICEF, UN Avian Influenza Coordination, MRC
- Oxfam Aus, WVL, Care International, CWW, SCA,

Outside the Country:
- ACDM (ARPDM, AADMER).
- UNOCHA, UNDAC, UNISDR, UNESCAP, ADPC, ADRC, JAXA,

- Interaction with users

From 2005 lesson learnt, Department of Meteorology and Hydrology has been improved the procedure of the delivering the early warning that: The National level an announcement on Typhoon warning, heavy rainfall, flood warnings, flood preparedness and mitigation will be provided by MAF (Ministry of Agriculture and Forestry) and Prime Minister's Office. An announcement is delivered by facsimile from Prime Minister's Office to provincial governor Office, concerned line agencies and broadcasts through mass media. NDMC (NDMO) also delivered the urgent warning to PDMC. The provincial governor offices with PDMC continued deliver an announcement by public telephone and facsimile to governor districts. The warning will be reached to Chief of villages by mobile phone or by transportation. Good example to learn from Khongxedon (Saravan province), the warning has been broadcasted 4 to 5 times a day through district's radio speaker and Chief of villages also broadcasted the warning to people through radio speaker. Weather and flood information monitored are necessary for local authority official for food prevention.
Celebration of AEAN Day on DM and International Day on DR 10 Th October.

- Meeting and Walking for Health
- Advertising through media means: TV, Radio, and Newspaper.
- Pictures exhibition, questionnaires and fire fighting simulation exercise.
- Banner sticking along the main road in Vientiane Capital

3.2 Training progress:

At least 4 times a year Disaster Risk Management course had been conducted for local disaster management committees, police, and army and media staffs. CBDM course also conducted for District disaster management committees and communities at the village level under the project cooperated with NGOs.
Flood preparedness planning training guideline had developed and conducted for the provincial disaster management committees at flood prone provinces in central and southern part of the country under MRC project.

Flood preparedness Project NongBok , Khammouane province
- Publish Training Manual on Flood Preparedness in Lao language and distribute
- Conduct one Provincial Training Course on Planning and Implementation of Flood
  Preparedness Program for Khammouane PDMC
- Preparation of Flood Preparedness
- Program in Khammouane Province and Nong Bok district
- National and Regional Experience Sharing Workshops

Mainstreaming DRM into School Curriculum :
Implementing the project on Mainstreaming Disaster Risk Reduction into Education Sector in Lao PDR, project cooperative with ADPC. The project theme is to:
- Incorporate DRM modules into the school curriculum.
- Construct all new schools located in hazard - prone areas to higher standards of hazard
  resilience
- Add features in schools in hazard prone areas for use as emergency shelters such as
  facilities for water, sanitation and cooking.

3.3 Research progress:
Nil

3.4 Other Cooperative / strategy plan Progress:

Up Coming Projects (2007 – 2011) , Under the LANGOCA PROGRAMS:
Cooperation with SCA, ADPC, WVL and Oxfam Aus:

SIHMP - Sayaboury Integrated Hazard Management Program (Long Term)
TDRA - Tools for District Risk Assessment (Short Term)
DREC - Disaster Risk Education for Children (Short Term)
CBDRR – Capacity Building Disaster Risk reduction project (Long Term).

In Macao

Disaster Prevention and Preparedness (Input from Macao Security Forces Coordination Office)

1. Progress in Member's Regional Co-operation and Selected Strategic Plan Goals and Objectives

Nil

2. Progress in Member's Important, High-Priority Goals and Objectives

Overview of impact of strong natural phenomena on Macao and relative situations during the year

Until September 30, 2007, it is fortunate that there has been no direct attack of various strong natural phenomena on Macao for the past 12 months. This is because of the contributions of Macao government's continuous improvement and its optimization in entire infrastructure on civil protection and operation of related organization structure. It is also the integration of past experience in various emergency responses to Macao's current and actual situations, as well as establishment of measures and decision-making timely aimed at multi-situations. Consequently, there was no great impact on Macao's society, neither serious casualties, nor incidents, even though the entire Framework of Civil Protection System and the mechanism of unified coordination and monitor by the Central Command Center for Civil Protection Action, located in Macao's Security Forces Coordination Office, have not been activated. Moreover, there also has been no large impact on Macao's economic damage, nor attack on Macao's entire social order.

Besides the Civil Protection Plan for Typhoon, there is still another Emergency Response Plan for Rainstorm, which is mainly composed of the public sectors such as the Macao Meteorological and Geophysical Bureau, the Education and Youth Affairs Bureau, the Fire Brigade, the Public Security Police and so on, and is in coordination with the Security Forces Coordination Office. In the last 12 months, there have only been 2 rainstorm signals issued in Macao as shown in table below.

Date	Time	Signal
2007-05-20	10:10 ~ 12:45	Rainstorm
2007-06-10	02:55 ~ 04:00	Rainstorm

According to the regulations of the plan mentioned above, the relevant government departments are requested to submit a report on the casualties, incidents and damages by a specified period. In accordance with the data analysis, the statistics of damage are listed in following table.

Flooding	Tree Collapses	Advertisement board fallen or tottering	Debris fallen off from wall	Scaffolding/ crane collapses or tottering	Window fallen or tottering	Eaves collapses or tottering	Landslide	Human injuries or deaths
9							1	
	5			3		1	1	

The operation and preparation of the Framework for Macao's Civil Protection System

The Security Forces Coordination Office working as a specialized department in civil protection related field has never been complacent at decrease of the impact of various natural phenomena, it keeps on searching for many kinds of essential infrastructure facility and equipment progressively for better and more efficient development of all available policies or measures, which are close to the pace of exiting social development in accordance with its established duties and missions of the relevant legal provisions, so as to conform with Macao's future development plans.

Macao's future development strategies in the aspect of civil protection

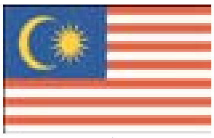
The Security Forces Coordination Office will keep on following the goals of cooperation closely and information exchange among members by participating actively in meetings for better interchanging of ideas and enhancing related knowledge as what has been done before. Therefore, we have joined such large cooperative meetings as the 39th Session of Typhoon Committee Meeting held in Manila, Philippines, the 2nd Meeting of Working Group on DPP held in Seoul, Korea, and the Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Events held in Bangkok, Thailand, on 4~9 December 2006, 22~24 August 2007 and 10~15 September 2007 respectively, during the past year. The Macao's participants of these meetings were not only able to commit to Macao's civil protection policies but also able to exchange information on all aspects of civil protection related issues with members directly and disinterestedly, as well as further understanding of their thoughts and situations on various levels of related field. These, consequently, benefit each member in carrying out its civil protection policies by enriching the related cognition.

In addition, Macao's organizations for civil protection are also able to exchange data on nature disasters and use the information as a reference, through the Typhoon Committee Disaster Information System (TCDIS) established by the Working Group on Disaster Prevention and Preparedness (WGDPP). Regarding the data analyzing and facilities monitoring relative to Meteorology and Hydrology, as well as the issuance of relative information, all are organized by Macao Meteorological and Geophysical Bureau, while some other practical coordinating actions relative to civil security are undertaken by the Security Forces Coordination Office.

Finally, the WGDPP, under the leadership and fully support of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) as well as the World Meteorological Organization (WMO), together with the cooperation with the working groups on Meteorology and Hydrology, is expected to make its utmost contributions and use its influences thoroughly on all aspects of DPP.

3. Opportunities for Further Enhancement of Regional Co-operation

Nil



In Malaysia

IV. Disaster Prevention and Preparedness (DPP)

Malaysia experiences various natural disasters such as floods, fire, landslide, typhoon, tsunami etc. However, the incident of disasters in Malaysia is minor as compared to many other countries affected by disaster in this region. In the month of December 2006 and February 2007, southern states of Peninsular Malaysia such as Johor, Malacca, Negeri Sembilan and Pahang were affected by severe floods. About 92,000 families or 340,000 people received services provided by various government agencies and NGO's as a disaster victim in relief centres and their relative houses.

Every year, just before the onset of the northeast or winter monsoon, the Honourable Deputy Prime Minister of Malaysia, as the chair of National Disaster Management and Relief Committee, would chair the flood disaster preparation and mitigation meeting. All disaster management agencies involved would assess and report on their preparedness on emergency response, recovery and rehabilitation for the flood disaster victims. Similar preparation and mitigation meetings are also held at the state and district levels.

Progress in Member's Regional Cooperation, Important, High-Priority Goals and Objectives

(a) Hardware and/or Software Progress

Structural Designs for Floods Mitigation

Structural mitigation measures in both engineered and non-engineered structures are implemented to minimise flood, such as through the construction of river embankments and Stormwater Management and Road Tunnel (SMART) system and through international cooperation.

Government Integrated Radio Network (GIRN)

The Government has recently introduced an integrated radio network project. This project will provide secure digital trunk radio system for the various government agencies involved in disaster management.

Fixed Line Alert System (FLAS)

The Fixed Line Alert System (FLAS) or Disaster Alert System (DAS) will enable the government to disseminate timely, short and precise early warning messages to a large number of targeted regional communities.

(b) Implications to Operational Progress

Directive No.20 of the National Security Council (NSC)

In order to facilitate the management of disaster, the National Security Council is tasked to coordinate efforts among the various agencies involved in disaster management. Under the Directive, when a severe disaster occurs meeting will be immediately convened by the Disaster Management and Relief Committee. A Disaster Control and Operation Centre will also be operationalised. The operation of the Disaster Control and Operation Centre will be established based on the disasters which could either be at the District, State or National level. Today, the NSC is taking steps by having meetings at regular intervals with the various agencies to further strengthen cooperation in disaster prevention and preparedness.

LUPar Programme

The purpose of LUPar is to provide general guidelines for policy makers, decision makers, national disaster managers, local authorities on the type of development to be allowed in hazard prone areas and to provide mitigation measures for the areas. The main goal for the LUPar programme is to encourage policy makers to apply the principles and practices of community based disaster management into their relevant Acts and legislations.

c. Interaction with users, other Members, and/or other components

National Disaster Management Strategy

The national disaster management strategy is to advance effective coordination and integrated approach in developing the culture of prevention and mitigation as well as providing safety for the community. The main components of the strategy are as follows:

(i) Development – reduce the risk of disaster for the through continuing development of disaster management capabilities in mitigation, preparedness, response and recovery processes;

(ii) Partnership – establish a national approach to disaster management through coordinated and integrated system involving multi-agency and private sector including non-governmental organizations and civil society;

(iii) Education and Training – develop and encourage participation in providing literature education and training to enhance awareness and effective disaster handling among officials of various agencies and the community;

(iv) Community Awareness – develop a national approach to foster and enhance community awareness of risks, preparedness, response and recovery strategy through drills;

(v) Total Defence / Public Participation – promote and develop concept of Total Defence as a mean to enhance Public Safety capability and resilience in response to threats of hazards and disasters; and

(vi) International Cooperation - promote and develop international cooperation network by exchanging, sharing experiences and best practices as well as training on disaster management.

Enhancement of Public Education and Awareness

To enhance disaster preparedness, the Malaysian government has continuously carried out public education program on disasters prevention to people living in flood prone areas with the objectives of protecting human lives and property; minimizing or to avoid social disruption and economic losses. Public education and awareness programmes are carried out through various media including TV and radio broadcasts. Among the programmes and activities that have been implemented to enhance public awareness are as follow:

(i) Dissemination of information on hazards and warnings to the public through pamphlets and mass media;
(ii) "Roadshow" on disaster awareness and management at the State and district levels; and
(iii) Campaign on the annual "National Disaster Awareness Day" on 26 December.

d. Training Progress

Training activities are organized at national and states level to cater for Social Welfare Officers and volunteers to work in disaster management. In the month of August 2007, the Department of Social Welfare organised special workshop in disaster management for national level. Other training modules include working at multi disciplines level, disaster technical management, rehabilitation and other issues related to disaster management. The objectives of these trainings are to provide knowledge and skills for officers and volunteers to work professionally in helping the disaster victims.

Disaster Management Exercise

NSC conducted exercises to ensure high level of responsiveness among the relevant agencies involved in disaster management in areas such as decision-making and implementation of procedures and guidelines. Although some of these exercises are not related to typhoon disaster threat management these exercises help to strengthen cooperation and to consolidate effort in multi-agency tasking. These exercises were held during the first quarter to third quarter of 2007:

(i) Disaster and crisis management exercise in various field;
(ii) Nuclear, biological and chemical exercise;
(iii) Influenza pandemic simulation exercise; and
(iv) Tsunami emergency drill.

In Philippines

4.1 Progress In Member's Regional Cooperation and Selected RCPIP Goals and Objectives

As Member of the WGDPP of the TC, the Philippines' contribution towards regional cooperation for the following activities are cited below:

4.1 Strengthening of the disaster preparedness and prevention capacity of people at local level and encourage local level participation.

a) Establishment of Community Based Disaster Management training for flood prone areas.
b) Provision of the necessary equipment and training for hydrometric data observation and notification of local flood conditions, forecasts, and / or warnings.

4.1.2 Typhoon Committee Database Information System (TCDIS)

a) Make available disaster preparedness and mitigation information via internet to TC Members.
b) Enhance list of Internet web sites which Member can access for disaster preparedness and prevention information.
c) Members share sound practice of existing system in use for Flood Early Warning System.

4.2 Interaction with users, other Members, and/or other components

a. Flood Hazard Mapping

In collaboration with PAGASA hydrologists, the DPP group of Quezon City conducted public information campaign and flood drills in San Bartolome, one of the Barangays in Quezon City, where the importance of the flood hazard map during emergency evacuation was emphasized.

4.3 Progress in Member's Important, High-Priority Goals and Objectives

Below are the main activities of the DPP group in the Philippines

a. With regards to the highest policy making, coordinating, and supervisory body at the national level for disaster management in the country, the National Disaster Coordinating Council (NCCC) announced its 4-point Plan of Action for multi-hazard mitigation:

- Upgrading of PAGASA and PHIVOLCS forecasting capability
- Enhancement of the public information campaign on disaster preparedness
-. Capacity building for local government units in identified vulnerable areas.
- Mechanism of the govt and private sector partnership in relief and rehabilitation

In line with the above-mentioned plan of action, the Hazard Mapping and Assessment for effective community-based disaster risk management which is also known as READY Project, was conceived. This 4-year project is funded by UNDP and AuSAID , with the Office of Civil Defense as the executing Agency. This is in collaboration with the following government agencies, namely: Philippine Institute of Volcanology and Seismology (PHIVOLCS), Philippine Atmospheric, Geophysical, Astronomical and Services Administration (PAGASA), Mines and Geosciences Bureau (MGB) and the National Mapping Resource and Information Authority (NAMRIA). The project covers 27 highly risk provinces, in terms of earthquakes, volcanic eruption, floods and rain-induced landslides.

The main activities of the project are:

- Production of multi-hazard mapping for earthquake and volcanic hazards
- Production of hazard mapping for floods and rain-induced landslides
- Public Education Campaign for realistic disaster preparedness plan for land-use planning.

b. Community-based Flood Warning System – Urban Setting

In collaboration with the hydrologists of PAGASA, below are activities spearheaded by the disaster prevention and preparedness group of the Department of Public Order and Safety of Quezon City :

- Established a model project on Community-based Flood Warning System in urban setting, that enhances local level participation and partnership with non-government organizations for flood forecasting, warning notification, and response activities. The pilot project is Barangay San Bartolome of Quezon City.

- Organized community dialogues in 4 barangays of Quezon City; i.e., San Bartolome, Roxas, Damayang Lagi, and Dona Imelda, on the importance of local level participation regarding the monitoring of floods.
- Coordinated with the Quezon City officials leading to the passing of a resolution on the Establishment of a Flood Early Warning System in all flood-prone barangays of the City.
- Initiated the promotion of an inter-local government units cooperation on Flood Warning System.

4.4 Implications to operational Progress

Effective flood warning system at the community level is a result of the close coordination between the hydrology and DPP sectors. This system encourages the active participation of the locals living in vulnerable areas to partake in flood forecasting/warning activities in their locality. This practice will strengthen their ability to cope up with floods or any other rain-induced hazard in their area.

4.5 Researches

Ongoing operational researches led by PAGASA are the following:

- Hydrometeorological Hazard Assessment
- Flood Hazard Mapping and Vulnerability Analysis
- Special Tropical Cyclone reconnaissance, Information and damage evaluation
- Tropical Cyclone Disaster review
- Multi-vernacular Meteorologically-induced Disaster glossary
- Hardware and/or Software Progress

4.6 Training Progress

A number of local and foreign training programs were attended by PAGASA personnel, from October 2006 to September 2007:

Local:

- National Workshop on Coastal Hazards Management Program
- Workshop on the Result of Multi-Hazard Mapping & Early Warning System

Foreign:

- WMO International Training on Tropical Cyclone Disaster Reduction
- Multi-Hazard Risk Assessment Course
- Workshop on the Physics of Tsunami, hazard Assessment Methods and Disaster Risk Management
- International Training Program for Typhoon and Flood Disaster Reduction 2007

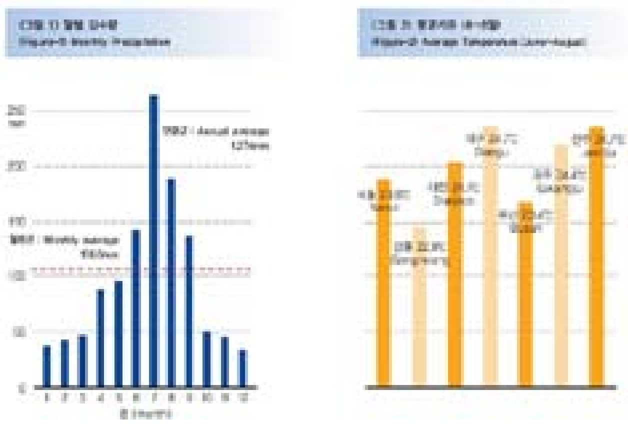
In Republic Of Korea

I. Geomorphologic and Climatic Characteristics

II. Disasters in Korea

I. Geomorphologic and Climatic Characteristics

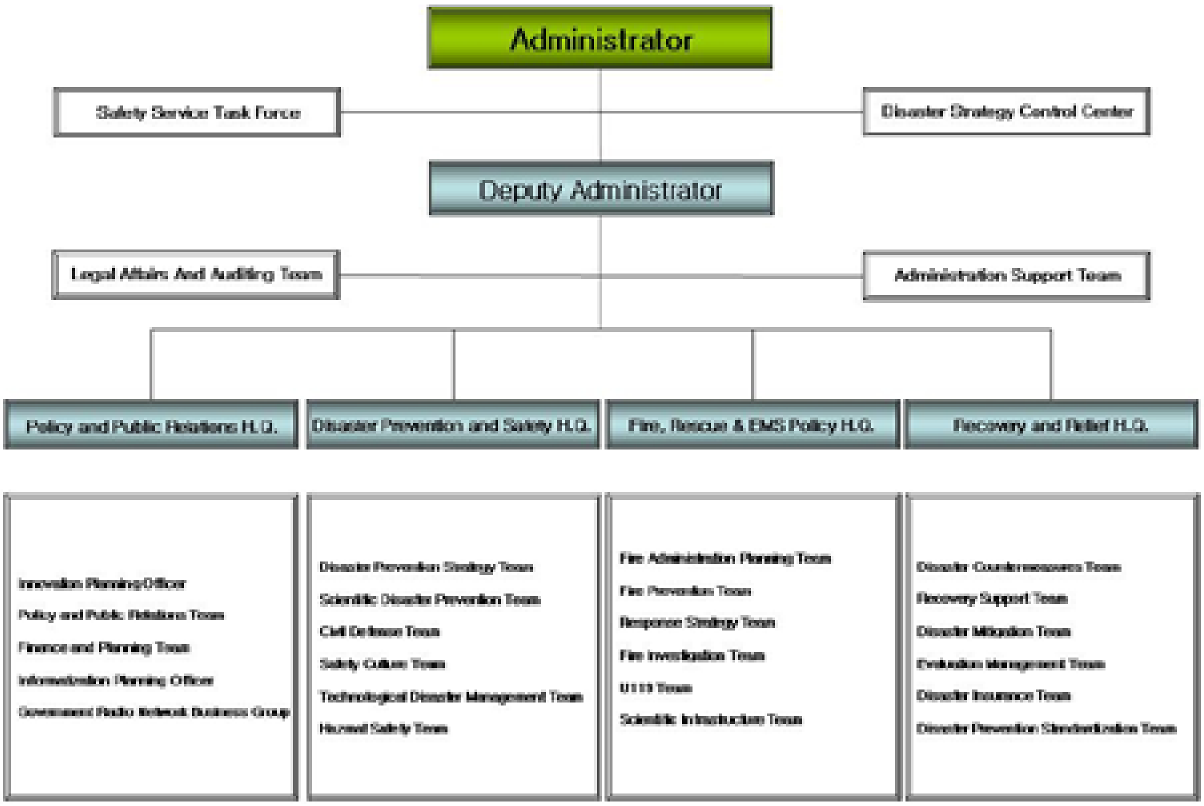
The Korean peninsula is located in the Far East facing the Chinese continent on its west and the Japanese archipelago on its east. About 70% of the total land area (220,848 km²) is mountainous area and Korea has a temperate climate with four distinct seasons characterized by many arid days in spring, substantial rain in summer and much snow in winter. Typhoons occur mostly from July to September with two or three affecting Korea directly or indirectly.
Torrential rain generally occurs from June to August. About two thirds of the annual average precipitation amounting to 1,274mm is concentrated during this period.



‹Climate Characteristics of Korea›

II. Disasters in South Korea

The Republic of Korea has been suffering from about 10 natural disasters per year causing 119 deaths and US$ 1.9 billion property damages annually and the recovery cost is about US$ 3 billion. The types of disasters are typhoon, torrential rain, heavy snow and these are about 85 % of total disaster types causing 95% of total damages.
Two to three typhoons hit Korea every year and two third of annual precipitation are concentrated during July and September. Unpredictable and localized torrential rains are occurring during June and August and heavy snow usually occurs during December and March causing damages in green houses in the rural area and traffic accidents.
Drought causes damages in agriculture areas and drinking



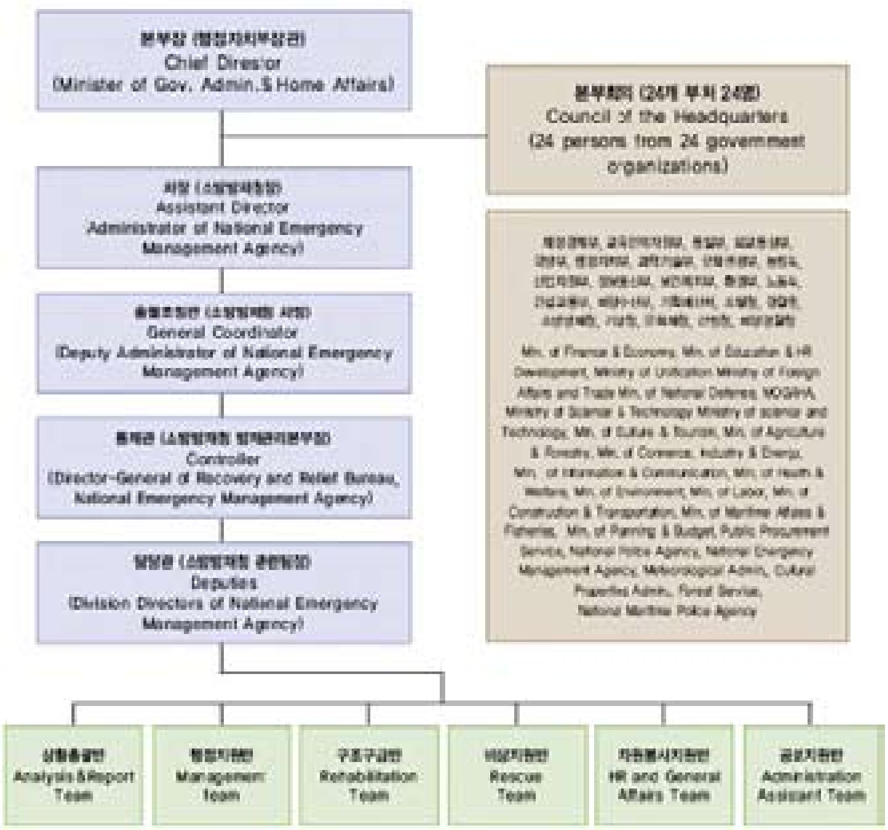
water shortage during March to June. Earthquake occurs about 27 times in Korea, but no substantial damages.

III. Organization of Disaster Management

The republic of Korea has 18 Ministries, 4 Central Offices, and 18 Agencies and each body has different roles in disaster management. The National Emergency Management Agency (NEMA) has an overall coordinating function in the national level.

‹Organization of NEMA›

The Central Disaster and Safety Countermeasures Headquarters (CDSCH) formulized as an ad hog organization during disaster period executing necessary measures in disaster prevention, status control, and recovery plans. The organization head or chief director is Minister of the Ministry of Government Administration and Home Affairs and deputy is Administrator of NEMA. Other committees support CDSCH.



‹Organization of CDSCH›

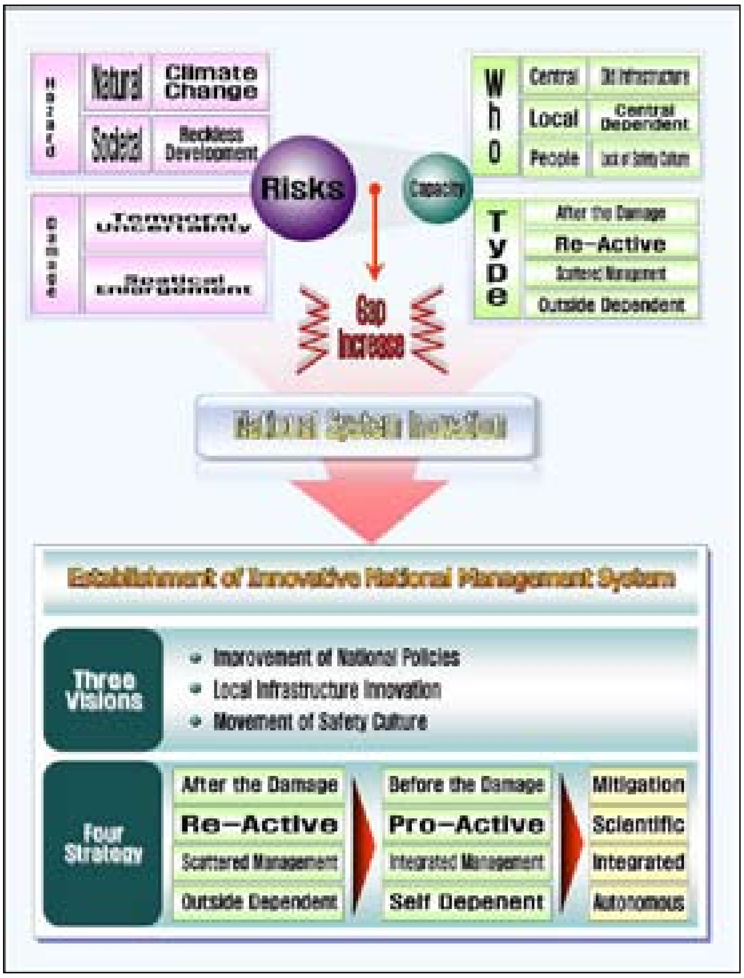
To offer a holistic approach in disaster management protecting people's lives, an innovative national disaster management system has been proposed in March 2007.
‹Concept Change in Innovative National Disaster Management System›

Item	Current Response and Central Oriented	Future Mitigation and Community Oriented
Target	Hazards	Vulnerability
Activity	Reactive	Proactive
Authority	Single Agency	Partnership
Tool	Science Driven	Multi-disciplinary approach
Theme	Response Management	Risk Management
Relationship	for Communities	with Communities

IV. Innovative National Disaster Management System

1. Background

Large-scaled disasters are occurring due to climate change and vulnerability increase. According to the statistic in the last 30 years, high intensity rainfall days which exceed 80 mm/day increased 1.5 times and property damage also increased 8 times.
Reckless development with urbanization and, in consequence, increase of impermeable areas worsened the flood disaster causing function failure in infrastructures such as underground facilities, road, electric, gas, and water facilities. Also, community-based disaster management is not practiced due to the recovery-oriented management and less participation of local people.
To solve these obstacles and improve current management system, several policies are proposed formulating a new paradigm.
‹A New Paradigm: Innovative National Disaster Management System of Korea›



2. Disaster Countermeasures in the New System

A. Improvement of Disaster-Prevention Facility

Different Ministries have different roles in maintaining facilities such as rivers, dams and reservoirs, and steep slopes, in disaster prevention management system. These scattered functions sometimes cause problems when setting up a comprehensive plan.

To integrate these functions, census on the national disaster management will be implemented every five years and the "National Disaster Prevention Standard Improvement Committee" will be set up to review the census and propose improvement plans.

<Concept of the Innovative National Disaster Management System of Korea>

B. Increase of Mitigation Budget

Due to the aged infrastructures and shortage of disaster-related facilities, stable budget for disaster prevention needs to be secured. Prioritization, allocation, and evaluation of the budget will be implemented in the new system.

C. Improvement Recovery

Previously, damaged facilities and rivers were repairs to their original status, which sometimes causes redundant damages. Design criteria are improved, relocation policy is highly enforced, and comprehensive flood measures are introduced based on the basin-level analysis. To select damaged sites which will be improved, disaster cause survey team is set up with local people and civilian experts.

D. Scientific Disaster Management

Korea invests reasonable research and development budget every year as a part of the National R&D program. Cyber safety checking system, damage prediction with disaster function, status control based on the sensor network, and ubiquitous disaster free city are some of on-going R&D projects.

E. Comprehensive Disaster Management System

Based on the "Integrated Water and Wind Related Disaster Management System", weather information, disaster site situation, damage prediction, mitigation, response, recovery, and assessment are integrated in one system and used to support activities in disaster phases.

F. Autonomous and Responsible Capacity Building

To decrease budget burden and to reduce moral hazard natural disaster insurance program similar to the National Flood Insurance is practiced. Safety Culture Promotion Basic Law is also introduced. Development of objective assessment indices and various manuals is an essential part in the disaster cycle. Reliable and efficient assessment system and various SOPs are established to guarantee strengthening assessment and feedback functions.

V. Major Disasters in 2007

1. Overview

In 2007 Korea suffers from 13 natural disasters losing 19 people and US$ 244 million as of September. The recovery cost is US$ 492 million.

2. Major Disasters

A. March 4th High Wind Disaster

Due to wind in the sea and land, southern part of the Korean peninsula were damaged, especially in agricultural areas, and 29 people were evacuated and US$ 23 million property damage were reported.

B. August 4th High Wind and Torrential Rain Disaster

Due to the torrential rain and high wind in the sea and land, middle and southern parts

of the Korean peninsula were damaged, especially in agricultural areas, military facilities, and bridges. 46 people were evacuated and US$ 32 million property damage was reported.

C. September 14th Typhoon "NARI" Disaster

Due to 11th Typhoon NARI, high wind and record-breaking rainfall record in Jeju Island. Southern part of the Korean peninsula was damaged. 18 people lost their lives, 14,170 people were evacuated and US$ 1.6 billion property damage was occurred.

IV. Disaster Statistics

1. Overview

During the period of October 1 to December 31 in 2006, 2 people died and cause approximately US$ 80 million property damage by strong winds. During the period of January 1 to September 31 in 2007, 19 people died and approximately US$ 244 million worth of property damage was incurred due to major disasters such heavy rains and typhoons.

‹ Damages Caused by Natural Disasters›

Classification	Units	Oct - Dec., 2006	Jan. - Sept., 2007	Total
Casualties (Dead or Missing)	Person	2	19	21
Displaced Person	Person	1,148	14,366	15,514
Farmland Lost or Buried	ha	6	4,859	4,865
House Destroyed or Damaged	Unit	41	286	327
Property Damage	U.S. $ million	80	244	324

2. Report on the Damage Caused by Typhoon-related Disasters

Oct. 1, 2006 ~ Dec. 31, 2006

Ⅰ. GENERAL	Sequence NO.	1	2	3	4	Total
1. Type of disasters		Wind	Wind Snow			
2. Date or period of occurrence		Oct. 22~25	Nov.4~9			
3. Name of regions/areas seriously affected		GW GB	CHN CLN			

* US: Ulsan Metropolitan City, GB: Gyeongsangbuk Do, CHN: Chungchungnam Do, CLN: Chollanam Do, JJ:Jeju Do, GG: Gyunggi Do, CHB: Chungchungbuk Do, , GN: Gyeongsangnam Do, CLB: Chollabuk Do, GW: Gangwon Do

Ⅱ. HUMAN DAMAGE	Unit	1	2	3	4	Total
4. Dead and missing	persons	2				2
5. Injured	persons	1				1
6. Homeless	Persons /Families	1,143 453	5 4			1,148 457
7. Affected	persons /families					
8. Total	**persons**	**1,146**	**5**			**1,151**

Ⅲ. MATERIAL DAMAGE IN PHYSICAL TERMS A. Houses and buildings	Sequence NO.	1	2	3	4	Total
9. Destroyed	Units	1				1
10. Damaged	Units	35	5			40
11. Affected	Units	421	1			422
12. Total	**Units**	**457**	**6**			**463**

B. Farmland	Sequence NO.	1	2	3	4	Total
13. Farmland	hectares					

C. Agricultural products	Sequence NO.	1	2			Total
14. Crops	Hectares	5.81				5.81
15. Livestock	heads	294	1,039			1,333
16. Fruit plants	Hectares					
17. Others	Hectares					

D. Public works facilities	Sequence NO.	1	2	3	4	Total
18. Road	sites	21				21
19. Bridge	sites					
20. River embankment	sites	12				12
21. Irrigation facilities	hectares (sites)	4				4
22. Reservoir and dam	number					
23. Harbor and port	number sites	5	1			6
24. Other	Number Sites					

E. Public utilities	Sequence NO.	1	2	3	4	Total
25. Railway	Km /sites	0.05 1				0.05 1
26. Electric supply	Affected families /Sites					
27. Water supply	Affected families /sites	14				14
28. Telecommunication	Circuits /Sites					
29. Other	Sites					

F. Others	Sequence NO.	1	2	3	4	Total
30. Ships lost or damaged	number	188	196			207
31. Landslide and collapse of slope	sites					

IV. MATERIAL DAMAGE IN MONETARY TERMS UNIT: million Won EXCHANGE RATE US$1 = 1,000 Won	Sequence NO.	1	2	3	4	Total
32. Damage of houses and loss of private property includes: houses and buildings for residential use, household furniture, appliances and possession, stored good and other assets of farmer's and fisherman's households, Others		0.555		0.075		
33. Loss of agricultural production includes: crops, vegetables, fruits livestock, Others						
34. Loss of industry						
35. Loss of public works facilities includes items under MATERIAL DAMAGE IN PHYSICAL TERMS: road, bridge, river embankment, etc, irrigation facility. reservoir and dam, harbour & port, and public buildings rehabilitation cost of farmland at government expense. Others		51	1.9			52.9
36. Loss of public utilities includes items under III MATERIAL DAMAGE IN PHYSICAL TERMS: - railway, electric supply, water supply, telecommunication - Other		1.2				1.2
37. Total estimated/counted damage cost& sum of items: 32,33,34,35,36		**77.4**	**3.3**			**80.7**

Jan. 1, 2007 ~ Sept. 31, 2007

I. GENERAL	1	2	3	4	5	6	7	Total
1. Type of disasters	Rain Wind	Typhoon Mani	Rain	Rain Wind	Typhoon Nari	*Other Disasters Are Just Skipped*		
2. Date or period of occurrence	Mar. 4~8	Jul. 13~16	Aug. 4~6	Sept. 4~9	Sept. 13~18			
3. Name of regions/areas seriously affected*	CHN GG	JJ US	CHB CHN GW	GB CLN	CLN JJ	*Only Total Reflected*		

* US: Ulsan Metropolitan City, GB: Gyeongsangbuk Do, CHN: Chungchungnam Do, CLN: Chollanam Do, JJ:Jeju Do, GG: Gyunggi Do, CHB: Chungchungbuk Do, , GN: Gyeongsangnam Do, CLB: Chollabuk Do, GW: Gangwon Do

II. HUMAN DAMAGE	Unit	1	2	3	4	5	6	7	Total
4. Dead and missing	persons				2	16	*Other Disasters Are Just Skipped.*		22
5. Injured	persons			2		13			16
6. Homeless	Persons /Families	34 16		412 146	605 222	14,170 5,713			15,696 6,302
7. Affected	persons /families						*Only Total Reflected*		
8. Total	persons	34		414	607	14,199			15,734

III. MATERIAL DAMAGE IN PHYSICAL TERMS A. Houses and buildings	Sequence NO.	1	2	3	4	5	6	7	Total
9. Destroyed	Units	2		2	3	61	*Other Disasters Are Just Skipped.*		72
10. Damaged	Units	13		8	2	151			214
11. Affected	Units			201	185	5,115			5,705
12. Total	Units	15		211	190	5,327	*Only Total Reflected*		5,991

B. Farmland	Sequence NO.	1	2	3	4	5	6	7	Total
13. Farmland	hectares				1,850	2,683			4,858

C. Agricultural products	Sequence NO.	1	2	3	4	5	6	7	Total
14. Crops	Hectares			28.62	0.15	667.39	*Other Disasters Are Just Skipped.* *Only Total Reflected*		736.44
15. Livestock	heads	67		6,355		99,401			165,853
16. Fruit plants	Hectares								
17. Others	Hectares								

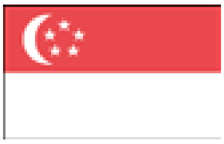
D. Public works facilities	Sequence NO.	1	2	3	4	5	6	7	Total
18. Road	sites			27	6	212	*Other Disasters Are Just Skipped.* *Only Total Reflected*		297
19. Bridge	sites			1		24			28
20. River embankment	sites			175	10	1,079			1,397
21. Irrigation facilities	hectares (sites)			36	2	179			258
22. Reservoir and dam	number								
23. Harbor and port	number sites	1				3			4
24. Other	Number Sites								

E. Public utilities	Sequence NO.	1	2	3	4	5	6	7	Total
25. Railway	Km /sites			0.55 2		0.545 7	*Other Disasters Are Just Skipped.* *Only Total Reflected*		1.095 9
26. Electric supply	Affected families /Sites								
27. Water supply	Affected families /sites	1		16	1	98			140
28. Telecommunication	Circuits /Sites								
29. Other	Sites								

F. Others	Sequence NO.	1	2	3	4	5	6	7	Total
30. Ships lost or damaged	number		81			57	*Other Disasters Are Just Skipped.* *Only Total Reflected*		370
31. Landslide and collapse of slope	sites								

IV. MATERIAL DAMAGE IN MONETARY TERMS UNIT: million Won EXCHANGE RATE US$1 = 1,000 Won	1	2	3	4	5	6	7	Total
32. Damage of houses and loss of private property includes: · houses and buildings for residential use, · household furniture, appliances and possession, · stored good and other assets of farmer's and fisherman's households, · Others	255		180	120	4,095	*Other Disasters Are Just Skipped.* *Only Total Reflected*		5,370
33. Loss of agricultural production include: · crops, vegetables, fruits · livestock, · Others	19,807	364	188	2	31,214			70,513

	1	2	3	4	5	6	7	Total
34. Loss of industry						*Other Disasters Are Just Skipped.* *Only Total Reflected*		
35. Loss of public works facilities includes items under III MATERIAL DAMAGE IN PHYSICAL TERMS: - road, bridge, river embankment, etc, irrigation facility. - reservoir and dam, harbor & port, and public buildings - rehabilitation cost of farmland at government expense. - Others	2,170	1,330	18,956	2,141	187,514			239,508
36. Loss of public utilities includes items under III MATERIAL DAMAGE IN PHYSICAL TERMS: - railway, electric supply, water supply, telecommunication - Other	8		256	80	6,575			8,247
37. Total estimated/counted damage cost& sum of items: 32,33,34,35,36	**22,240**	**1,694**	**19,580**	**2,343**	**229,398**			**323,638**



In Singapore

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress

(See item II 2a)

b. Implications to Operational Progress

c. Interaction with users, other Members, and/or other components.

d. Training Progress

In view of an increased expectation from the public and media on early warnings and alerts on severe weather conditions, NEA had organized a 2-day Intensive Level Media Management Training Seminar to equip staff with media handling skills. More than 10 NEA senior staff members including those from MSD attended the seminar. Some specific skills and difficulties related to the recent Severe Monsoon Season were discussed.

e. Research Progress.

f. Other Cooperative/ Strategic Plan Progress.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress

b. Implications to Operational Progress

c. Interaction with users, other Members, and/or other components

Singapore is located close to the equator (1.5 N) and normally not affected by tropical cyclone directly. However, historical record shows that tropical cyclone "Vamei" came as close as 50 km from Singapore on 27 December 2001. The event did not cause significant damage to Singapore due to its rapid weakening on approaching land.

Under the backdrop of climate change, a multi-agency task force called Extreme Weather Group (EWG) was formed. The EWG was tasked to study the how best the impact of similar events in the future could be mitigated. The study has concluded and has provided recommendations for various agencies. A follow-up more-detailed investigation –Climate Change Vulnerability Study which is a joint effort between NEA and National University of Singapore has also been initiated. The ongoing study is looking into impacts of possible sea-level rise and extreme weather conditions.

e. Research Progress.

f. Other Cooperative/ Strategic Plan Progress.

3. Opportunities for Further Enhancement of Regional Cooperation

Nil

In Thailand

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress

Nil

b. Implication to Operational Progress

Nil

C. Interaction with users, other Members, and/or other components

+ One delegate from DDPM, Ministry of Interior, Thailand attended the Integrated Workshop on Social-economic Impacts of Extreme Typhoon-related Events held during 10-14 September 2007 at UN Conference Center in Thailand.

d. Training Progress

Nil

e. Research Progress

Nil

f. Other Cooperative /RCPIP Progress

Nil

2. Progress in Member's Important, High-Priority Goals and Objectives

a. Hardware and/or Software Progress

The 2007 key projects of disaster management are as follows:

+ The continual CBDRM Approach
Department of Disaster Prevention and Mitigation--DDPM has continually implemented project of Community-Based Disaster Risk Management--CBDRM from 2004 aiming to 1) prepare community in risk areas to enable in disaster management by themselves, 2) create disaster prevention and mitigation network in the village/ community level and 3) set up village working group responsible on disaster management in the village. Up to date, there are 1,676 at risk communities passing the CBDRM training courses. Furthermore , DDPM has collaborated with the international organizations and related governmental bodies to launch these following CBDRM projects:

- German by GTZ has Implemented CBDRM in 2 pilot areas. One is Tsunami disaster risk areas in Mooban Taplamu, Lamkaen Sub-district, Training District, Phang Ngaprovince and the other area is flood disaster risk areain Mooban Tung Kraborg. Sator Sub-district, Kaosaming District, Trd province.
- The Asian Disaster Reduction Center--ADRC coordinated with the Ministry of Education conducted the Education for Disaster Preparedness in Primary School Project in 2 pilot schools in Phang Nga.
- DDPM, in collaboration with JICA and other relevant agencies, have conducted a program to enhance the disaster management capacities for government officials in relevant sectors as well as the community members. The project places its focus in 3 pilot provinces namely Chumporn (flood), Phuket (tsunami) and Mae Hong Son (landslide). Started in August 2006, this program will terminate in August 2008.

+ OTOS Project
DDPM has recognized the immediate need to establish a range of search and rescue capacities at national, provincial and most importantly, local levels. Thus, DDPM has launched the "One tambon One Search and Rescue Team--OTOS Programme" which will resulted in the establishment, training and long- term maintenance of specially trained search and rescue team in every tambon community.
DDPM, has incorporated various government agencies and NGO such as Department of Local Administration, Health Insurance Office, Office of Health Promotion and Support Fund, and Thai Red Cross, to achieve the following OTOS objectives;

- To ensure the safety of life, and the rapid and efficient search and rescue operation,
- To establish efficient search and rescue team at every provinces, district and tambon in the country,
- To enhance capacity and efficient search and rescue team through technical training and drilling,
- To provide first aid treatment and rapid transfer to the appropriate medical

establishment.

OTOS programme has been expected to complete in 2008. Upon the completion, there will be a SAR team (10 members) based in each tambon (7,255tambons) throughout the country.

+ The Flashflood and Mudslide Warning Programme
The Royal Thai Government has realized that natural disaster of flashflood and mudslide is becoming Thailand's current threatening hazards. In this regard, DDPM has collaborated with Department of Provincial Administration, Department of Local Administration, the Meteorological Department, Mineral Resources, National Park, Wildlife and Plant Conservation Department and National Disaster Warning Center to implement the project called "Mr. Disaster Warning" from 2006 to 2007.
This course aims at creating disaster warning network in flashflood and mudslide prone village. "Mr. Disaster Warning" is the village volunteer who has been selected and trained to function as a vigilant, a forewarner and a coordinator. As the vigilant, he will keep the close watch on the development of the potential flood and mudslide and check the level of rainwater in the simple rain gauge installed in his village. As the forewarner, he will report the village headman if there is any indication that these will be an emergency, then the headman will signed the manual siren to warn the villagers to evacuate to the safe area. As the coordinator, functions as the contact person or the coordinators between his community and the agencies concerned to arrange the warning system and evacuation drill in his village. Since the inception of the programme, approximately 6,455 villagers were trained and assigned to be "Mr. Disaster Warning".

+ Civil Defense Volunteers (CDVs)
CDVs play an important role in disaster management in Thailand. Authorized by the Civil Defense Act 1979 and MOI's Civil Defense Regulations 2005, Local governments can recruit local residents with age over 18 years to have 5-days trainings and then grant them the CDV status. Roles of CDVs can be found in disaster response, relief, recovery, prevention, mitigation and preparedness. In other words, all activities in disaster management have been involved by the volunteers. CDVs have been also engaged in general activities organized by government agencies at national, provincial and local level. Normally, CDVs are not paid by the governments. They work on a voluntary basis. At present, there are around 835,000 CDVs in the country (about 1.3% of the total population). But due to the increase in number, scale and complexity of disaster, MOI has planed to increase the number of CDV to 2 millions (2% of the population) within the year 2007.

b. Implications to Operational Progress

+ In 2006, there have been 120 batches (360 communities/ villages) of community-based disaster risk management courses conducted. The training course was implemented in the communities which are prone to flooding and landslide.

+ The training of 435 provincial SAR Team members to be SAR instructors has been completed. In district level, the 4,400 district SAR team is now undergoing. DDPM is expected the total number of 72,550 tambon SAR team member will be trained completely

+ Since in August 2006, DDPM in cooperation with the earlier mentioned government agencies, had launched this training course in flood and mudslide prone villagers of 51 provinces (out 76 provinces) nationwide. The total number of 6,455 "Mr. Disaster Warning" have been designated and tasked as the "village – based disaster warning volunteers in their respective villages" DDPM made "Mr. Disaster Warning" manual and distribute to villages and agencies concerned.

c. Interaction with users, other Members, and or other components

- DDPM has continuously disseminated disaster –related information to the public through the mass media, with the close coordination with concerned agencies such as National Disaster Warning Center, Department of Meteorological, the Royal Irrigation Department and Department of Water Resources during the occurrence of disasters.

d. Training Progress

+ DDPM has promoted the officials to attend the workshops, meetings, conferences and exercises in a number of countries in Asia, Europe and elsewhere

+ The DDPM has sent their staffs to attend the "Disaster Management" training course in such as chemical disaster prevention and Disaster Management by Thai government fund and foreign countries.

+ DDPM's Disaster Prevention and Mitigation Academy (DPMA) has conducted a number of disaster management training courses for DDPM officials, local government staffs and volunteers. Since its establishments, DPMA has trained more than

e. Research Progress

DDPM in conjunction with Vietnam has planned to implement a co-research program on GIS for flood area management.

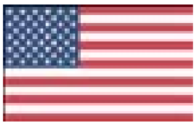
f. Other Cooperative/Strategic Plan Progress

Department of Water Resources has implemented the work plans set forth in the national water policy, one is the accelerate preparation of plans for flood and drought protection. In the year 2007, completed and ongoing projects are supported as follows;
Promote the year of National water agenda in various campaign weeks.

1. Preparation and promotion the master plan for short term and long term plan national flood mitigation.
2. Optimization of hydrological and meteorological monitoring network in Bangpakong river basin and Prachup Khirikhan coast basin.
3. Flood and landslide early warning system cover on 53 villages risk area.
4. The telemetering of hydrological network and regional center for flood forecasting in Chi and Mun basin.
5. Strengthening cooperation with other countries in lower Mekong river basin.
6. Raise public awareness and education in Integrated water resources management.
7. Raise public participation in Integrated water resources management.

3. Opportunities for Further Enhancement of Regional Cooperation

Nil



In USA

I. Weather Forecast Office (WFO) Guam, Micronesia, Western North Pacific

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and/or Software Progress.

- HURREVAC information software. During his annual training visits to Micronesia, the Guam WCM implemented and/or updated HURREVAC typhoon tracking and evacuation management software and provided refresher training at the Micronesian Weather Service Offices and Disaster Management Offices. This software allows for improved tropical cyclone response and recovery. Also during the year, WFO Guam provided refresher training to Guam Civil Defense and CNMI Emergency Management Office users of HURREVAC.
- FM Weather Radio Broadcast for Chuuk. An FM radio station was installed at the Chuuk, FSM Weather Service Office (WSO). This station provides an inexpensive method for the residents of the Chuuk Lagoon islands to obtain weather information and warnings. This FM station can reach about 30,000 of the 40,000 residents in the Lagoon. A repeater will placed in the Lagoon to extend the signal to other residents. Broadcasting weather information on FM radios will provide vital weather information and warnings to a population that has only very limited radio transmission capabilities. This is the first step toward developing an early warning system for Chuuk State.
- FM Weather Radio Broadcast for Majuro. An FM radio station similar to the one placed at the Chuuk WSO will be placed at the Majuro WSO in 2008. This station will provide weather information and warnings to the 35,000 residents of Majuro Atoll and the 1,000 residents of Arno Atoll.
- NOAA All Hazards Radio to public schools. WFO Guam MIC and WCM presented twenty six NOAA All-Hazards Radios to the Commonwealth of the Northern Marianas (CNMI) Public School System (PSS). Several Principals and staff, Emergency Management Office (EMO) officials and the Governor of the CNMI's Senior Policy Advisor were in attendance for this ceremony. The Guam MIC acquainted the group with the background of the NWR program and its history in the Marianas. The WCM provided training to PSS staff and EMO staff on how to use, program, and register the radios.

b. Implications to Operational Progress.

NTR.

c. Interaction with users, other Members, and/or other components.

- Typhoon Exercise. On 26 October 2006, WFO Guam and Guam Civil Defense held the annual typhoon exercise that normally involves key Government agencies, military and Non-Governmental Organization representatives, and emergency managers. With Guam having just been recognized as StormReady and TsunamiReady, the Guam Civil Defense opted to conduct a table-top exercise that would test specific capabilities and new plans. The scenario involved a weak typhoon that was forecast to pass well south of the island, but instead, rapidly intensified into a Category 4 typhoon and moved straight toward the island in the early morning hours. This "worst case" scenario, revealed some weaknesses in the system, and allowed the emergency managers to strengthen procedures. The exercise lasted 5 hours.
- Media Workshop. The media is extremely important for getting WFO Guam weather information and warnings out to the general population. Because of this important partnership, WFO Guam provided three Media Workshops on Guam and one on Saipan. The Workshops included presentations on WFO Guam operations and products, tropical cyclone hazards and behavior, and tsunami behavior. Each attendee was also provided a comprehensive 54-page Media Reference Guide with detailed information on each WFO Guam product and program.
- Tropical Cyclone and Disaster Preparedness Workshops. The WCM conducted 2-day Tropical Cyclone, Disaster Preparedness, and Climate Workshops at: Saipan, Rota, and Tinian in the CNMI; Koror, Republic of Palau; Pohnpei, Kosrae, Chuuk, and Yap in the FSM; at Majuro in the Republic of the Marshall Islands; and on Guam. In Palau, twelve Environmental Biology and Marine Science Students and two science instructors from the Palau Community College attended the entire workshop. Each workshop included: tropical cyclone characteristics, behavior and hazards; WFO Guam tropical cyclone program and products; the timing of the products; causes of the weather at the specific island states and nations; other meteorological and ocean hazards; rip currents, volcanoes and

tsunamis; tropical cyclone plotting and speed-distance-time computations; climate and climate change, and the potential affects on Micronesia; ENSO and its impacts and status, and rainfall, tropical cyclone, and sea-level forecasts; the Saffir-Simpson Tropical Cyclone Scale and how the Scale was used to assess the winds associated with Typhoon Chaba (August 2004); and tropical cyclone decision making. The Workshop is tailored for each of the locations and is updated and improved annually. A Certificate of Achievement was presented to all that completed the course.

- Visits to College of Micronesia Campuses. At the request of the U.S Ambassador to the Federated States of Micronesia (FSM), the WFO Guam WCM makes annual presentations at the campuses of the College of Micronesia. The topic in 2006 was: "Typhoons on [Yap] [Chuuk] [Pohnpei] [Kosrae]: Past, Present, and Future". The topic in 2007 is "Climate Variability and Change: Implications for [Palau] [Yap]. Over 200 students, faculty and guests attended the four presentations. Radio interviews (1.5 hr) were also given on Yap and on Pohnpei.
- WMO Guangzhou. At the invitation of the Chairman of the Chinese Academy of Meteorological Sciences, the Guam WCM attended the WMO Workshop on Tropical Cyclone Disaster Reduction in Guangzhou, China from 26-30 March 2007. The WCM joined several esteemed lecturers from the US and Asia to address methods and techniques that could help reduce tropical cyclone-related disasters. The WCM gave three very popular presentations and provided numerous training materials to the 52 participants from many Pacific and Indian Ocean nations, and from as far away as Cuba.
- Disaster Prevention and Preparedness Meeting. The Disaster Preparedness and Prevention (DPP) working group of the Typhoon Committee held its second meeting on 22-24 August 2007 in Seoul, Korea. The WFO Guam WCM participated in the meeting, where the purpose was to develop the prototype Typhoon Committee Disaster Information System (TCDIS). Once the WCM returned Guam, he developed and provided the needed input for the basic information system. This information included the basic disaster preparedness and prevention organizational structures, programs, and methods of the various island nations of Micronesia.
- StormReady and TsunamiReady designation for Saipan. On 20 August 2007, Saipan joined Guam as the second location in Micronesia to be designated as both StormReady and TsunamiReady. StormReady and TsunamiReady are two prestigious NOAA programs that recognize locations as being highly prepared to respond to and recover from severe storms and tsunamis. The Island of Saipan successfully completed a comprehensive 1-year evaluation of its programs and capabilities in order to earn this distinction. WFO Guam, the Saipan Emergency Management Office, the Saipan Mayor's Office, the Commonwealth of the Northern Mariana Islands (CNMI) Red Cross Executive Director, and the Coastal Resources Management Department comprised the evaluation committee. Rota and Tinian in the CNMI will be the next Micronesian locations to work toward becoming StormReady and TsunamiReady.
- ESCAP Integrated Workshop. MIC participated in the Integrated Workshop on Social-Economic Impacts of Extreme Typhoon-related Events held 10-14 September at Bangkok Thailand. MIC represented the USA in the Working Group on Disaster Prevention and Preparedness. The primary objectives of the workshop were to exchange information on priorities and key areas related to assessment and mitigation of social-economic impacts of extreme typhoon-related disasters as part of the implementation of the Strategic Plan of the Typhoon Committee and to review progress in the working groups, their achievements of priority projects, and identifying priority needs of the Typhoon Committee in promoting an integrated multi-hazard early warning system.
- Participation in TOPOFF 4. The WFO Guam WCM was part of the Guam Venue Core Planning team for the nation's largest anti-terrorism exercise. The exercise occurred in October 2007, and involved 15,000 participants in four different US venues including Guam. The results of this exercise will improve inter-agency coordination at local, regional and national levels that will further improve preparedness, response, and recovery for all kinds of natural and man-made disasters. This massive, extremely complex exercise was two years in the planning.

d. Training Progress.

- Spotter training. The WCM provided spotter training for the mayors of Guam and their staffs, for several Ham Radio operators, and for members of the Homeland Security/Office of Civil Defense. The training included tsunamis, tropical cyclones, lightning, waterspouts and funnel clouds, hazardous surf, and volcanic ash/haze. A total of 53 people attended the three training sessions. In addition, the WCM provided surf observation training to three observers in the Marshall Islands, eight observers in the CNMI and five observers on Guam during the year.

e. Research Progress.

NTR

f. Other Cooperative/RCPIP Progress.

- Boating Safety/Fishing Derby. In August, WFO Guam set up a display at the annual Boating Safety and Fishing Derby. The display drew about 150 visitors. A new brochure entitled: Break the Grip of the Rip to Avoid the Grief of the Reef was a very popular handout at the event.

- National Disaster Preparedness Month. On 28 September 2007, WFO Guam members joined with local Government, US military, Non-Governmental Organizations, and emergency management representatives in providing a large collection of displays at a popular shopping mall to culminate Disaster Preparedness Month. The WFO Guam display drew some 300 visitors.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress

NTR.

b. Implications to Operational Progress.

NTR.

c. Interaction with users, other Members, and/or other components.

- Extended Tropical Cyclone Best Track data sent to RSMC Tokyo. The WCM completed the compilation of tropical storm and typhoon landfall data for Micronesian locations for all storms from 1995 affecting the Area of Responsibility. As per US agreement with the WMO, these data will be appended to the official RSMC-Tokyo Best Track data sets to augment them for research and reassessment purposes.

d. Training Progress.

- Participation in the Roving Seminar 2007 in Manila, Philippines from 5-8 September. Altogether, 43 participants from eight Member countries attended this 4-day seminar. The WFO Guam Science and Operations Officer (SOO) participated as one of two US invited lecturers, and one from Japan. The lecturers provided expert training on topics such as microwave satellite imagery and scatterometer interpretation, Doppler radar analysis and tropical cyclones' interaction with monsoon systems. Feedback was very favorable on the seminar with nearly all trainees indicating that the knowledge and techniques acquired would be operationally useful. Over 90% of the respondents indicated that they would be able to apply such knowledge and techniques operationally within five years, and nearly 60% of respondents in a matter of two years.

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

- Micronesia Managers Pre-Meeting. Managers from the Weather Service Offices of Koror (Republic of Palau), Yap, Chuuk and Pohnpei (Federated States of Micronesia) and Majuro (Republic of the Marshall Islands) gathered at the WFO Guam from 23 to 27 July. This meeting precedes the annual meeting of all Managers in the Pacific Region. The purpose of this meeting was to deal with issues closer to home and in the charge of the WFO Guam. In addition to discussions on operations, equipments, and communications in Micronesia, the Managers were treated to presentations from the University of Guam Water and Environmental Research Institute and a tour at the U.S. Coast Guard Facility.

3. Opportunities for Further Enhancement of Regional Cooperation. (including identification of other DPP-related topics and opportunities, possible further exchange of information and priority needs for assistance).

II. Regional Specialized Meteorological Centre (RSMC) Honolulu / Weather Forecast Office (WFO) Honolulu

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and/or Software Progress.

- RSMC Honolulu Tropical Cyclone Mailing List. RSMC Honolulu tropical cyclone mailing list was implemented and heavily advertised prior to the 2007 Central Pacific Hurricane Season. The mailing list allows subscribers to receive RSMC Honolulu bulletins via email within minutes of being issued. There are nearly 1,000 active subscriptions.
- Tropical Cyclone Graphics. RSMC Honolulu implemented several new tropical cyclone graphics for the 2007 Central Pacific Hurricane Season. The principal graphic illustrated the track and intensity forecast, cone of error, and active watches and warnings. Other graphics detailed the maximum 1-minute wind speed forecast and probabilities, and swaths of tropical storm and hurricane force winds. These graphics debuted during Hurricane Flossie and were well received by the public. RSMC Honolulu web sites received over 3 million hits in a four day period as Flossie approached then passed south of Hawaii.

b. Implications to Operational Progress.

- Hawaii State Hazard Mitigation Plan Update. The Hawaii State Hazard Mitigation Forum, of which RSMC Honolulu is a member, was tasked with updating the Hawaii State Hazard Mitigation Plan in 2007. Forum members met regularly and completed the draft, as approved by the Governor of Hawaii, and submitted to FEMA for final approval on July 31, 2007. The purpose of the mitigation plan is to protect lives and property from loss and destruction during a natural hazard.

c. Interaction with users, other Members, and/or other components.

- Press Tour of RSMC Honolulu and WFO Honolulu. The Director and Warning Coordination Meteorologist hosted a press tour of RSMC Honolulu and Weather Forecast Office Honolulu on May 18, 2007. The tour was attended by station directors, weather anchors, assignment managers, public information officials, and copy editors representing local newspaper agencies, television stations, radio stations, and the State of Hawaii Civil Defense Agency. Background information, weather products, and services of RSMC Honolulu/WFO Honolulu were presented, along with a demonstration of the various software packages used to create weather and tropical cyclone forecasts.
- RSMC Honolulu Press Conference for the 2007 Central Pacific Hurricane Season. RSMC Honolulu hosted a press conference to announce the 2007 Central Pacific Hurricane Season Outlook on May 21, 2007. Following opening remarks from the RSMC Honolulu Director, Bill Unruh gave a brief talk about surviving Hurricane Ioke while on Johnston Island. Governor Linda Lingle provided the keynote address, signed a proclamation declaring the week of May 20-26, 2007 as Hurricane Awareness Week in Hawaii, and signed several bills relating to hurricane preparedness. The press conference concluded with a brief overview of new RSMC Honolulu products and services followed the 2007 outlook. Notable attendees included Nancy Ward, Director, FEMA Region IX.
- Hurricane Preparedness Workshops. RSMC Honolulu personnel conducted 7 hurricane preparedness workshops on four islands. Combined, over 200 representatives from banks, insurance companies, hospitals, county government agencies, media outlets, and military bases attended. The workshops brought key representatives together to foster better collaboration and communication in the event of a tropical cyclone impacting the islands.
- Hurricane Preparedness Workshops for visitor industry groups. RSMC Honolulu provided six presentations on hurricane safety and preparedness to visitor industry groups in Hawaii. These presentations, given to the Hawaii Hotel and Visitor Industry Security Association, Sheraton Waikiki Resort, Waikiki Parc Hotel, and the Halekulani Hotel, aid the planning effort to ensure visitor safety if a tropical cyclone threatens the State of Hawaii.
- After Dark in the Park Series Talk: "Central Pacific Hurricanes and Possible Impacts from Global Climate Change". The Director of RSMC Honolulu reviewed important hurricanes of past years, announced the 2007 Central Pacific Hurricane Season outlook, and discussed how certain conditions of climate change and global warming may affect future hurricane activity and intensity for Hawaii. To help residents prepare, the Director covered hurricane preparedness, family action plans, and a state program to partially pay for retrofitting homes to reduce storm damage. "After Dark in the Park" is a weekly lecture series hosted by the USGS Hawaii Volcanoes Observatory.
- NOAA Lecture Series at Bishop Museum, Honolulu: The 4th in a six month series of lectures by NOAA scientists was given by Central Pacific Hurricane Center Director. His presentation, "Hurricanes and Climate Change: Preparing for the Worst," was accompanied by satellite data images on Science on a Sphere. The lectures were open to the public.
- Emergency Preparedness Seminars and Expos. RSMC Honolulu participated in several events to promote safety and disaster preparedness in the event of a tropical cyclone. Various RSMC staff members gave presentations, staffed booths and handed out hurricane safety and preparedness brochures at events sponsored by the American Red Cross Hawaii Chapter, Maui County, Sam's Club warehouse store and Zephyr Insurance Company.
- RSMC Honolulu Visit by Hawaii Civil Defense Agency (HCDA) and Disability Communications Access Board (DCAB). The RSMC Honolulu Warning Coordination Meteorologist hosted an office tour for Danny Tengan, HCDA, and Kristine Pagano, DCAB, at RSMC Honolulu on June 5, 2007. Kristine is working with HCDA to ensure people with disabilities and other special needs are adequately served during disasters such as hurricanes, tsunamis, and severe weather. Participants discussed several options available on modern NOAA Weather Radio's for people with disabilities, including strobe lights and vibrating pads.
- Tour of RSMC by Naval Maritime Forecast Center personnel. The Warning Coordination Meteorologist provided a tour of RSMC Honolulu for 3 new staff members of the Naval Maritime Forecast Center, the parent agency of the Joint Typhoon Warning Center located at Pearl Harbor, Hawaii. The staff members wanted to familiarize themselves with RSMC Honolulu operations. The Warning Coordination Meteorologist provided in-depth demonstrations of the IFPS/GFE, NMAP, and AWIPS software packages.

d. Training Progress.

StormReady/TsunamiReady. Maui and Kauai Counties successfully renewed their StormReady/TsunamiReady recognition through 2010. StormReady and TsunamiReady are programs of the U.S. National Weather Service (NWS). In conjunction with emergency managers, the NWS completes a checklist of various items that are necessary for a county or community to be prepared for hazardous weather situations. The items on the checklist include ensuring the community has a 24 hour point of contact, multiple ways of receiving NWS watches and warnings, multiple ways to dissemination the NWS watches and warnings once they receive them, and adequate plans for various types of hazardous weather. In 2004, Hawaii was the first state in the United States to be StormReady and TsunamiReady statewide.

Makani Pahili Hurricane Exercise. The annual Makani Pahili Hurricane Exercise, coordinated by Hawaii State Civil Defense in partnership with the National Weather Service Forecast Office in Honolulu, began messages on Friday, 10 May 2007. This year's exercise brought a fictitious category 4 storm directly over the island of Oahu and the city of Honolulu. Local, state, and federal government agencies, as well as military partners participated in the week-long exercise. Businesses, hospitals, infrastructure companies, and other entities also planned internal exercises of varying scopes. RSMC Honolulu exercised coordination procedures with civil defense and military partners around Hawaii during the exercise.

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

NTR.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress

NTR.

b. Implications to Operational Progress.

NTR.

c. Interaction with users, other Members, and/or other components.

NTR.

d. Training Progress.

NTR.

e. Research Progress.

NTR.

f. Other Cooperative/RCPIP Progress.

NTR.

3. Opportunities for Further Enhancement of Regional Cooperation (including identification of other DPP-related topics and opportunities, possible further exchange of information and priority needs for assistance).

In Vietnam

1. Progress in Member's Regional Cooperation and Selected RCPIP Goals and Objectives:

a. Hardware and Software Progress
NIL

b. Implication to Operational Progress
NIL

c. Interaction with users, other Members
NIL

d. Training Progress

- Some training courses on Natural Disaster Prevention and Preparedness have been organized for communities and local staffs at Dien Bien, Thua thieen – Hue, Ben Tre with the help of ChurchWorld Service, Oxfam – Hong Kong...
- Two staffs of CCFSC attended training course the Advanced seminar on Puplic Health and Medicine on Emergency Situations for the Asian Expert to be held on 4 – 10 June,2007 in Jakarta, Indonesia.
- One staff of CCFSC attended ASEAN Regional disaster Emergency Response Simulation Exercise (22-25 Oct, 2007).
- One staff of CCFSC attended Workshop on Disaster Risk Reduction 23-27. Oct, 2007 in Chiang-mai, Thailand help by Help Age International Asia/ Pacific Regional Development Center.
- One staff of CCFSC attended Regional Workshop on Innovative Approaches to flood Risk Reduction in the Mekong Basin, 17-19 Oct, 2007 Khon Kaen, Thai Lan.
- One staff of CCFSC attended training on Post-Disaster recovery and rehabilitation Management in Beijing, China 19/11-3/12-2007.

e. Research Progress

NIL

f. Other Cooperative Progress
NIL

2. Progress in Member's Important, High-Priority Goals and Objectives:

a. Hardware and Software Progress
NIL

b. Implication to Operational Progress

- Regular maintaining and upgrading the dikes systems and hydraulic structures for dyke system in Bac Bo area and northern part of Central Viet Nam.
- Continue the Riverbank Erosion Control program by building new riverbank protection's structure.
- Implement the emergency relief and recovery program for overcome disaster consequences.
- Implement the bamboo's planting to protect dykes from water's waves.
- Implement a program to relocate residents living in disaster prone areas
- Implement a program to improve the safety for fisherman.
- Workshop of Strategic plan on CBDRM, 9-10 August 2007, Ha Noi, Viet Nam).
- Relocated people & social-economic development Program in disaster prone areas, extremely difficult areas, border areas, island areas, unplanned migration, critical areas of protective forest from 2006-2010. A project for transferring and resettling people from low areas and prone -landslide areas has been carried out in almost provinces.
- Strengthening and improve sea dike in the Northern part of Vietnam from Quang Ninh province to Quang Nam province, on-developing program for the Southern part of Viet Nam from Quang Ngai to Kien Giang

c. Interaction with users, other Members

A special program has been settled up at Viet Nam Television (Channel 2) to propagate knowledge and raise the community awareness on natural disasters.

d. Training Progress

¬ Workshop on integrate indicators related to children into natural disaster statistical data (June, 2007, Ha Noi, Viet Nam).

- Workshop on sharing experience in building and implementing disaster risk reduction projects

according to the integrated approaches, 23 April 2007, Danang city, Vietnam.
- Workshop on flash flood for the mountainous areas in the Northern of Viet Nam, Mong Cai town, Viet Nam.

e. Research Progress

NIL

f. Other Cooperative Progress

NIL

3. Opportunities for Further Enhancement of Regional Cooperation

NIL

1.4 Typhoon Committee Secretariat (TCS)

The Typhoon Committee Secretariat was transferred from Manila, Philippines, to Macao, Special Administrative Region of China, in the beginning of 2007 and it began officially to work on February 13, date of the signature of the Agreement between the Government of Macao SAR and the TC. This Agreement complements the previous "Host Country Agreement" between People's Republic of China and TC, signed in Manila, on December 7, 2006.

A series of events were organized to celebrate the inauguration of the new premises of the TCS on February 13 and 14, 2007, in collaboration with Macao Meteorological and Geophysical Bureau and the co-sponsorship of Macao Foundation.

One of these events consisted of the "High-Level Workshop on the TC Strategic Plan Implementation" with the purpose to enhance the cooperation among the TC Members for a more effective implementation of the TC Strategic Plan, which had been adopted in December 2006 at the 39th TC Session in Manila.

The ceremony of the inauguration of the new premises was attended by members of the Macao SAR Government, representatives of the Central Government of PR of China, ESCAP, WMO, ADRC, and high officers of Macao Administration. During this ceremony it was also inaugurated the library of TCS, to which it was given the name "Dr. Roman L. Kintanar Library", in recognition of the long and devoted services rendered by Dr. Kintanar to the Committee during the past 39 years. Dr. Kintanar unveiled the a plaque at the entrance of the library.

Two short term missions of Ms Bella Mendoza, from PAGASA, of one week and one month, respectively in April and October/November, were achieved in order to give continuity to the practices of TCS.

The Secretary of TC attended the 63rd Session of ESCAP, held in Almaty, Kazakhstan, 17-23 May 2007, where he presented the Report of the Typhoon Committee - 2006, under the item "Report of Regional Intergovernmental Bodies".

The meteorologist of TCS, Mr. Leong Kai Hong, in representation of the TC Secretary, participated in the Asian Conference on Disaster Reduction 2007, held in Astana, Kazakhstan, from 25 to 27 June 2007, invited by the Director of Asian Disaster Reduction Center. He participated as panelist in the discussions.

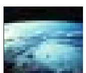
TCS coordinated, with Mr. Edwin Lai, Chairman of the TRCG, and RSMC the attachment of two women forecasters from Cambodia and Philippines at RSMC Tokyo on 18 – 27 July. The training attachment was successfully completed and details can be found in the TRCG and RSMC Tokyo annual reports.

TCS also coordinated the participation of the attendants, together with the Chairman of TRCG and PAGASA, to the Seventh Roving Seminar of the Typhoon Committee which was held at the Tiara Oriental Hotel, in Makati City, Philippines, from 5 to 8 September 2007. It was attended by a total of 43 participants, which included 2 from China; 2 from Hong Kong, China; 2 from Malaysia; 3 from Viet Nam; 1 each from Singapore, Republic of Korea and Thailand; 27 from the Philippines; as well as 3 lecturers from the USA and Japan. The Secretary of the Typhoon Committee delivered his opening message and also read the message of Mr. Edwin S.T. Lai, Chairman of the Training and Research Coordination Group (TRCG).

The Secretary, the Meteorologist Leong Kai Hong, Derek and the Administrative Senior Secretary, Denise Lau participated in the Integrated Workshop on Social-economic Impacts of Extreme Typhoo-related Events, Bangkok, Thailand,10-14 September 2007. A message was addressed by the Secretary at the opening Ceremony.

The Bureau of Hydrology (BoH) of the Ministry of Water Resources of People's Republic of China, TRCG and TCS collaborated in the organization of the Training Course on Flood Forecasting System and Its Application (OFFSIA), which was held in Beijing, from 15 to 21 October 2007, under the auspices of the BoH. The training course was attended by 10 overseas participants from 7 selected Members of the Typhoon Committee. The TC Secretary addressed a message on behalf of the Chairman of TC and made a presentation on the TC activities. The Secretary also had the opportunity to visit CMA and the Bureau of Hydrology.

Actions were taken to recruit a Hydrologist for TCS. For that purpose the vacant notice TCS/VN001-2007 dated 25 April 2007 was issued for all Members. There were three candidates and, in order to proceed to the selection of the most suitable one, it was constituted a panel of evaluation. The selected Hydrologist was Mr. Jinping



Liu, from the Bureau of Hydrology, Ministry of Water Resources of China. The process of recruitment was completed with the signature of a letter of agreement between TCS and the BoH. The current composition of TCS is as follows:

Secretary: Olavo Rasquinho
Meteorologist: Leong Kai Hong, Derek
Hydrologist: Jinping Liu (starts to work in December)
Senior Administrative Secretary: Denise Lau
Senior Finance Clerk - Kou Meng Kit, Lisa:

The previous Website contract with Philippines Online finished in September of 2007. TCS staff in collaboration with the Macao Meteorological and Geophysical Bureau (SMG) created the Website of TC.

In accomplishment of a TC decision taken in the 39th Session the TCS developed an implementation plan for the "Roman L. Kintanar Award for Typhoon-related Disaster Mitigation", which will substitute in the near future the "ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award".

The ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award was given in 2007 to the Civic and Municipal Affairs Bureau of Macao in recognition of its relevant services in support of mitigation of the consequences of typhoons.

Tropical Cyclones in 2007

1.1 Overview

This is a summary of the tropical cyclones that developed over the western North Pacific and the adjacent seas bounded by the Equator 45°N, 100°E and 180°E. In 2007, a total number of 24 tropical cyclones developed and affected this region, of which 15 reached typhoon (T) intensity, 4 attained severe tropical storm (STS) intensity, and 5 attained tropical storm intensity (TS). The total number of tropical cyclones with tropical storm intensity or higher is less than the 30 year average (1971-2000) of 26.7.

As a result of low convective activities until July in 2007, there are less tropical cyclones developments than usual in this period. Only five tropical cyclones occurred in the western North Pacific and South China Sea from January to July. However, the enhanced convection and cyclonic wind shear in the lower troposphere were apparent from August to November. The rest of the 19 tropical cyclones formed between August and November.

There were no tropical cyclones developed over the western North Pacific and South China Sea from January to March. The first tropical cyclone for the year 2007 occurred in April with the formation of Kong-rey. The most intense tropical cyclone was Sepat (0708) which had an estimated maximum wind of about 204 km/h and a minimum sea-level pressure of about 910 hPa.

KONG-REY (0701) formed as a tropical depression (TD) over the western North Pacific around the Marshall Islands at 12 UTC in 30 March 2007 and moved west-northwestwards. Kong-rey intensified into a tropical storm on 1 April. Keeping the northwestward track, it intensified into a severe tropical storm on 2 April and further into a typhoon the next day. After turning east-northeastward, it was downgraded to tropical storm intensity on 5 April and then transformed into an extra-tropical cyclone east of Minamitorishima Islands the next day. Moving to the east, it dissipated on 7 April.

YUTU (0702) formed as a tropical depression over the western North Pacific around the Caroline Islands on 15 May 2007 and moved westward. It intensified into a tropical storm and turned to a northwesterly track on 17 May and continued intensified into a severe tropical storm the next day. Moving northwestward, it was upgraded to typhoon intensity over the sea east of the Philippines on 18 May. It turned to a northeasterly track on 20 May and then weakened into a tropical storm on 22 May. Keeping its east-northwestward track, it became an extra-tropical cyclone over the sea east of Japan. It crossed longitude 180 degrees east of the sea south of the Aleutian Islands on 25 May.

TORAJI (0703) formed as a tropical depression over the South China Sea on 3 July and moved generally northwestwards. It was upgraded to tropical storm intensity around the southern coast of Hainan the next day. Toraji crossed Hainan that afternoon and entered Beibu Wan on the morning of 5 July. It made landfall near Dongxing at the coast of Guangxi that evening and then weakened to tropical depression and dissipated on 6 July.

MAN-YI (0704) developed as a tropical depression over the sea around the Caroline Islands on 7 July 2007. Moving north-westward, it intensified into a severe tropical storm on 9 July and further into a typhoon over the sea far east of the Philippines. Man-yi turned to move north-northwestward on 12 July and then further northwards on 13 July. It recurved off the west coast of Okinawa Island the next day and turned to the northeast and made landfall in Kyusyu with typhoon intensity on 14 July. Man-yi weakened into a severe tropical storm. After skirting alone the coast of the Japanese Islands, it was downgraded to tropical storm intensity on 15 July, and transformed into an extra-tropical cyclone over the sea east of Japan on 16 July.

USAGI (0705) developed as a tropical depression over the sea south of Minamitorishima Island on 27 July 2007 and moved generally westwards. It developed into a tropical storm on 29 July and then a severe tropical storm the next day. Turning to the northwest, it was further intensified into a typhoon over the sea south of Iwojima Island. Usagei then turned north and made landfall on Kyushu the next day. After recurvature, it was downgraded to tropical storm on the same day and moved westward over the Sea of Japan and made landfall in the northern part of Honshu on 4 August. It then weakened into a tropical depression and then transformed into an extra-tropical cyclone over the sea south of Hokkaido. Moving eastward, it dissipated on 5 August.

PABUK (0706) formed as a tropical depression over the sea far east of the Philippines on 4 August 2007 and moved generally west-northwestwards. It intensified into a severe tropical storm on 5 August. After crossing the southern tip of Taiwan, Pabuk weakened into tropical storm over the sea east of Hong Kong and then weakened into a tropical depression off the southern coast of Hong Kong. It turned northeastwards and crossed the western part of Hong Kong and made landfall in Zhongshan. Moving to the northeast, it entered the East China Sea on 12 August. Pabuk then turned to moving northwards and transformed into an extra-tropical cyclone over the northern part of the Korean Peninsula on 14 August.

WUTIP (0707) formed as a tropical depression over the sea east of the Philippines on 6 August 2007. Wutip moved northwestwards and intensified into a tropical storm on 8 August. Moving to the northwest, Wutip rapidly dissipated off the eastern coast of Taiwan on 8 August.

SEPAT (0708) formed as a tropical depression over the sea far east of the Philippines on 12 August 2007. Moving westwards, it was upgraded into the tropical storm intensity and then further into a typhoon on 14 August over the same sea. After turning to the northwest, it hit Taiwan on 17 August. After the landfall near Quanshou City in Fujian Province, Sepat was downgraded to tropical storm intensity and then further to tropical storm on 19 August. It moved to the west and dissipated over the southeastern China on 24 August.

FITOW (0709) formed as a tropical depression over the sea south of Minamitorishima Island on 27 August and moved northeastwards. It developed into a tropical storm on 29 August and gradually turned to take a westerly track, Fitow intensified into a typhoon on 31 August. Moving to the west, Fitow was downgraded to a severe tropical storm over the sea east of Chichijima Island on 3 September but re-intensified into a typhoon on 5 September. After turning to the north and crossing the eastern part of Honshu on 6 September, Fitow weakened into a tropical storm on 7 September and then transformed into an extra-tropical cyclone near Hokkaido on 8 September.

DANAS (0710) formed as a tropical depression over the sea east of Minamitorishima Island on 6 September 2007 and move generally northwestwards. It intensified into a tropical storm the next day. During the recurvature, Danas further intensified into a sever tropical storm on 9 September. Moving eastward, it weakened into a tropical storm and then an extra-tropical cyclone over the western North Pacific to the east of Japan on 11 September.

NARI (0711) formed as a tropical depression over the sea far east of the Philippines on 11 September and moved generally northwestwards. Moving west-northwestwards, it intensified into tropical storm and then rapidly developed into typhoon on 13 September. After passing to the southwest of Okinawa, Nari turned to move north and then crossed the southeastern part of Korea on 16 September. Nari became an extra-tropical cyclone over the Sea of Japan the next day.

WIPHA (0712) formed as a tropical depression over the sea far east of the Philippines on 15 September 2007 and moved west-north-westwards. It intensified into a tropical storm and then a severe tropical storm the next day. Moving to the northwest, it further intensified into typhoon on 17 September and passed to the north of Taiwan. Wipah made landfall on Zhejiang on 18 September. Turning to the north, it rapidly weakened into tropical storm and became an extra-tropical storm over the Yellow Sea on 20 September.

FRANCISCO (0713) formed as a tropical cyclone over the sea to the north of Luzon Island on 21 September and moved westwards. It intensified into tropical cyclone on 23 September over the sea south of Hong Kong. Francisco made landfall over Hainan on 24 September and then weakened into a tropical depression and crossed the Beibu Wan the next day. After landfall over Vietnam, it dissipated on 26 September.

LEKIMA (0714) formed as a tropical depression over the sea east of Luzon Island on 28 September. Moving west-southwestward, it crossed Luzon Island and developed into a tropical storm in the South China Sea on 30 September. Turning to the northwest, it further intensified into severe tropical storm on 1 October. After turning to the west, Lekima hit Vietnam the next day. Keeping its westward track, Lekima weakened into tropical storm on 3 October and then dissipated inland afterwards.

KROSA (0715) formed as a tropical depression over the sea east of the Philippines on 1 October and was almost stationary. Then it intensified into tropical storm on the same day, and further into a typhoon the 3 October over the same sea. It crossed the northern part of Taiwan on 6 October. Weakening in intensity it made landfall over the coast of southeast China on 7 October. Then it was downgraded into a tropical depression the next day and moved east-northeastwards. It later transformed into an extra-tropical cyclone around the coast of China on the same day.

HAIYAN (0716) developed as a tropical depression over the sea west of the Midway Islands on 30 September. After turning in a counterclockwise circle, it was upgraded into a tropical storm on 5 October. Turning to the north, Haiyan weakened into a tropical depression and dissipated over the same sea on 7 October.

PODUL (0717) formed as a tropical depression over the western North Pacific around the Mariana Islands on 3 October and moved generally to the northeast, and then was upgraded into a tropical storm on 5 October. Moving northeastward, Podul further intensified into a severe tropical storm the next day. As Podul continued to move northeastward, it transformed into an extra-tropical cyclone over the sea far east of Japan on 7 October and then dissipated on 9 October.

LINGLING (0718) formed as a tropical depression over the sea east of Wake Island on 10 October 2007 and moved generally northwestwards. It intensified into a tropical storm the next day. Turning to move from northwestwards to northeastward over the sea east of Japan over the sea east of Japan, Lingling transformed into an extra-tropical cyclone over the sea south of the Aleutian Islands on 15 October.

KAJIKI (0719) formed as a tropical depression over the western North Pacific around the northern part of the Mariana Islands on 18 October and moved generally northwestward. It intensified into a tropical storm and then a severe tropical storm the next day. Kajiki rapidly developed into a typhoon on 20 October and turned to move northwards. It moved over the sea east of Japan and gradually turned to move eastwards on 21 October and weakened into a severe tropical storm. Later, Kajiki became an extra-tropical cyclone far east of Japan on 22 October.

FAXAI (0720) formed as a tropical depression over the sea east of the Philippines on 25 October and moved northwestwards. It intensified into tropical storm and turned to move northwards. Turning to the northeast and accelerating, Faxai further intensified into a severe tropical storm on the same day. Keeping its northeastward track, Faxai passed around the Izu Islands and then became an extra-tropical cyclone over the sea east of Japan on 27 October.

PEIPAH (0721) formed as a tropical depression over the sea east of Philippines on 1 November 2007 and moved westwards. It intensified into a tropical storm on 3 November. Keeping its westward track, it was upgraded to a severe tropical storm on 4 November and crossed Luzon. Then it entered the South China Sea on 5 November and slowed down. Peipah intensified into a typhoon on 6 November. Peipah turned to move southwestwards the next day and weakened into a tropical storm on 7 November. After weakening into a tropical depression on 8 November at 18UTC on 8 November, it hit the southern part of Vietnam on 10 November and then dissipated at 18UTC the same day.

TAPAH (0722) formed as a tropical depression over the sea south of Iwojima Island on 11 November and moved generally northeastwards. It intensified into a tropical storm on 12 November. Tapah weakened into a tropical depression at 18 UTC the same day and then dissipated over the sea north of Minamitorishima the next day.

MITAG (0723) formed as a tropical depression over the sea east of the Philippines on 19 November and moved generally west-northwestwards. It developed into a tropical storm on 20 November. Keeping its westerly track, it intensified into a typhoon on 22 November. It turned to move northwest on 23 November and crossed Luzon on 26 November then moved northwestwards. It gradually weakened into severe tropical storm, then a tropical storm on the same day. It was downgraded to a tropical depression and then dissipated on 27 November.

HAGIBIS (0724) formed as a tropical depression over the sea east of Mindanao Island on 18 November and moved westward to cross the Philippines on 19 November. It intensified into tropical storm, then severe tropical storm on 20 and 21 November. After turning to the west-northwest, it intensified further into a typhoon on 22 November. Hagibis turned to move the east on 23 November and then weakened into tropical storm on 25 November. After crossing the central Philippines on 27 November, it weakened into a tropical depression and dissipated over the sea east of Luzon the next day.

Of the 15 tropical cyclones affecting the Members of Typhoon Committee, disastrous events occurred in China, Republic of Korea, the Philippines, Japan and Vietnam. List of tropical cyclones affecting Members of the Typhoon Committee is shown on table 2.1.2., and list of casualties and damage sustained by Members of the Typhoon Committee due to tropical cyclones in 2007 is shown on table 2.1.3.

In China, the economic losses caused by typhoons were less severe compared with the last 10 years and the least severe one in the past 4 years. According to the preliminary statistics, more than 27 million people and 11800 km2 farmland were affected. 61 people were killed and 18 people were missing. 57 thousands houses destroyed and 143 thousands houses were damaged. The direct economic losses were about 2 billion US dollars.

There were seven tropical cyclones which affected Japan, and three of them actually made landfalls. The most severe impact was due to Man-yi which caused seven death and 80 people injured.

In Korea, 19 people died and approximately 230 million US dollars worth of property damage occurred due to the impacts of typhoons. In Vietnam and the Philippines, causalities and property were significant due to the passage of typhoons.

There were no disastrous events due to the tropical cyclones were reported in the remaining Members of the Typhoon Committee in the year 2007.

Table 2.1.1 *List of tropical cyclones in 2007*

Name of Tropical Cyclones			Beginning of Composite Track				End of Composite Track				Maximum Intensity1	
			Date	Time UTC	Position °N	Position °E	Date	Time UTC	Position °N	Position °E	Maximum sustained surface wind (km/h)	Minimum central pressure (hPa)
T	KONG-REY	(0701)	30 Mar	12	5.8	158.2	06 Apr	18	27.1	166.3	148	960
T	YUTU	(0702)	15 May	06	8.1	146.6	25 May	00	36.6	183.0	176	935
TS	TORAJI	(0703)	03 Jul	00	15.4	111.7	06 Jul	00	22.6	105.2	65	994
T	MAN-YI	(0704)	07 Jul	06	5.6	148.9	23 Jul	06	49.5	180.1	176	930
T	USAGI	(0705)	27 Jul	12	19.0	155.3	04 Aug	18	42.3	148.9	167	945
T	PABUK	(0706)	04 Aug	18	18.4	137.5	15 Aug	06	44.4	133.6	120	975
TS	WUTIP	(0707)	02 Aug	12	15.0	130.0	08 Aug	18	22.9	121.7	65	990
T	SEPAT	(0708)	12 Aug	00	17.6	135.8	24 Aug	06	25.0	106.0	204	910
T	FITOW	(0709)	27 Aug	18	16.7	152.5	08 Sept	00	43.4	141.0	130	965
STS	DANAS	(0710)	06 Sept	00	23.6	161.3	13 Sept	00	41.9	182.0	102	990
T	NARI	(0711)	11 Sept	12	18.6	138.8	18 Sept	00	39.0	138.4	185	935
T	WIPHA	(0712)	15 Sept	00	19.4	133.6	20 Sept	12	37.9	123.9	185	925
TS	FRANCISCO	(0713)	21 Sept	12	19.5	122.0	26 Sept	00	20.7	105.3	74	990
STS	LEKIMA	(0714)	28 Sept	18	17.3	125.0	04 Oct	18	17.5	100.8	111	975
T	KROSA	(0715)	01 Oct	06	17.6	130.6	14 Oct	00	47.1	183.3	194	925
T	HAIYAN	(0716)	30 Sept	18	27.8	172.9	07 Oct	00	33.6	170.7	74	994
STS	PODUL	(0717)	03 Oct	00	19.7	146.7	08 Oct	18	47.9	172.7	102	985
TS	LINGLING	(0718)	10 Oct	12	21.1	175.7	15 Oct	12	37.5	181.2	83	994
T	KAJIKI	(0719)	18 Oct	12	17.6	145.8	23 Oct	12	37.9	182.4	167	945
STS	FAXAI	(0720)	25 Oct	06	18.8	134.4	28 Oct	18	42.8	162.9	102	975
T	PEIPAH	(0721)	1 Nov	18	18.1	132.5	10 Nov	12	10.7	107.1	130	970
TS	TAPAH	(0722)	11 Nov	12	20.5	140.5	13 Nov	00	28.2	152.4	65	996
T	MITAG	(0723)	19 Nov	18	10.0	140.0	27 Nov	12	20.6	124.0	148	955
T	HAGIBIS	(0724)	18 Nov	18	8.9	127.0	27 Nov	18	14.2	124.5	130	970

* Maximum peak intensity from available post analyses

() The 4-digit codes for tropical cyclones are assigned by RSMC Tokyo-Typhoon Center

Table 2.1.2 *List of tropical cyclones affecting Members of the Typhoon Committee in 2007*

Name of Tropical Cyclones			Beginning of Composite Track				End of Composite Track				Maximum Intensity[1*]	
			Date	Time	Position		Date	Time	Position		Maximum sustained surface wind (km/h)	Minimum central pressure (hPa)
				UTC	ºN	ºE		UTC	ºN	ºE		
TS	TORAJI	(0703)	03 Jul	00	15.4	111.7	06 Jul	00	22.6	105.2	65	994
T	MAN-YI	(0704)	07 Jul	06	5.6	148.9	23 Jul	06	49.5	180.1	176	930
T	USAGI	(0705)	27 Jul	12	19.0	155.3	04 Aug	18	42.3	148.9	167	945
T	PABUK	(0706)	04 Aug	18	18.4	137.5	15 Aug	06	44.4	133.6	120	975
TS	WUTIP	(0707)	02 Aug	12	15.0	130.0	08 Aug	18	22.9	121.7	65	990
T	SEPAT	(0708)	12 Aug	00	17.6	135.8	24 Aug	06	25.0	106.0	204	910
T	FITOW	(0709)	27 Aug	18	16.7	152.5	08 Sept	00	43.4	141.0	130	965
T	NARI	(0711)	11 Sept	12	18.6	138.8	18 Sept	00	39.0	138.4	185	935
T	WIPHA	(0712)	15 Sept	00	19.4	133.6	20 Sept	12	37.9	123.9	185	925
TS	FRANCISCO	(0713)	21 Sept	12	19.5	122.0	26 Sept	00	20.7	105.3	74	990
STS	LEKIMA	(0714)	28 Sept	18	17.3	125.0	04 Oct	18	17.5	100.8	111	975
T	KROSA	(0715)	01 Oct	06	17.6	130.6	14 Oct	00	47.1	183.3	194	925
T	PEIPAH	(0721)	1 Nov	18	18.1	132.5	10 Nov	12	10.7	107.1	130	970
T	MITAG	(0723)	19 Nov	18	10.0	140.0	27 Nov	12	20.6	124.0	148	955
T	HAGIBIS	(0724)	18 Nov	18	8.9	127.0	27 Nov	18	14.2	124.5	130	970

* Maximum peak intensity from available post analyses
() The 4-digit codes for tropical cyclones are assigned by RSMC Tokyo-Typhoon Center

Table 2.1.3 Causalities and damage sustained by Members of the Typhoon Committee due to the tropical cyclones in 2007

Name of Tropical Cyclones	Date	Member of Typhoon Committee Substained Damage	Causalities			Damage							Damage in monetary terms (in million USD)		
			Persons			Houses			Homeless		Affected		Infrastructure	Agriculture Production	Total Damage
			Dead	Missing	Injured	Destroyed	Damaged	Affected	Persons	Families	Persons	Families			
TS TORAJI	3 – 6 Jul	China				4000				29400	1113000				10
T MAN-YI	7 -23 Jul	Japan	6		82	32	29	4443							16,480
T USAGI	27 Jul - 4 Aug	Japan			30	2	8	894							3,329
T PABUK	4 - 15 Aug	China	1							64200	1131000				220
TS WUTIP	6 – 8 Aug	China	3			900	2700								
T SEPAT	12 – 24 Aug	China	62			35200	75500			354120	11423300				740
		Philippines	5		1						716386	148700			1.5
T FITOW	27 Aug – 8 Sept	Japan	3		90	10	27	2598							10000
T NARI	11 – 18 Sept	Japan			2	14	22	117							273
		Korea	2			61	151	5115			605				230
T WIPHA	15 – 20 Sept	China	13				16100	64200		563980	13933900				1010
		Philippines	1		4						62975	12595			
TS FRANCISCO	21 – 26 Sept	China								5600	198000				
STS LEKIMA	28 Sept – 4 Oct	Philippines	9	1	1						12370	2503			0.23
		Vietnam	88	8	180	1853									
T KROSA	1 – 13 Oct	China									7000000				850
T PEIPAH	1 – 10 Nov	Philippines	7								600000				
T MITAG	19 – 27 Nov	Philippines	12												3.8
T HAGIBIS	18 – 27 Nov	Philippines	14												
TOTAL			228	9	390	42072	94537	77367		1017300	36191536	163798			33147.53

Note: Causalities and damage figures were complied from Member's country report and the ADRC web site.

2.2. NARRATIVE REPORTS OF INDIVIDUAL TROPICAL CYCLONES WHICH AFFECTED MEMBERS OF THE TYPHOON COMMITTEE

2.2.1 **KONG-REY (0701)**
30 Mar – 6 April

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 30/03	06UTC 31/03
TS	00UTC 01/04	18UTC 31/03
STS	18UTC 01/04	18UTC 01/04
T	00UTC 03/04	00UTC 03/04
STS	18UTC 04/04	06UTC 04/04
TS	06UTC 05/04	06UTC 05/04
LOW	00UTC 06/04	-
DISSIPATION	00UTC 07/04	-

KONG-REY (0701) formed as a tropical depression (TD) over the western North Pacific around the Marshall Islands at 12UTC on 30 March 2007 and moved west-northwestwards. Kong-rey intensified into a tropical storm on 1 April. Keeping the northwestward track, it intensified into a severe tropical storm at 18UTC on 2 April and further into a typhoon at 00UTC on 3 April. Kong-rey attained the peak strength with maximum sustained wind of 148 km/h and central pressure of 960 hPa at 12UTC on 3 April. After turning east-northeastward, it was downgraded to tropical storm intensity at 06UTC on 5 April and then transformed into an extra-tropical cyclone east of Minamitorishima Islands the next day. Moving to the east, it dissipated on 7 April.

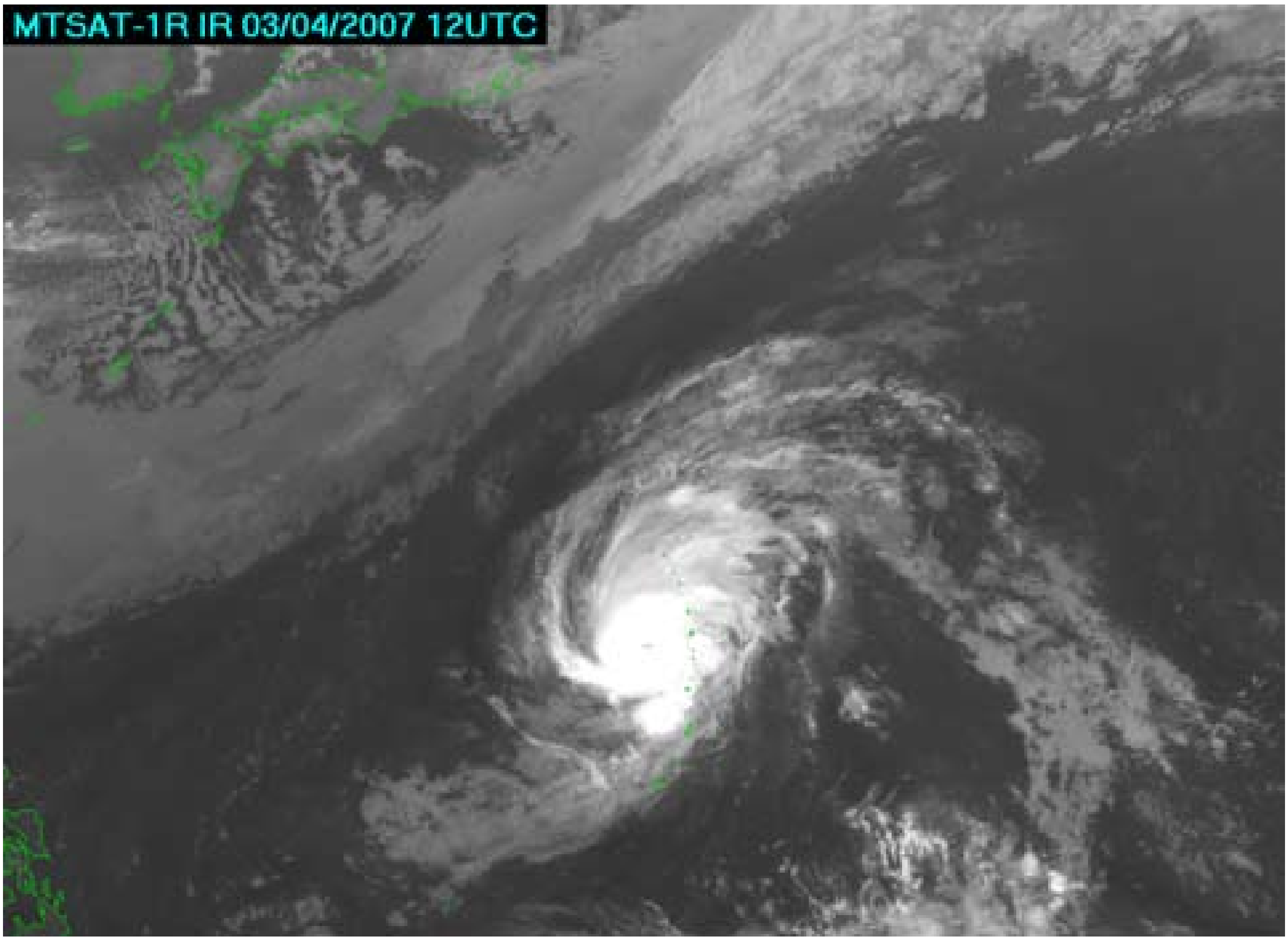


Figure 2.2.1a MTSAT - IR VS imagery of Kong-rey (0701) at 12UTC on 03 April.
(Courtesy of Japan Meteorologyical Agency-JMA)

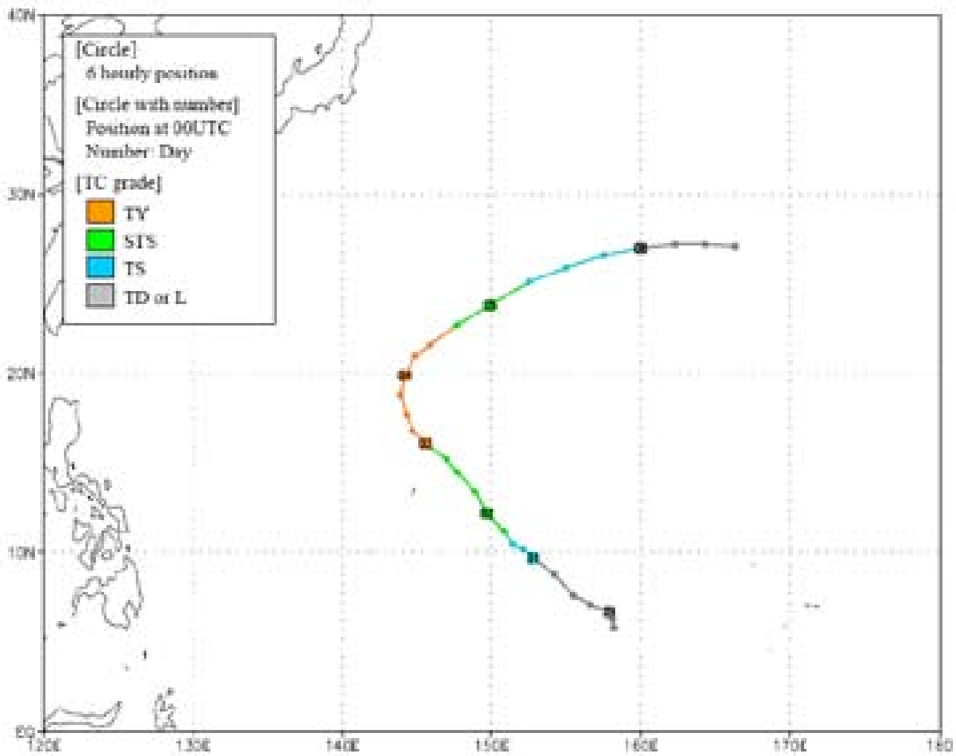


Figure 2.2.1b Track of Kong-rey (0701).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.2 YUTU (0702)
15 – 24 May

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	06UTC 15/05	06UTC 16/05
TS	18UTC 17/05	12UTC 17/05
STS	06UTC 18/05	06UTC 10/05
T	18UTC 18/05	00UTC 19/05
STS	12UTC 22/05	12UTC 22/05
TS	18UTC 22/05	18UTC 22/05
LOW	00UTC 23/05	-

YUTU (0702) formed as a tropical depression over the western North Pacific around the Caroline Islands at 06UTC on 15 May 2007 and moved westwards. It intensified into a tropical storm at 18UTC on 17 May and turned to a northwesterly track. Then it continued to intensify into a severe tropical storm at 06UTC the next day. Moving northwestward, it was upgraded to typhoon intensity over the sea east of the Philippines at 18UTC on 18 May. Yutu reached its peak strength with maximum wind of 176 km/h with a central pressure of 935 hPa at 12UTC on 20 May. It turned to a northeasterly track on 20 May and then weakened into a tropical storm at 18UTC on 22 May. Keeping its east-northwestward track, it became an extra-tropical cyclone over the sea east of Japan. It crossed longitude 180 degrees east of the sea south of the Aleutian Islands on 25 May.

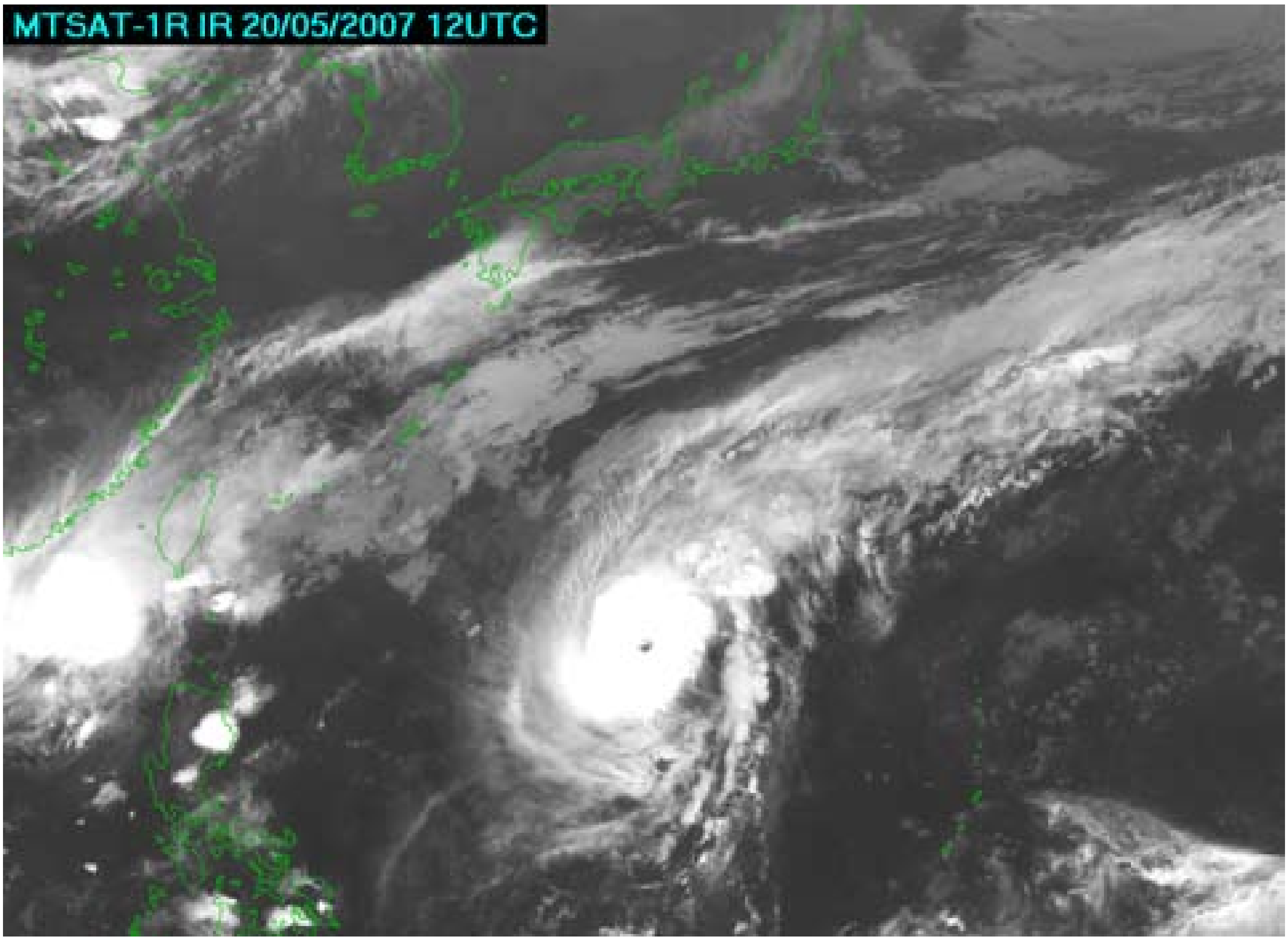


Figure 2.2.2a MTSAT - IR VS imagery of Yutu (0702) at 12UTC on 20 May.
(Courtesy of Japan Meteorologyical Agency-JMA)

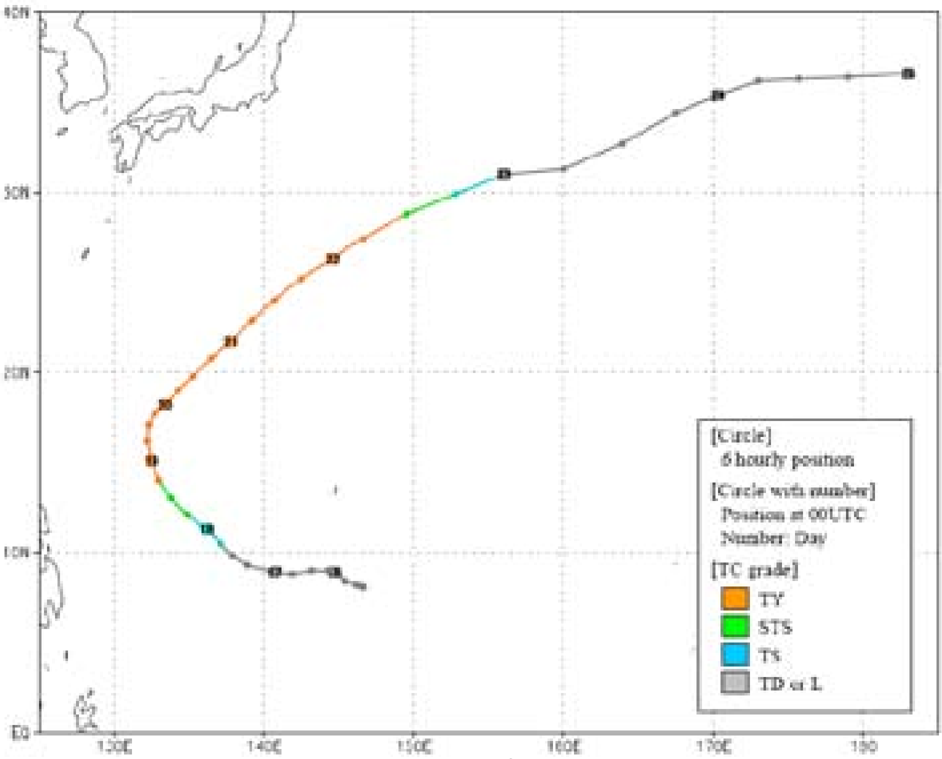


Figure 2.2.2b Track of Yutu (0702).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.3 TORAJI (0703)
3 - 6 July

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	00UTC 03/07	06UTC 04/07
TS	06UTC 04/07	06UTC 05/07
TD	18UTC 05/07	18UTC 05/07
DISSIPATED	06UTC 06/07	-

TORAJI (0703) formed as a tropical depression over the South China Sea on 3 July and moved generally northwestwards. It was upgraded to tropical storm intensity around the southern coast of Hainan at 06UTC on 4 July. Troaji crossed Hainan with maximum sustained wind of 65 km/h with a central pressure of 994 hPa at 18UTC the same day. It entered Beibu Wan and made landfall near Dongxing at the coast of Guangxi on 5 July. Toraji then weakened to tropical depression at 18UTC on 5 July and then dissipated at 06UTC on 6 July. About 4000 rooms were destroyed and more than 1 million people were affected. The direct economic loss was estimated about 10 million US dollars.

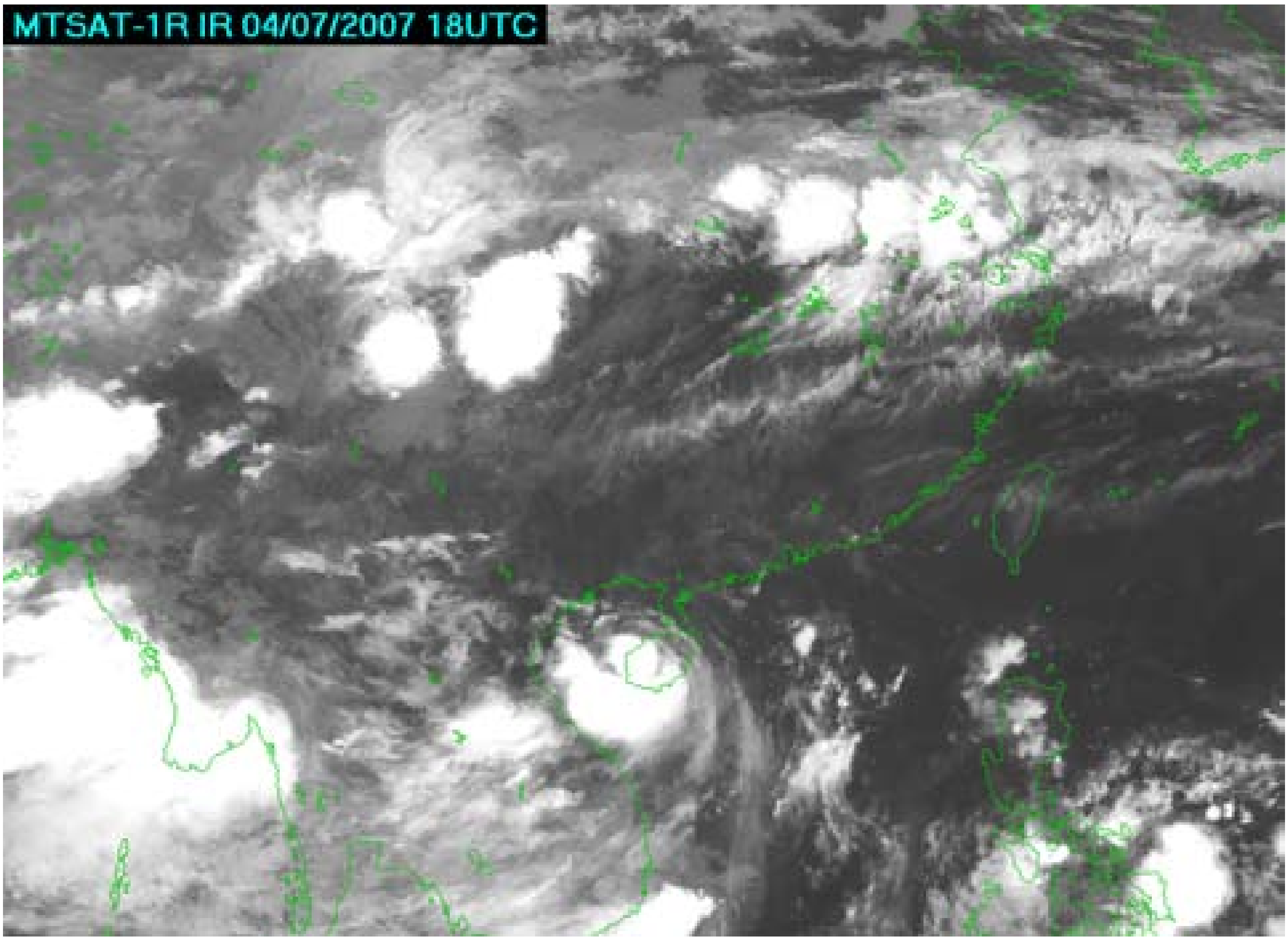


Figure 2.2.3a MTSAT - IR VS imagery of Toraji (0703) at 18UTC on 04 July.
(Courtesy of Japan Meteorologyical Agency-JMA)

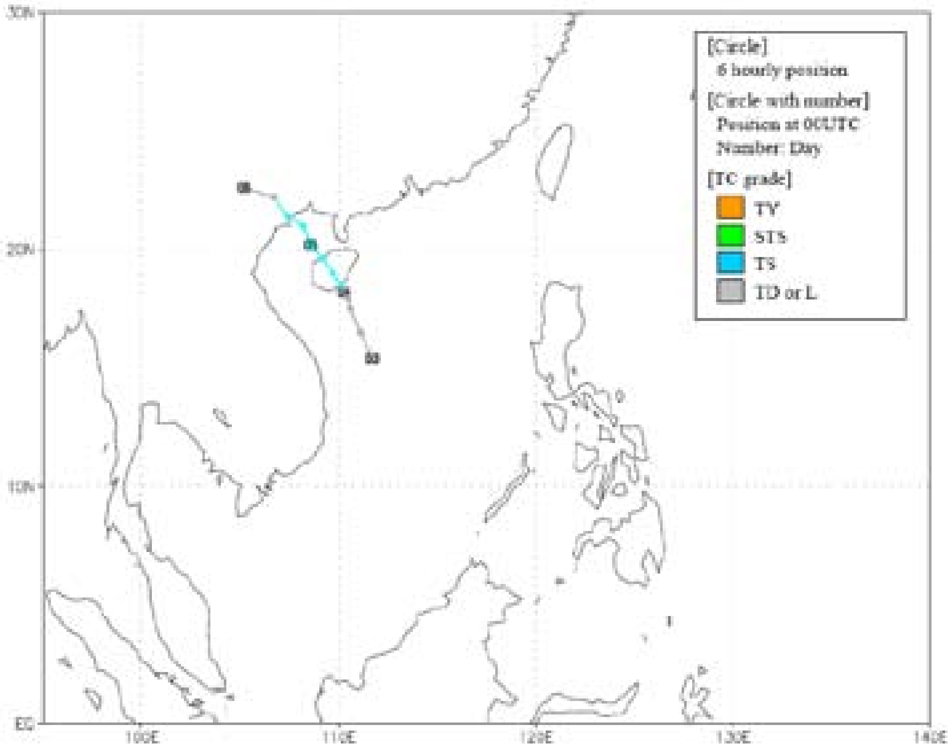


Figure 2.2.3b Track of Toraji (0703).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.4 MAN-YI (0704)
7 -23 July

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	06UTC 07/07	12UTC 07/07
TS	00UTC 09/07	18UTC 08/07
STS	18UTC 09/07	00UTC 10/07
T	18UTC 10/07	18UTC 10/07
STS	18UTC 14/07	00UTC 15/07
TS	12UTC 15/07	12UTC 15/07
LOW	00UTC 16/07	-

MAN-YI (0704) developed as a tropical depression over the sea around the Caroline Islands at 06UTC on 7 July 2007. Moving north-westward, it intensified into a severe tropical storm at 18UTC on 9 July and further into a typhoon at 18UTC the next day over the sea far east of the Philippines. It attained its peak intensity with maximum sustained wind of 176 km/h with a central pressure of 930 hPa at 00UTC on 12 July. Man-yi turned to move north-northwestward on 12 July and then further to the north on 13 July. It recurved off the west coast of Okinawa Island the next day and turned to the northeast and made landfall in Kyusyu with typhoon intensity on 14 July. Man-yi weakened into a severe tropical storm at 18UTC on 14 July. After skirting alone the coast of the Japanese Islands, it was downgraded to tropical storm intensity at 12UTC on 15 July, and transformed into an extra-tropical cyclone over the sea east of Japan at 00UTC on 16 July. Man-Yi caused major damages in Kyushu region. Six people were dead and one was missing, and 79 people were injured due to strong winds, heavy rain and flooding. About 32 houses were destroyed and 4500 houses were affected. Man-yi also cut-off power supply in Okinawa and Kyushu. Hundreds of flights were cancelled. The direct economic loss was estimated about 16 billion US dollars.

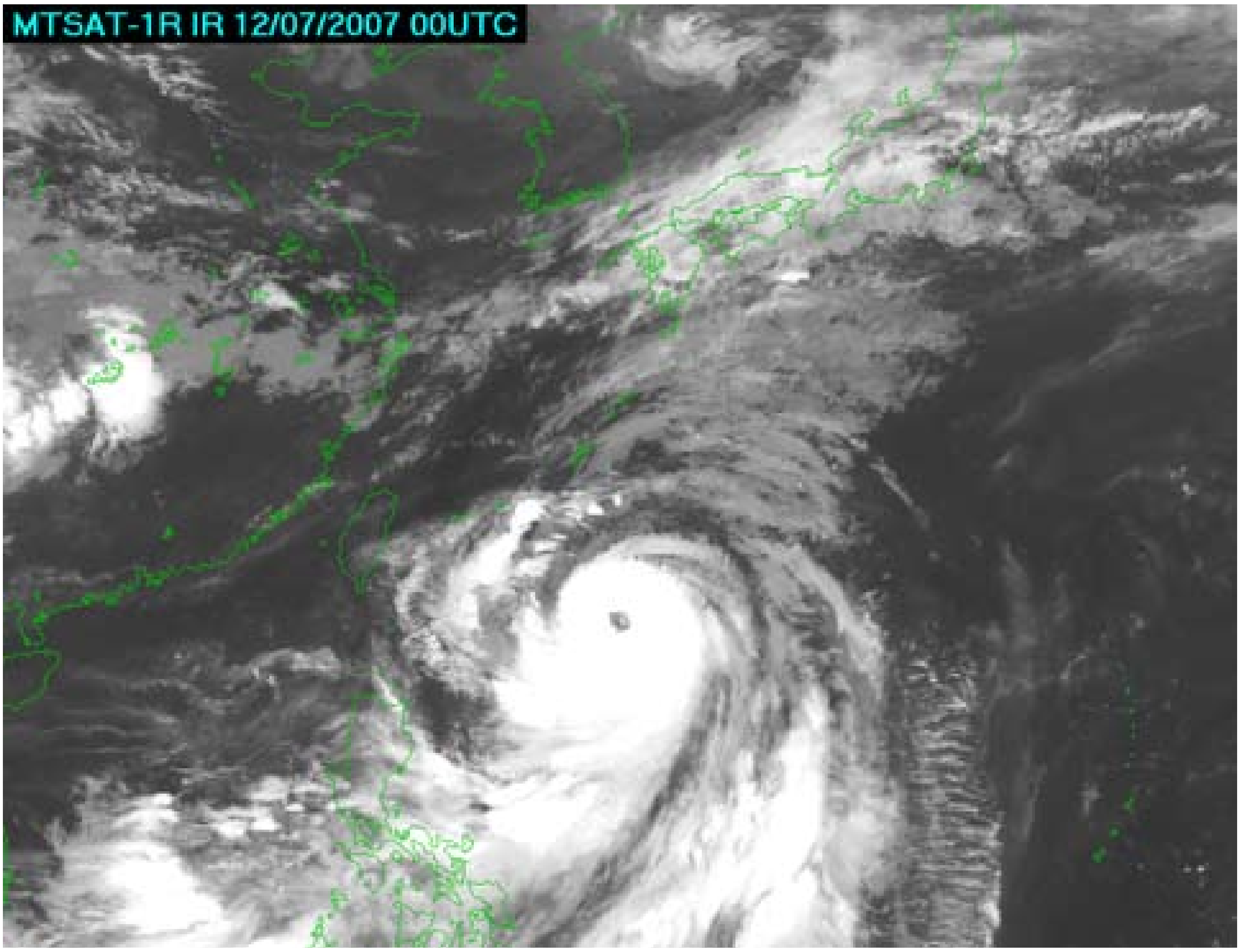


Figure 2.24a MTSAT - IR VS imagery of Man-yi (0704) at 00UTC on 12 July.
(Courtesy of Japan Meteorologyical Agency-JMA)

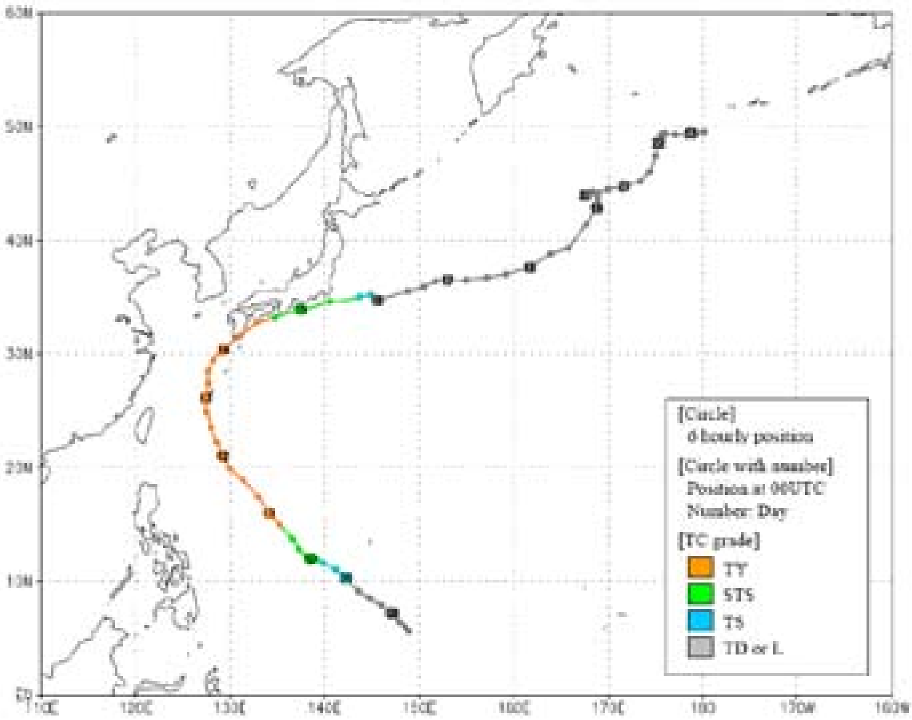


Figure 2.2.4b Track of Man-yi (0704).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.5 USAGI (0705)
27 July - 4 August

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 27/07	18UTC 27/07
TS	06UTC 29/07	06UTC 29/07
STS	00UTC 30/07	00UTC 30/07
T	12UTC 30/07	00UTC 31/07
STS	12UTC 02/08	12UTC 02/08
TS	21UTC 02/08	00UTC 03/08
TD	06UTC 04/08	00UTC 04/08
DISSIPATED	00UTC 05/08	-

USAGI (0705) developed as a tropical depression over the sea south of Minamitorishima Island on 27 July 2007 and moved generally westwards. It developed into a tropical storm at 06UTC on 29 July and then a severe tropical storm at 00UTC the next day. Turning to the northwest, it was further intensified into a typhoon over the sea south of Iwojima Island at 12UTC on 30 July. Usagi attained the peak strength with maximum sustained wind of 167 km/h with a central pressure of 945 hPa at 00UTC on 1 August. Usagei then turned north and made landfall on Kyushu the next day. After recurvature, it was downgraded to tropical storm at 21UTC on the same day and moved westward over the Sea of Japan and made landfall in the northern part of Honshu on 4 August. It then weakened into a tropical depression at 06UTC on 4 August and then transformed into an extra-tropical cyclone over the sea south of Hokkaido. Moving eastward, it dissipated on 5 August. 30 people were injured and about 900 houses were affected. The estimated economic loss due to Usagi in Japan was 3.3 billion US dollars.

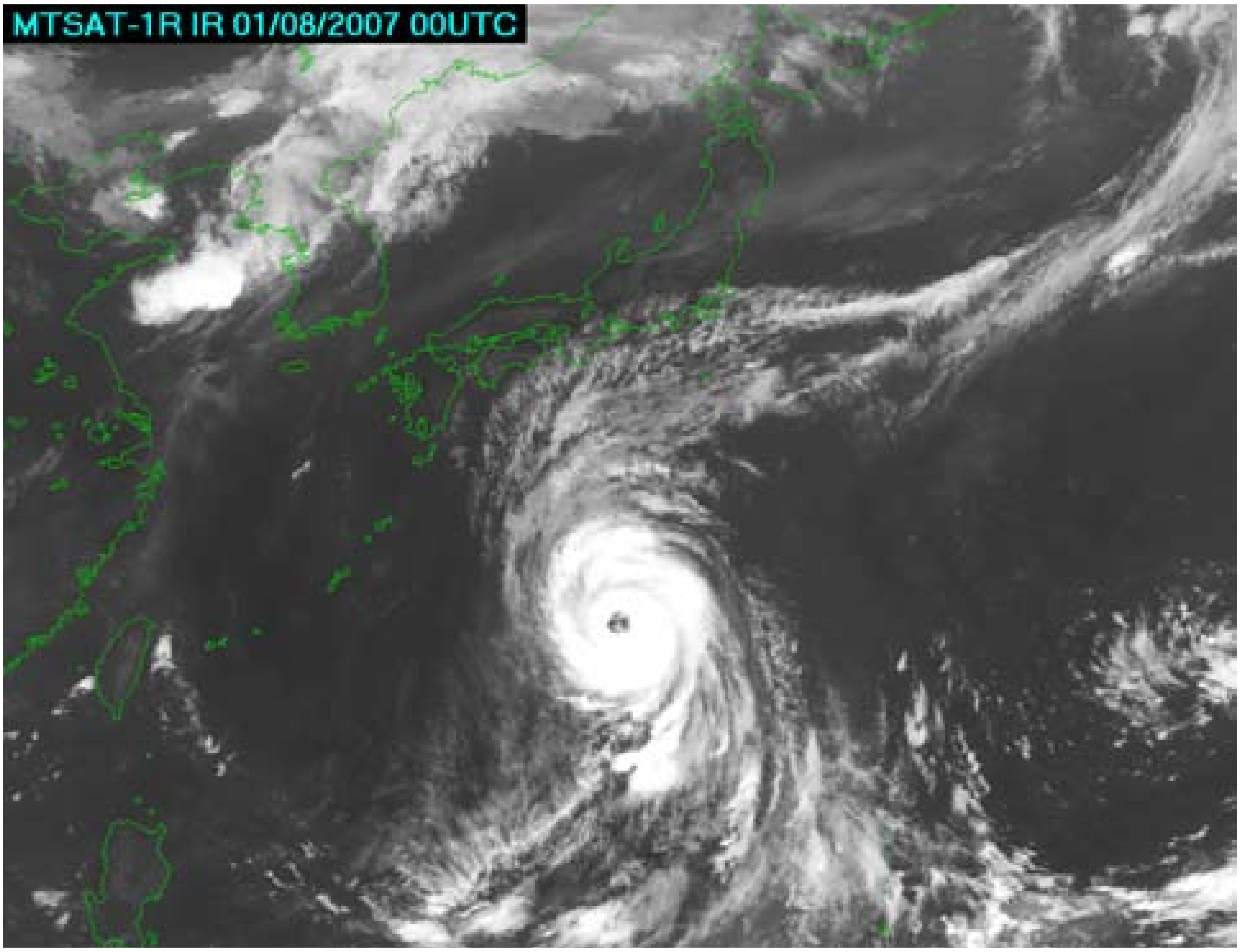


Figure 2.2.5a MTSAT - IR VS imagery of Usagi (0705) at 00UTC on 01 August.
(Courtesy of Japan Meteorologyical Agency-JMA)

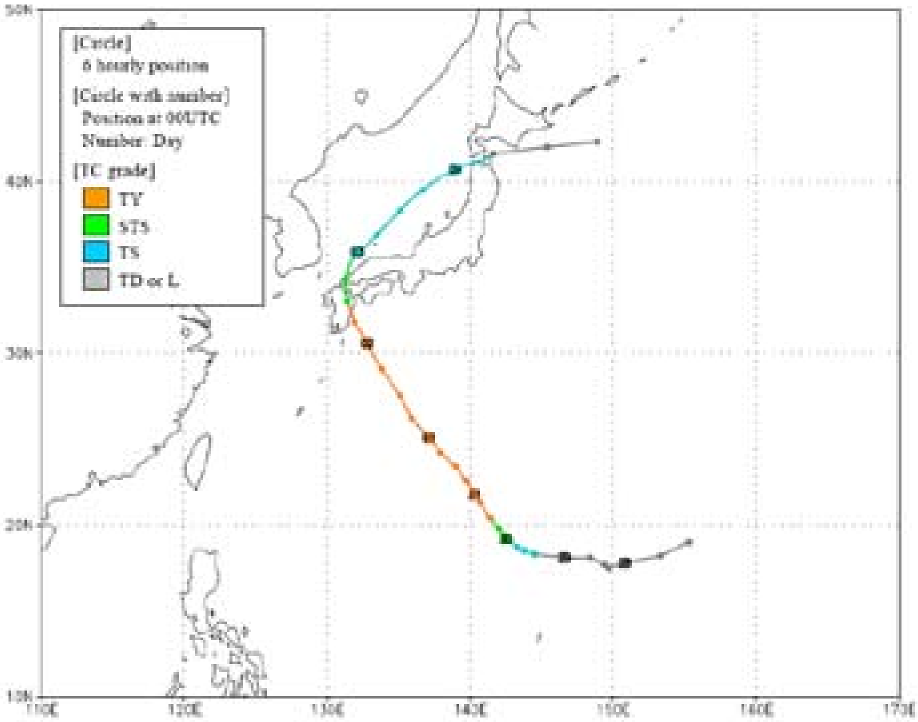


Figure 2.2.5b Track of Usagi (0705).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.6 PAPUK (0706)
4 – 15 August

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 04/08	06UTC 31/07
TS	06UTC 05/08	06UTC 01/08
STS	18UTC 06/08	18UTC 01/08
T	09UTC 07/08	12UTC 02/08
STS	18UTC 07/08	18UTC 03/08
TS	12UTC 08/08	00UTC 04/08
TD	06UTC 09/08	12UTC 04/08
DISSIPATED	12UTC 15/08	-

PABUK (0706) formed as a tropical depression over the sea far east of the Philippines at 18UTC on 4 August 2007 and moved generally west-northwestwards. It intensified into a severe tropical storm at 06UTC on 5 August. Pabuk reached its peak intensity with maximum sustained wind of 120 km/h and a central pressure of 975 hPa at 09UTC on 7 August. After crossing the southern tip of Taiwan, Pabuk weakened into tropical storm at 12UTC on 8 August over the sea east of Hong Kong and then weakened into a tropical depression at 06UTC on 9 August off the southern coast of Hong Kong. It turned northeastwards and crossed the western part of Hong Kong and made landfall in Zhongshan. The direct economic loss was estimated about 220 million US dollars. Moving to the northeast, it entered the East China Sea on 12 August. Pabuk then turned to moving northwards and transformed into an extra-tropical cyclone over the northern part of the Korean Peninsula on 14 August.

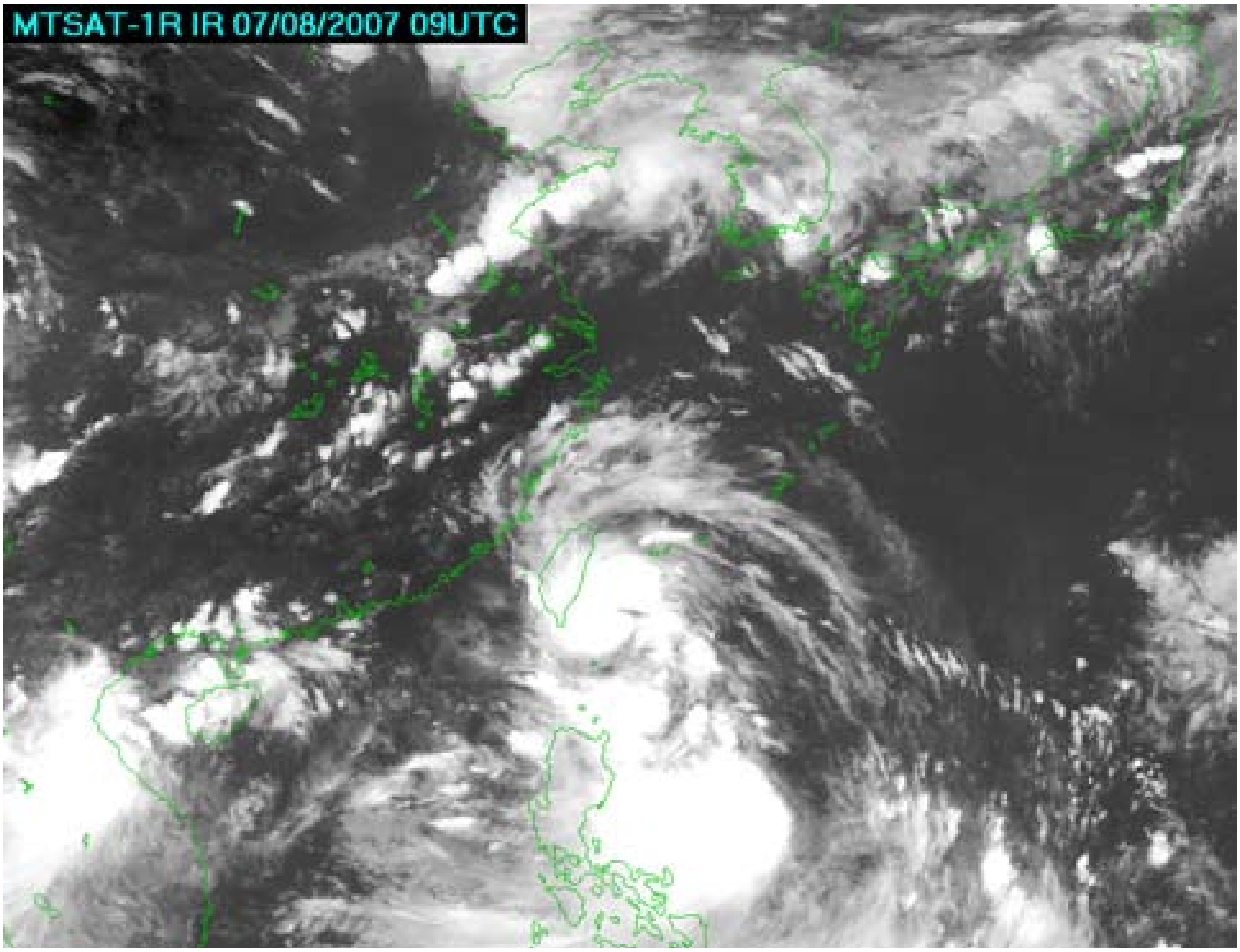


Figure 2.2.6a MTSAT - IR VS imagery of Pabuk (0706) at 09UTC on 07 August.
(Courtesy of Japan Meteorologyical Agency-JMA)

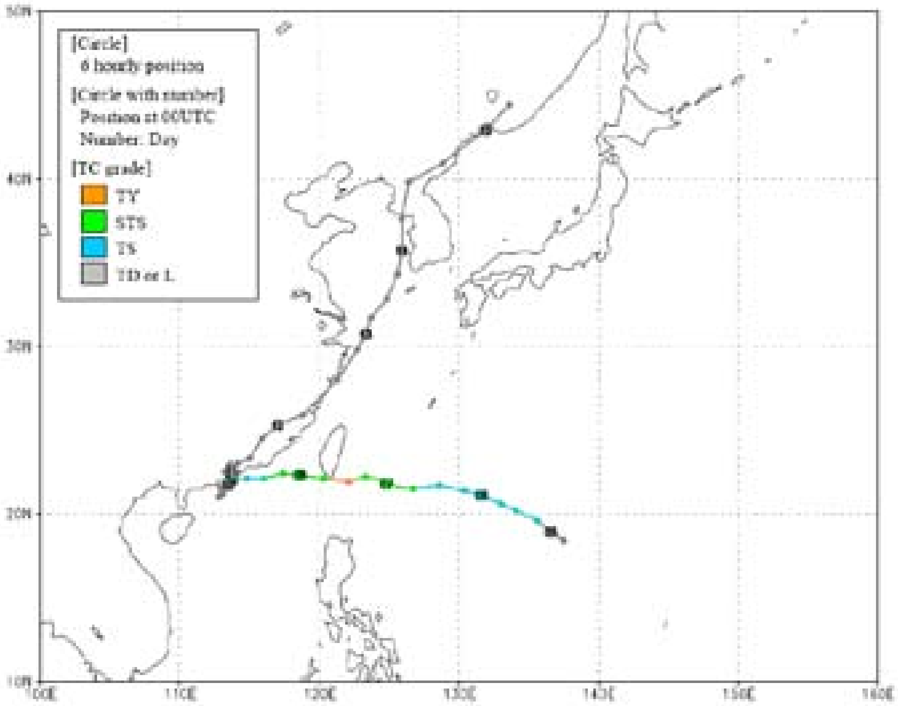


Figure 2.2.6b Track of Pabuk (0706).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.7 WUTIP (0707)
6 – 8 August

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 06/08	18UTC 06/08
TS	00UTC 08/08	06UTC 08/08
TD	-	00UTC 09/08
DISSIPATED	21UTC 08/08	-

WUTIP (0707) formed as a tropical depression over the sea east of the Philippines at 12UTC on 6 August 2007. Wutip moved northwestwards and intensified into a tropical storm at 00UTC on 8 August. It reached its peak intensity with maximum sustained wind of 65 km/h and a central pressure of 990 hPa at 03UTC on 8 August. Moving to the northwest, Wutip rapidly dissipated off the eastern coast of Taiwan on 8 August

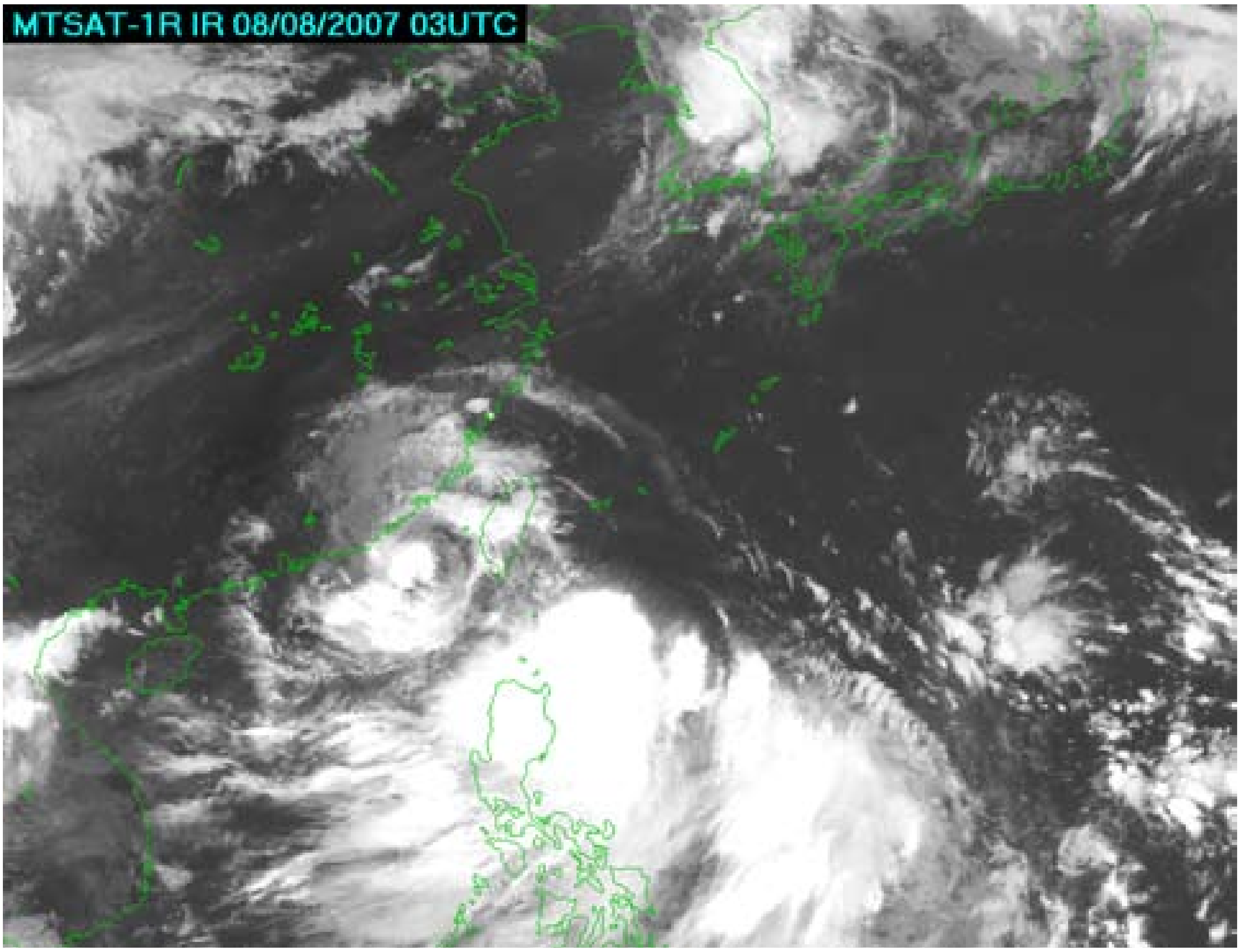


Figure 2.2.7a MTSAT - IR VS imagery of Wutip (0707) at 03UTC on 08 August.
(Courtesy of Japan Meteorologyical Agency-JMA)

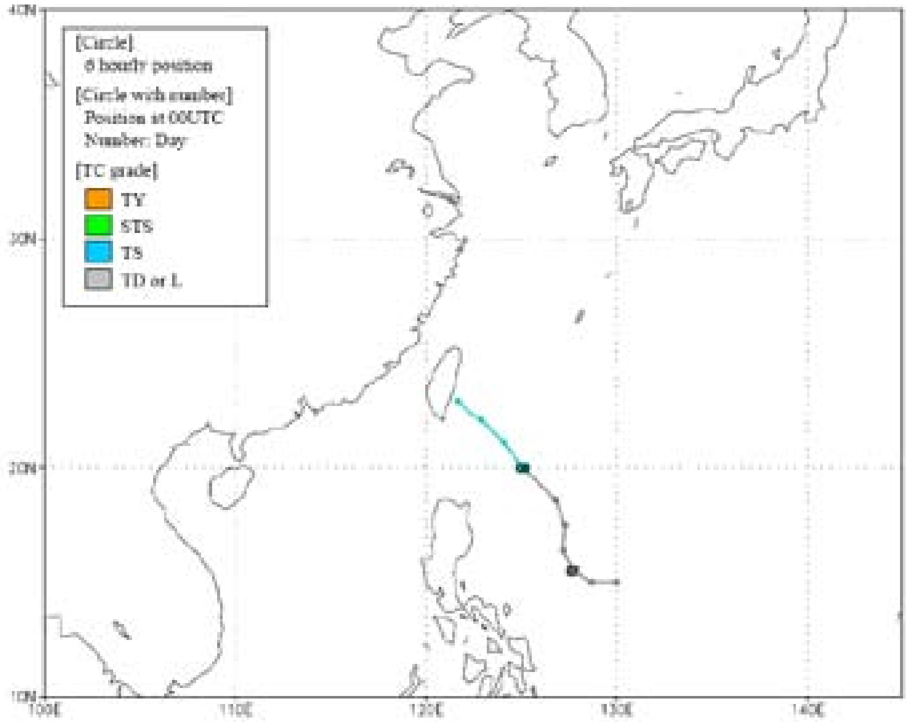


Figure 2.2.7b Track of Wutip (0707).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.8 SEPAT (0708)
12 -24 August

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	00UTC 12/08	06UTC 12/08
TS	18UTC 12/08	18UTC 12/08
STS	06UTC 13/08	06UTC 13/08
T	00UTC 14/08	00UTC 14/08
STS	03UTC 18/08	18UTC 18/08
TS	00UTC 19/08	00UTC 19/08
TD	12UTC 19/08	18UTC 19/08
DISSIPATED	12UTC 24/08	-

SEPAT (0708) formed as a tropical depression over the sea far east of the Philippines at 00UTC on 12 August 2007. Moving westwards, it was upgraded into a severe tropical storm at 06UTC on 13 August and then further into a typhoon at 00UTC on 14 August over the same sea. It reached its peak intensity with maximum sustained wind of 204 km/h and a central pressure of 910 hPa at 00UTC on 16 August. After turning to the northwest, it hit Taiwan on 17 August, and caused one people dead and 24 injured. After the landfall near Quanzhou City in Fujian Province, Sepat was downgraded to tropical storm intensity at 00UTC on 19 August and then further to tropical depression at 12UTC on 19 August. It moved to the west and dissipated over the in Hunan province, China on 24 August. The direct economic loss was estimated about 740 million US dollars. 25 people died and 13 people missing were reported.

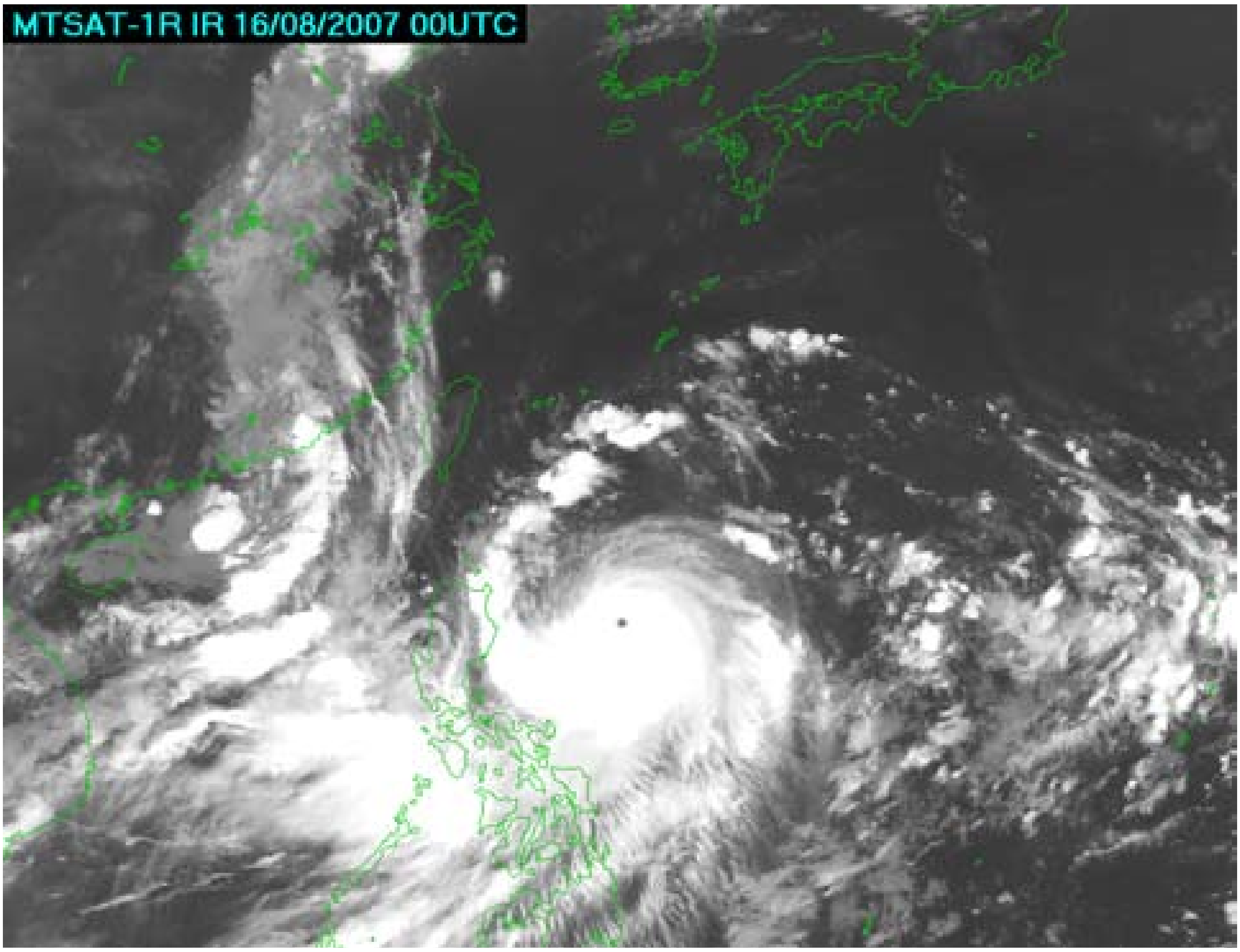


Figure 2.2.8a MTSAT - IR VS imagery of Sepat (0708) at 00UTC on 16 August.
(Courtesy of Japan Meteorologyical Agency-JMA)

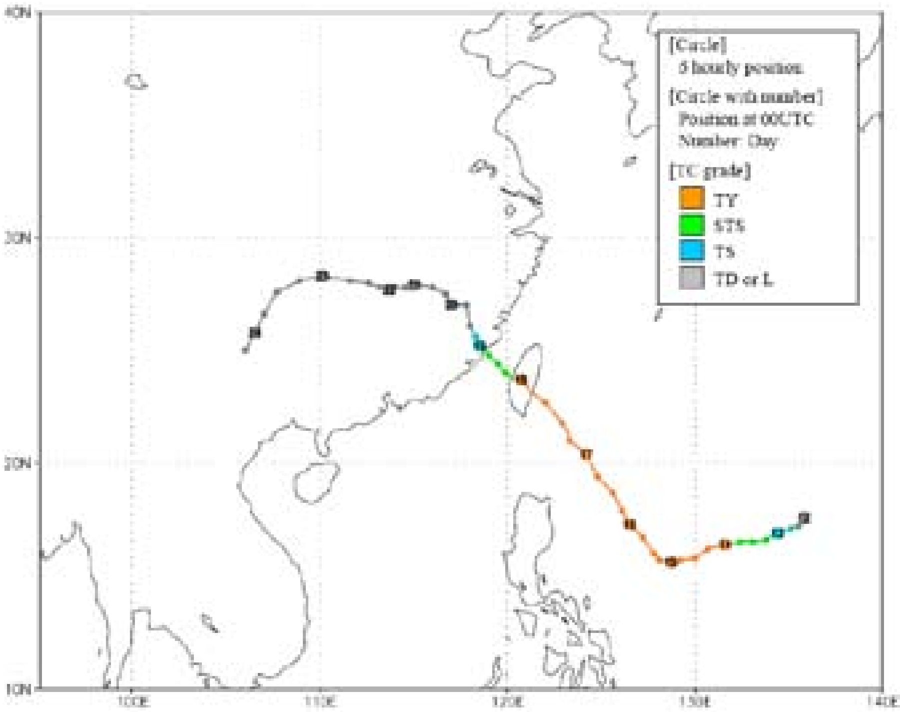


Figure 2.2.8b Track of Sepat (0708).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.9 FITOW (0709)
27 August - 8 September

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 27/08	00UTC 28/08
TS	00UTC 29/08	06UTC 29/08
STS	12UTC 29/08	12UTC 29/08
T	12UTC 30/08	12UTC 30/08
STS	12UTC 03/09	12UTC 03/09
T	21UTC 04/09	00UTC 05/09
STS	21UTC 06/09	00UTC 07/09
TS	12UTC 07/09	12UTC 07/09
LOW	00UTC 08/09	-

FITOW (0709) formed as a tropical depression over the sea south of Minamitorishima Island at 18UTC on 27 August and moved northeastwards. It developed into a tropical storm at 00UTC on 29 August and gradually turned to take a westerly track. Fitow intensified into a typhoon at 12UTC on 31 August, and reached its peak intensity with maximum wind of 130 km/h with a central pressure of 965 hPa at 00UTC on 1 September. Moving to the west, Fitow was downgraded to a severe tropical storm over the sea east of Chichijima Island at 12UTC on 3 September but re-intensified again into a typhoon at 21UTC on 4 September. After turning to the north and crossing the eastern part of Honshu on 6 September, Fitow weakened into a tropical storm at 12UTC on 7 September and then transformed into an extra-tropical cyclone near Hokkaido on 8 September. In Japan, 3 people were reported dead or missing and more than 2500 houses were affected. The estimated economic is 10 billion US dollars.

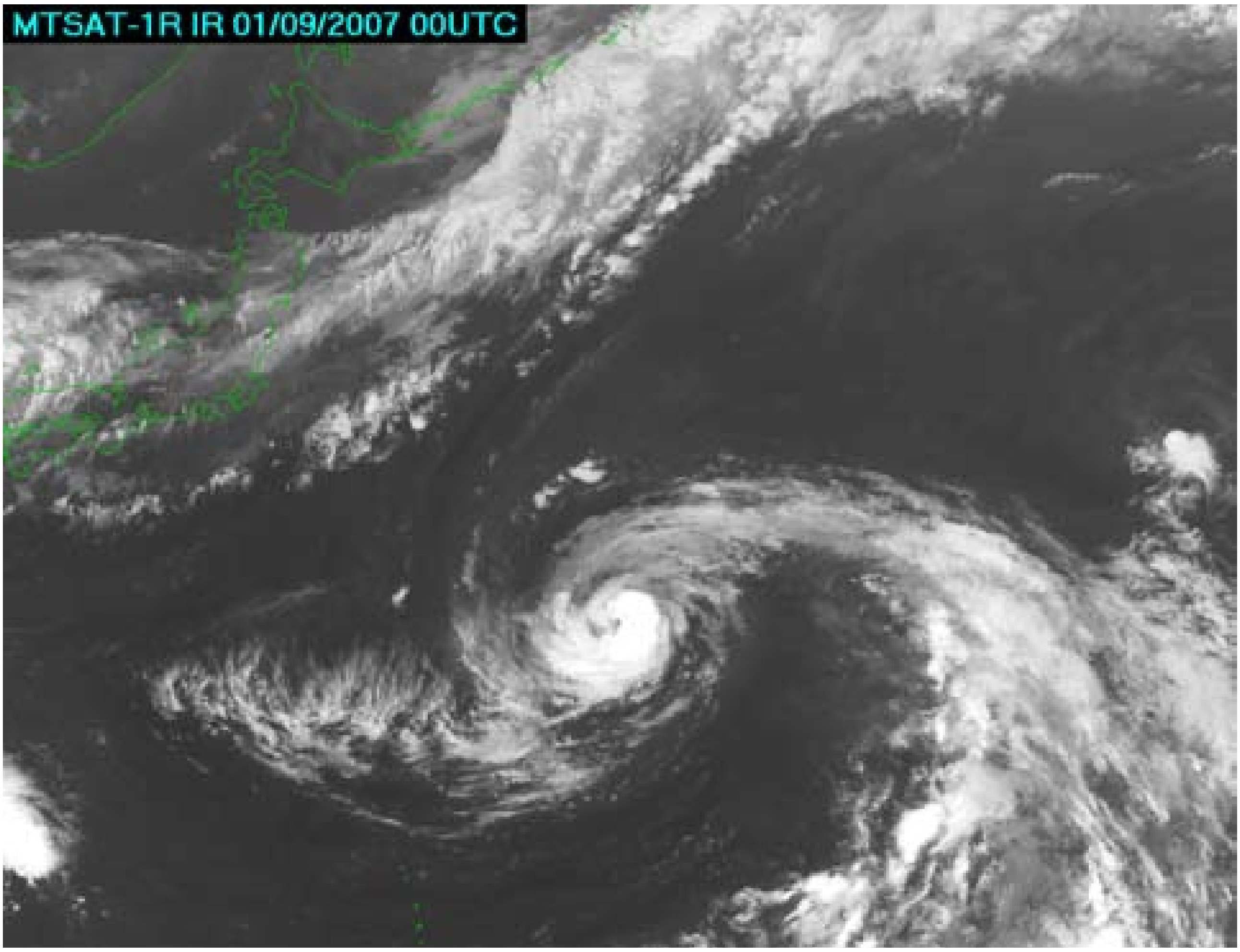


Figure 2.2.9a MTSAT - IR VS imagery of Fitow (0709) at 00UTC on 01 September.
(Courtesy of Japan Meteorologyical Agency-JMA)

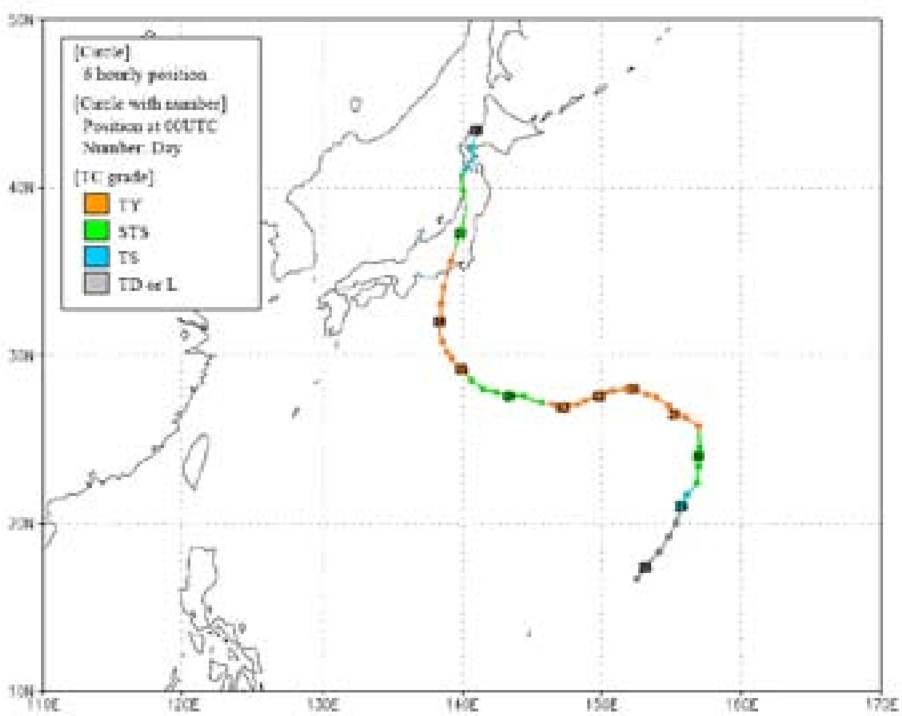


Figure 2.2.9b Track of Fitow (0709).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.10 DANAS (0710)
6 - 12 September

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	00UTC 06/09	06UTC 06/09
TS	06UTC 07/09	12UTC 07/09
STS	12UTC 09/09	00UTC 10/09
TS	12UTC 11/09	12UTC 11/09
LOW	18UTC 11/09	-

DANAS (0710) formed as a tropical depression over the sea east of Minamitorishima Island at 00UTC on 6 September 2007 and move generally northwestwards. It intensified into a tropical storm at 06UTC the next day. During the recurvature, Danas further intensified into a sever tropical storm at 12UTC on 9 September. Danas attained the peak intensity with maximum wind of 102 km/h and a central pressure of 990 hPa at 18UTC on 10 September. Moving eastward, it weakened into a tropical storm at 12UTC and then an extra-tropical cyclone over the western North Pacific to the east of Japan on 11 September. No significant damages were reported.

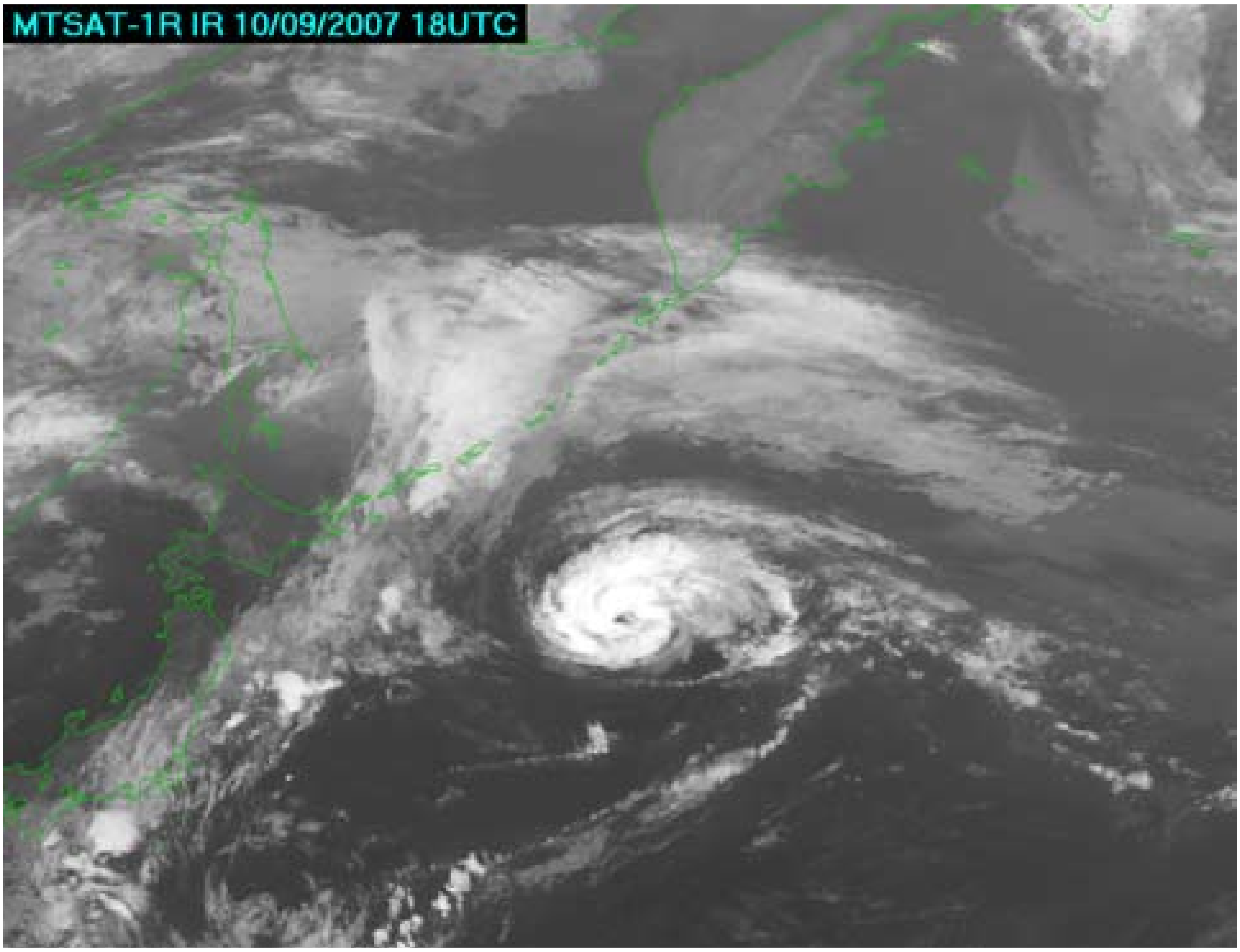


Figure 2.2.10a MTSAT - IR VS imagery of Danas (0710) at 18UTC on 10 September.
(Courtesy of Japan Meteorologyical Agency-JMA)

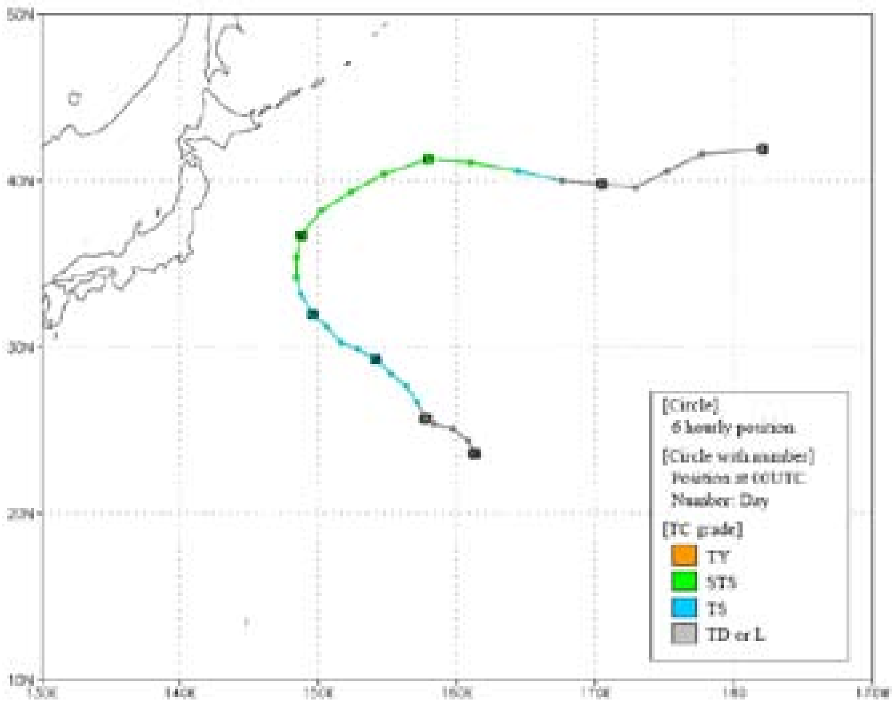


Figure 2.2.8b Track of Danas (0710).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.11 NARI (0711)
11 -18 September

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 11/09	18UTC 12/09
TS	00UTC 13/09	06UTC 13/09
STS	12UTC 13/09	12UTC 13/09
T	18UTC 13/09	00UTC 14/09
STS	-	12UTC 16/09
TS	12UTC 16/09	18UTC 16/09
LOW	00UTC 17/09	-

NARI (0711) formed as a tropical depression over the sea far east of the Philippines at 12UTC on 11 September and moved generally northwestwards. It intensified into tropical storm at 00UTC and then rapidly developed into typhoon at 18UTC on 13 September. Nari attained its peak intensity with maximum wind of 185 km/h and a central pressure of 935 hPa at 12UTC on 14 September. Nari passed to the southwest of Okinawa and a number of people were injured. Nari then turned to move north and then crossed the southeastern part of Korea on 16 September. Cheju Island suffered from heavy rainfall due to passage of the typhoon. 16 people were reported dead and missing and 13 people were injured. The total estimated damages were 230 million US dollars. Nari became an extra-tropical cyclone at 00UTC on 17 September over the Sea of Japan.

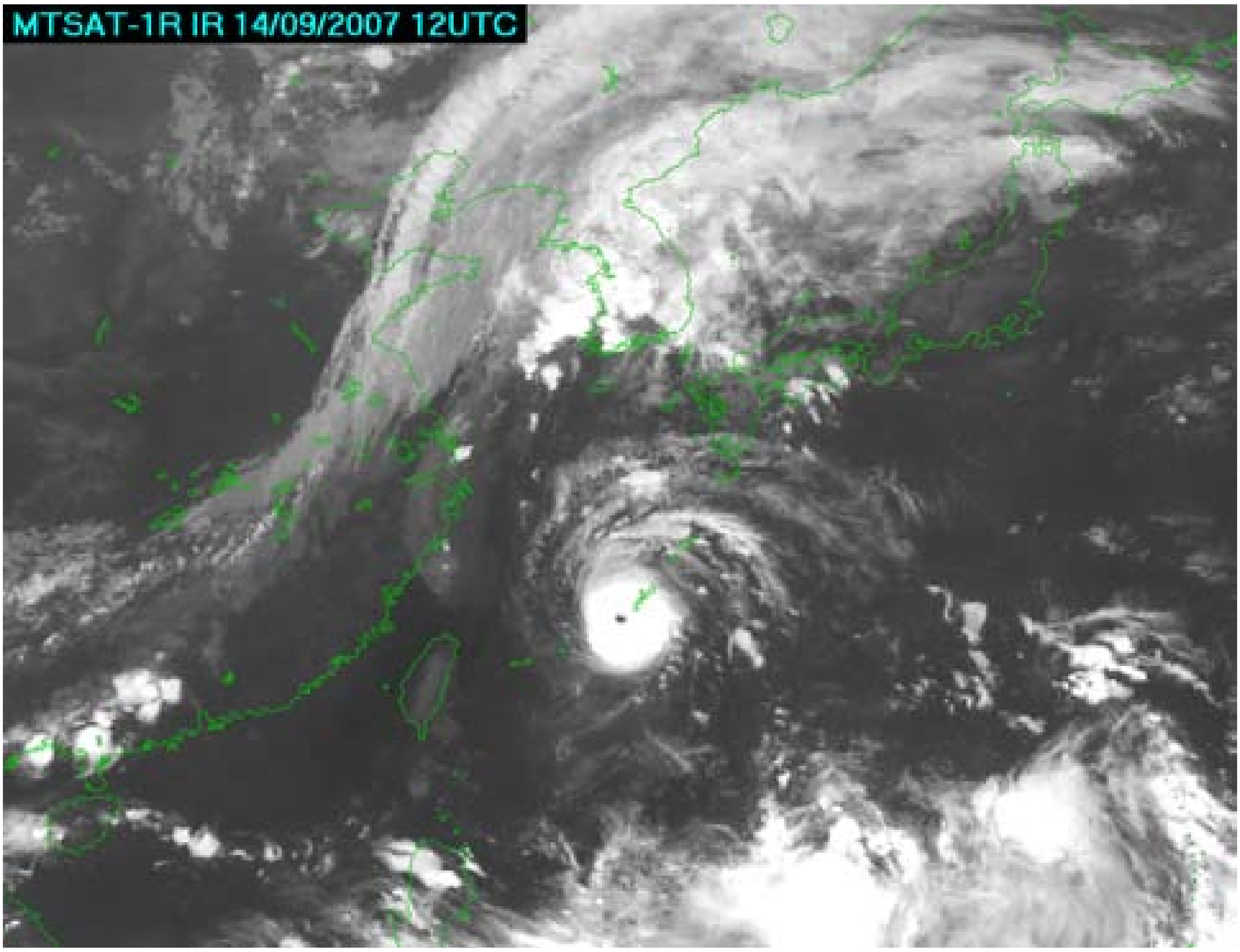


Figure 2.2.11a MTSAT - IR VS imagery of Nari (0711) at 12UTC on 14 September.
(Courtesy of Japan Meteorologyical Agency-JMA)

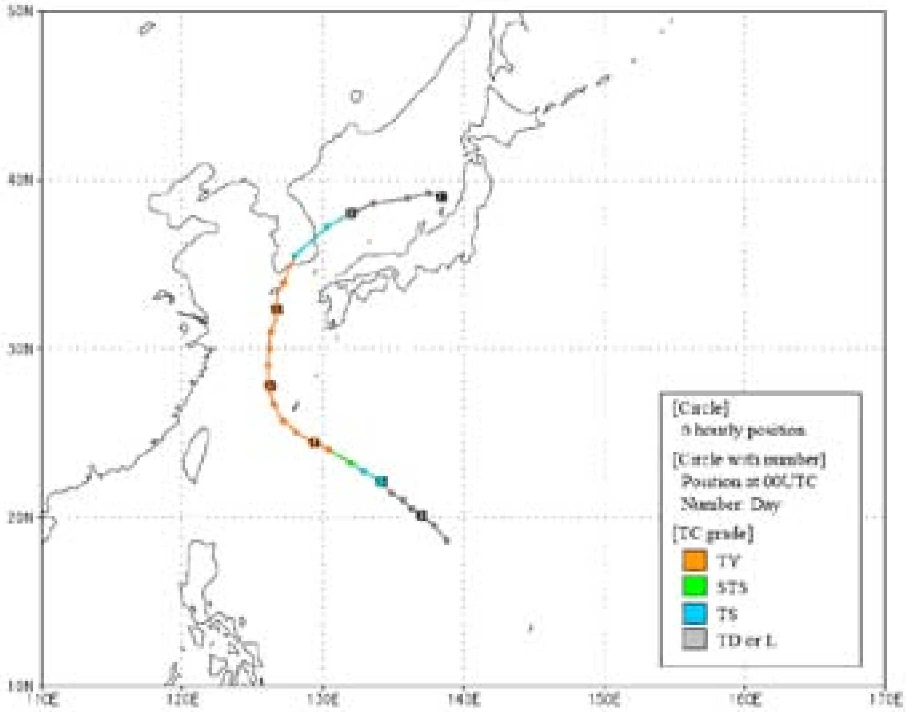


Figure 2.211b Track of Nari (0711).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.12 WIPHA (0712)
15 – 20 September

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	00UTC 15/09	00UTC 15/09
TS	00UTC 16/09	00UTC16/09
STS	12UTC 16/09	12UTC 16/09
T	00UTC 17/09	00UTC 17/09
STS	00UTC 19/09	00UTC 19/09
TS	06UTC 19/09	06UTC 19/09
TD	12UTC 19/09	-
LOW	00UTC 20/09	-

WIPHA (0712) formed as a tropical depression over the sea far east of the Philippines at 00UTC on 15 September 2007 and moved west-north-westwards. It intensified into a tropical storm 00UTC and then a severe tropical storm at 12UTC on 16 September. Moving to the northwest, it further intensified into a typhoon at 00UTC and attained its peak intensity with maximum wind of 185 km/h and a central pressure of 925 hPa at 18UTC on 17 September and passed to the north of Taiwan. Wipah made landfall on Zhejiang on 18 September. Turning to the north, it rapidly weakened into tropical storm and tropical depression, and then became an extra-tropical storm over the Yellow Sea on 20 September. Many places over East China were affected with heavy flooding caused by Wipha and cold air from north. It was reported 8 people died, 3 people missing and 2539 thousands people transfer in this period. The direct economic loss was estimated about 1010 million dollars.

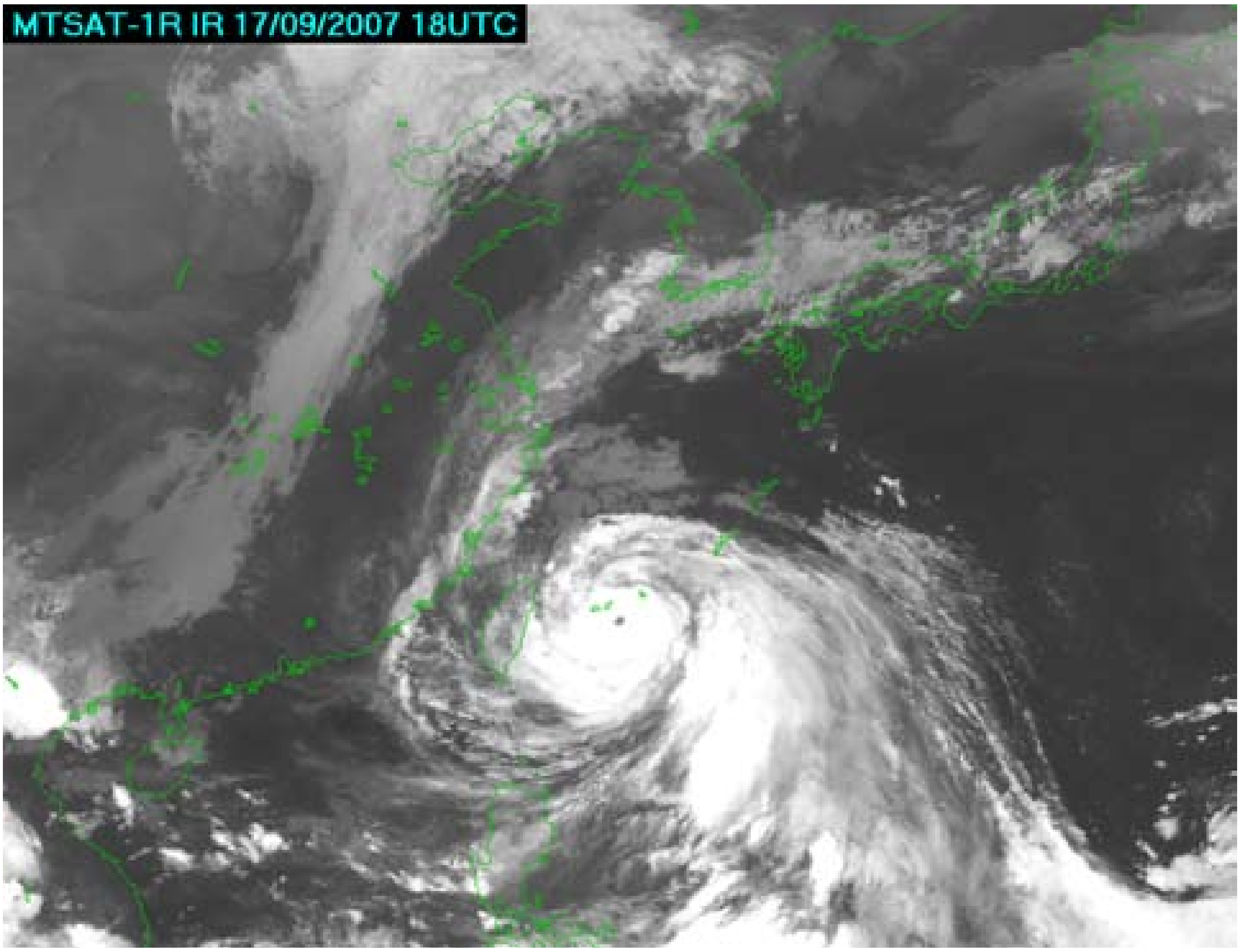


Figure 2.2.12a MTSAT - IR VS imagery of Wipha (0712) at 18UTC on 17 September.
(Courtesy of Japan Meteorologyical Agency-JMA)

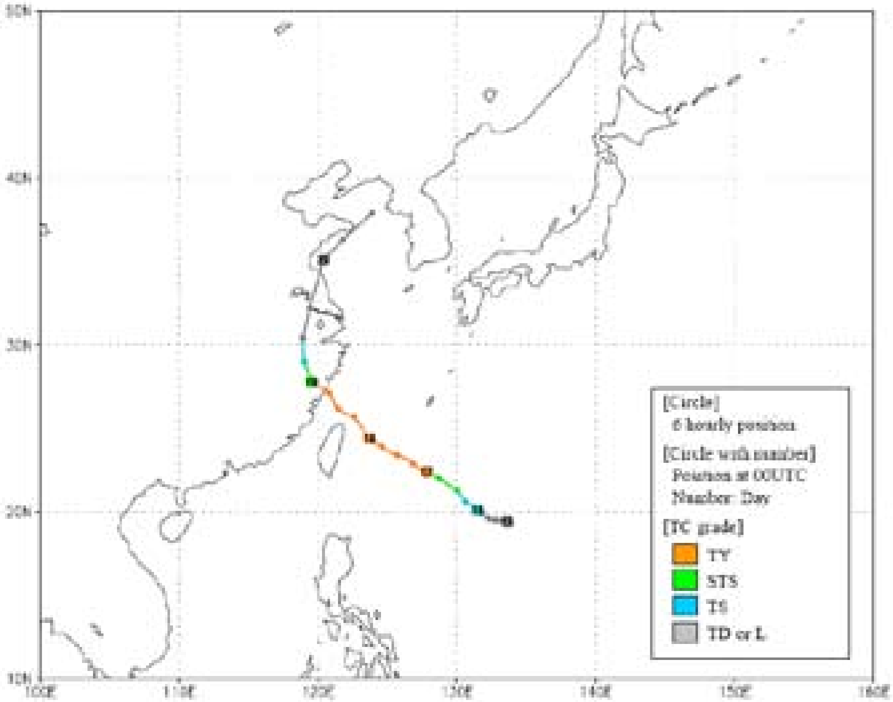


Figure 2.2.8b Track of Wipha (0712).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.13 FRANCISCO (0713)
21 – 26 September

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 21/09	06UTC 22/09
TS	12UTC 23/09	06UTC 23/09
TD	06UTC 25/09	18UTC 24/09
DISSIPATED	06UTC 26/09	-

FRANCISCO (0713) formed as a tropical cyclone over the sea to the north of Luzon Island at 12UTC on 21 September and moved westwards. It intensified into tropical storm at 12UTC on 23 September over the sea south of Hong Kong. It attained its peak intensity with maximum wind of 74 km/h and a central pressure of 990 hPa at 18UTC on 23 September. Francisco made landfall and traversed Hainan on 24 September and then it weakened into a tropical depression at 06UTC on 25 September and crossed the Beibu Wan. After landfall over Vietnam, Francisco dissipated at 06UTC on 26 September. The direct economic loss was estimated about 26 million US dollars.

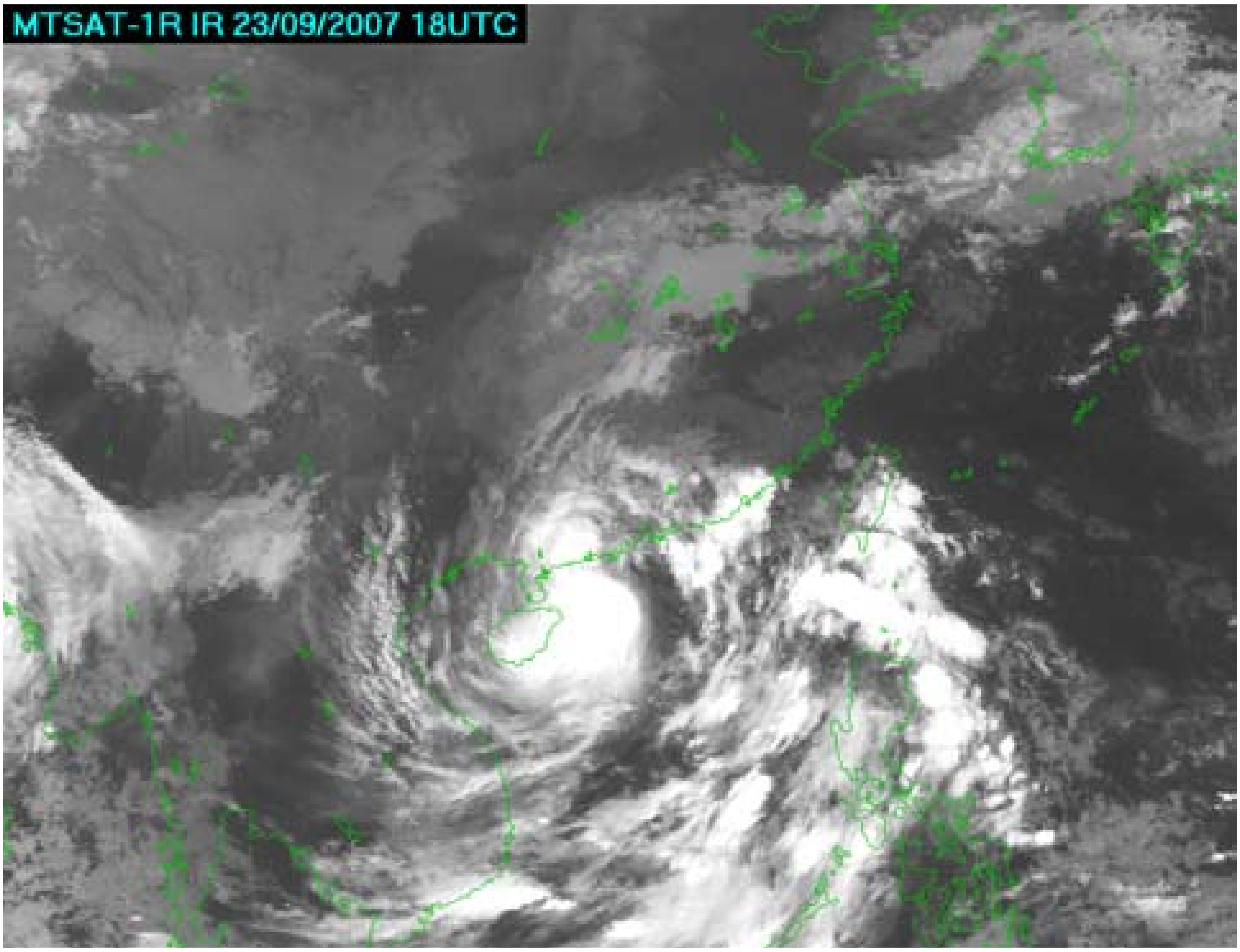


Figure 2.2.13a MTSAT - IR VS imagery of Francisco (0713) at 18UTC on 23 September.
(Courtesy of Japan Meteorological Agency-JMA)

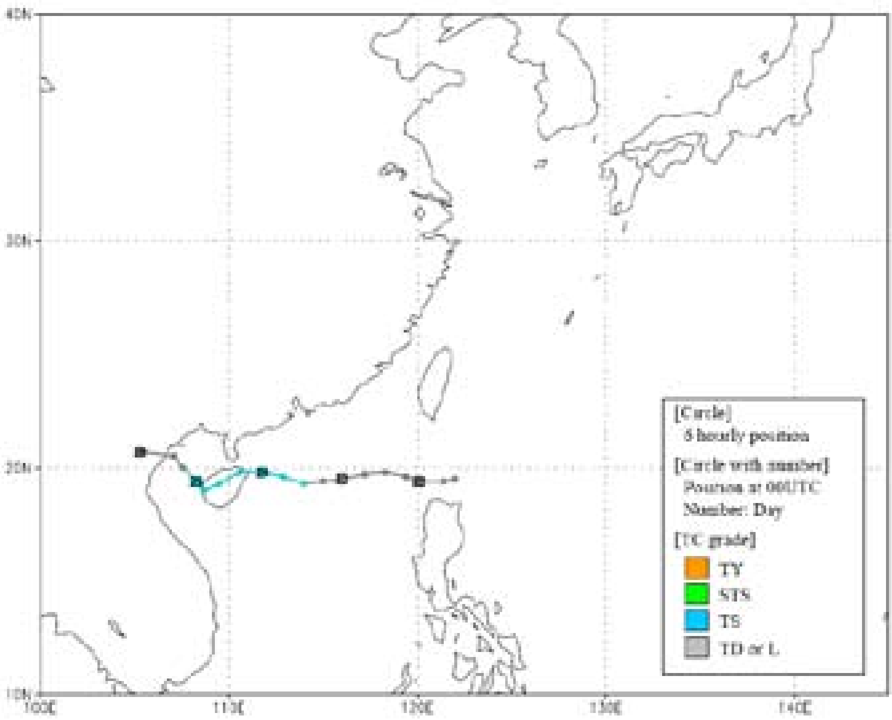


Figure 2.2.13b Track of Francisco (0713).
(Courtesy of Japan Meteorological Agency-JMA)

2.2.14 LEKIMA (0714)
28 September – 4 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 28/09	00UTC 29/09
TS	00UTC30/09	00UTC 30/09
STS	00UTC 01/10	00UTC 01/10
T	-	06UTC 03/10
TS	18UTC 03/10	18UTC 03/10
TD	06UTC 04/10	06UTC04/10
DISSIPATED	00UTC 05/10	-

LEKIMA (0714) formed as a tropical depression over the sea east of Luzon Island at 18UTC on 28 September. Moving west-southwestward, it crossed Luzon Island and developed into a tropical storm at 00UTC on 30 September in the South China Sea. In the Philippines, Lekima caused 10 people dead or missing. The total damage is about 230 thousand US dollars. Turning to the northwest, it further intensified into severe tropical storm at 00UTC on 1 October, and attained its peak intensity with maximum wind of 111 km/h and a central pressure of 975 hPa at 00UTC on 2 October. After turning to the west, Lekima hit Vietnam the next day. It was reported that 88 people dead, 180 people injured and 8 missing and 1853 houses collapsed in Vietnam. Keeping its westward track, Lekima weakened into tropical storm at 18UTC on 3 October and then dissipated inland afterwards.

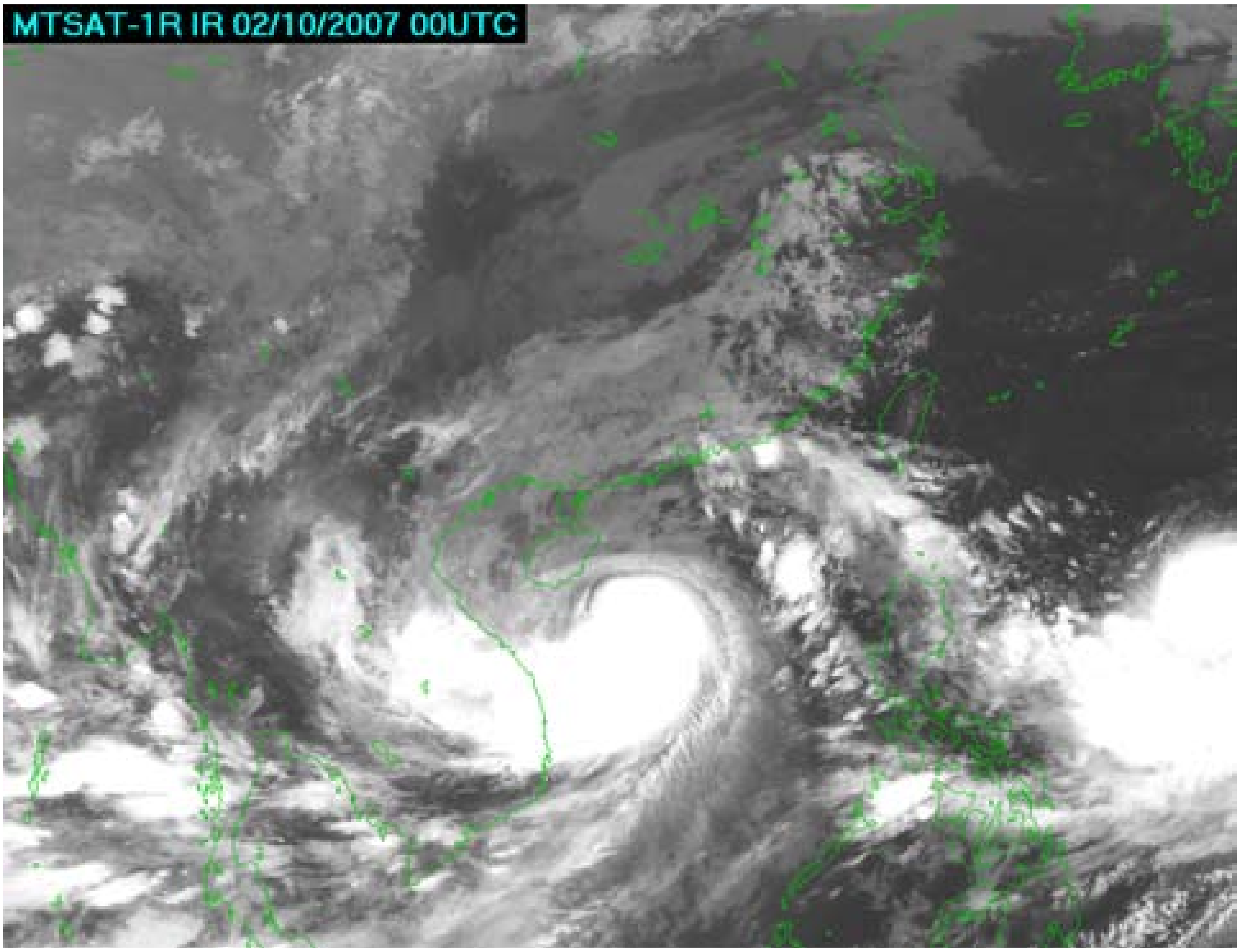


Figure 2.2.14a MTSAT - IR VS imagery of Lekima (0714) at 00UTC on 02 October.
(Courtesy of Japan Meteorologyical Agency-JMA)

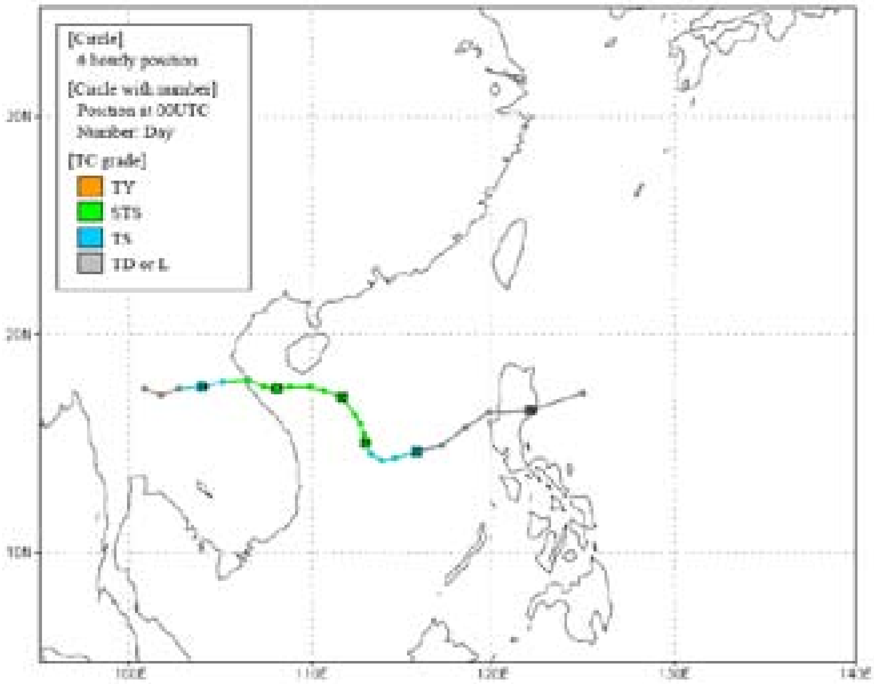


Figure 2.2.14b Track of Lekima (0714).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.15 KROSA (0715)
1 – 13 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	06UTC 01/10	06UTC 01/10
TS	18UTC 01/10	18UTC 01/10
STS	06UTC 02/10	18UTC 02/10
T	00UTC 03/10	00UTC 03/10
STS	00UTC 07/10	12UTC 07/10
TS	12UTC 07/10	00UTC 08/10
TD	00UTC 08/10	12UTC 08/10
LOW	06UTC 08/10	-

KROSA (0715) formed as a tropical depression over the sea east of the Philippines at 06UTC on 1 October and was almost stationary. Then it intensified into tropical storm at 18UTC on the same day, and further into a typhoon at 00UTC on 3 October over the same sea. Krosa attained its peak intensity with maximum wind of 194 km/h and a central pressure of 925 hPa at 06UTC on 5 October. It crossed the northern part of Taiwan on 6 October. Weakening in intensity it made landfall over the coast of southeast China on 7 October. Krosa brought heavy rain to Zhejiang where some 7 million people were affected. It was downgraded into a tropical depression at 00UTC and then extra-tropical cyclone at 06UTC on 8 September and moved east-northeastwards. It continued to move eastward in East China Sea and then over the sea south of Japan. Damage to houses and farm products were reported in Japan.

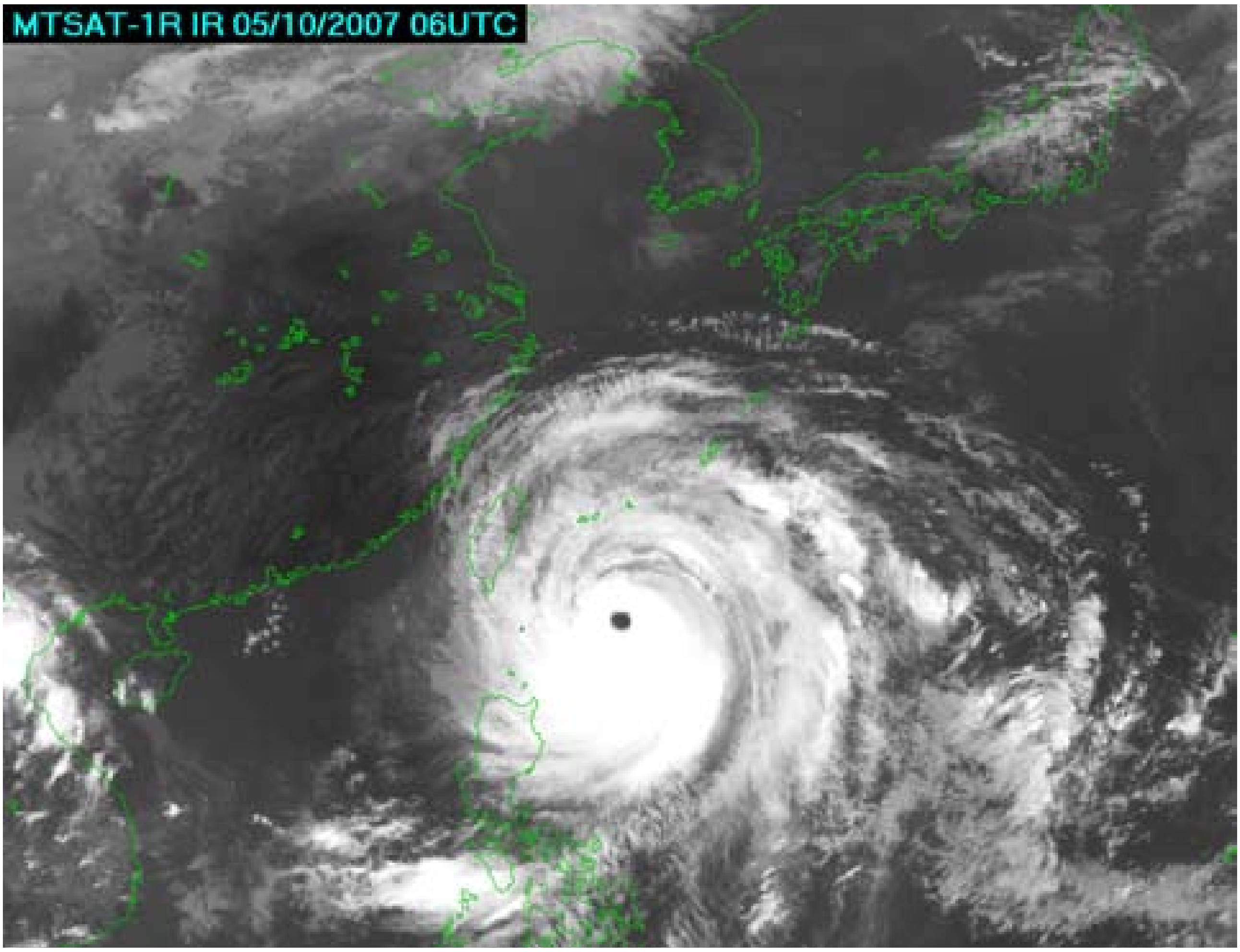


Figure 2.2.15a MTSAT - IR VS imagery of Krosa (0715) at 06UTC on 05 October.
(Courtesy of Japan Meteorological Agency-JMA)

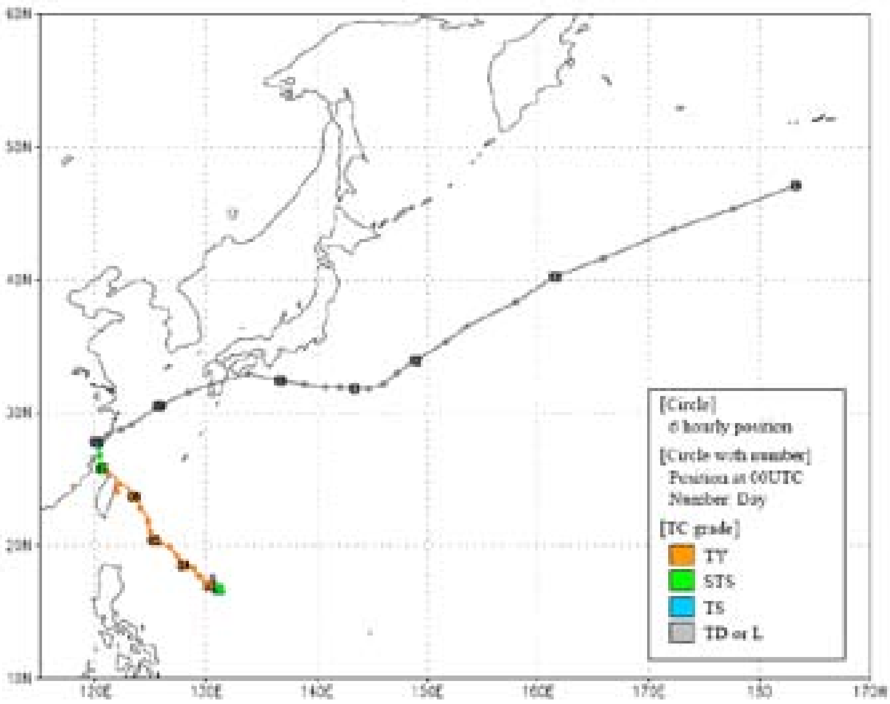


Figure 2.2.15b Track of Krosa (0715).
(Courtesy of Japan Meteorological Agency-JMA)

2.2.16 HAIYAN (0716)
30 September – 7 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 30/09	06UTC 04/10
TS	00UTC 05/10	00UTC 05/10
TD	06UTC 06/10	06UTC 06/10
DISSIPATED	06UTC 07/10	-

HAIYAN (0716) developed as a tropical depression over the sea west of the Midway Islands at 18UTC on 30 September. After turning in a counterclockwise circle, it was upgraded into a tropical storm at 00UTC on 5 October. Haiyan attained its peak intensity with maximum wind of 74 km/h and a central pressure of 994 hPa at 12UTC on the same day. Turning to the north, Haiyan weakened into a tropical depression at 06UTC on 6 October and dissipated over the same sea on 7 October.

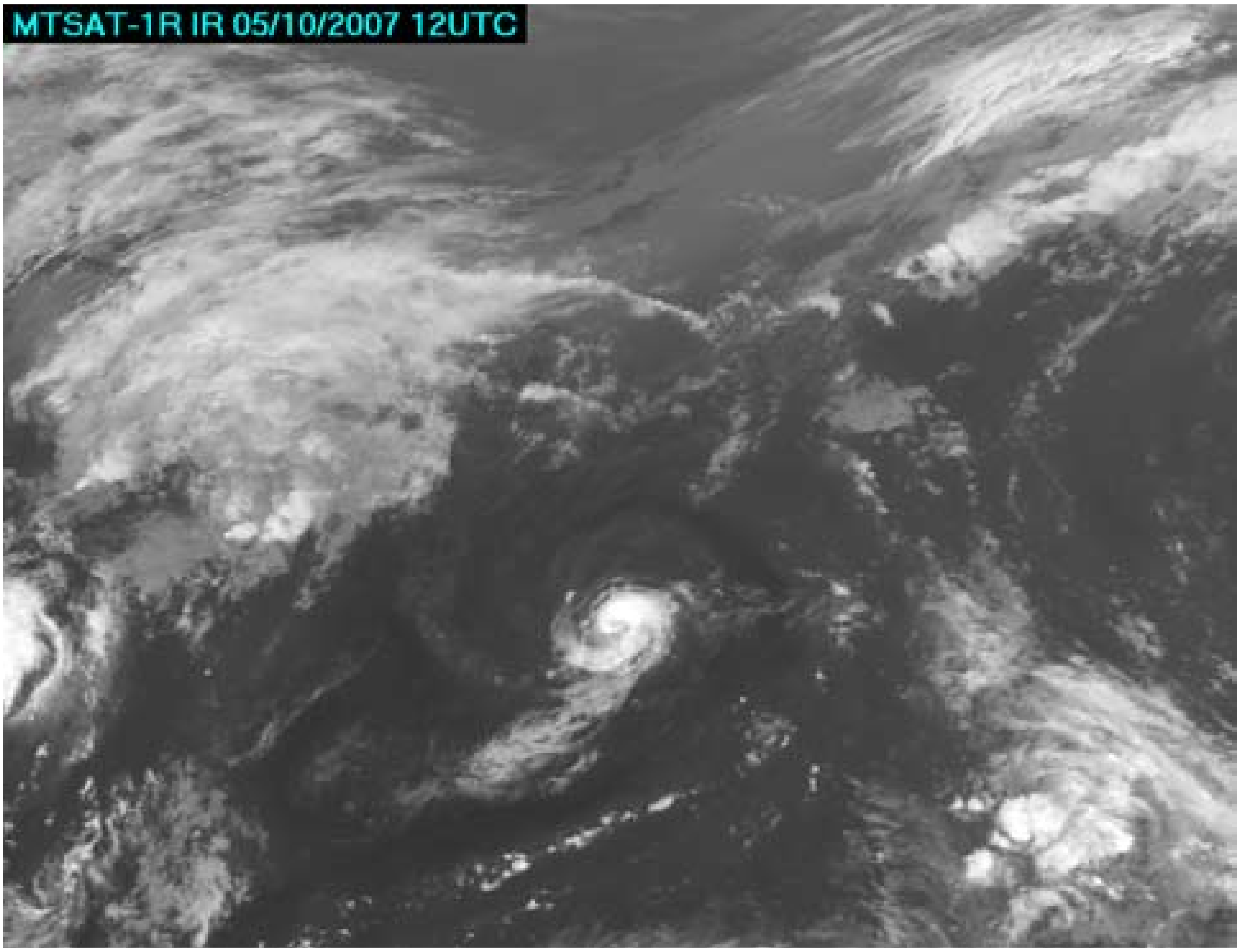


Figure 2.2.16a MTSAT - IR VS imagery of Haiyan (0716) at 12UTC on 05 October.
(Courtesy of Japan Meteorologyical Agency-JMA)

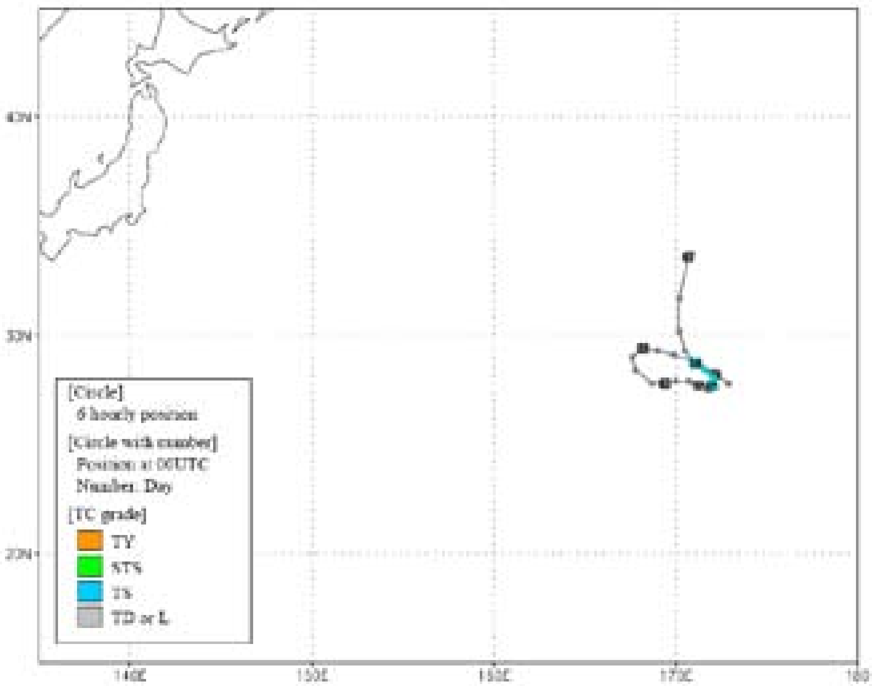


Figure 2.2.16b Track of Haiyan (0716).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.17 PODUL (0717)
3 October – 8 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	00UTC 03/10	06UTC 03/10
TS	00UTC 05/10	12UTC 03/10
STS	00UTC 06/10	
LOW	06UTC 07/10	-
DISSIPATED	00UTC 09/10	-

PODUL (0717) formed as a tropical depression over the western North Pacific around the Mariana Islands at 00UTC on 3 October and moved generally to the northeast, and then was upgraded into a tropical storm at 00UTC on 5 October. Moving northeastward, Podul further intensified into a severe tropical storm at 00UTC and attained its peak intensity with maximum wind of 102 km/h and a central pressure of 985 hPa at 06UTC on 6 October. As Podul continued to move northeastward, it transformed into an extra-tropical cyclone over the sea far east of Japan at 06 UTC on 7 October and then dissipated on 9 October.

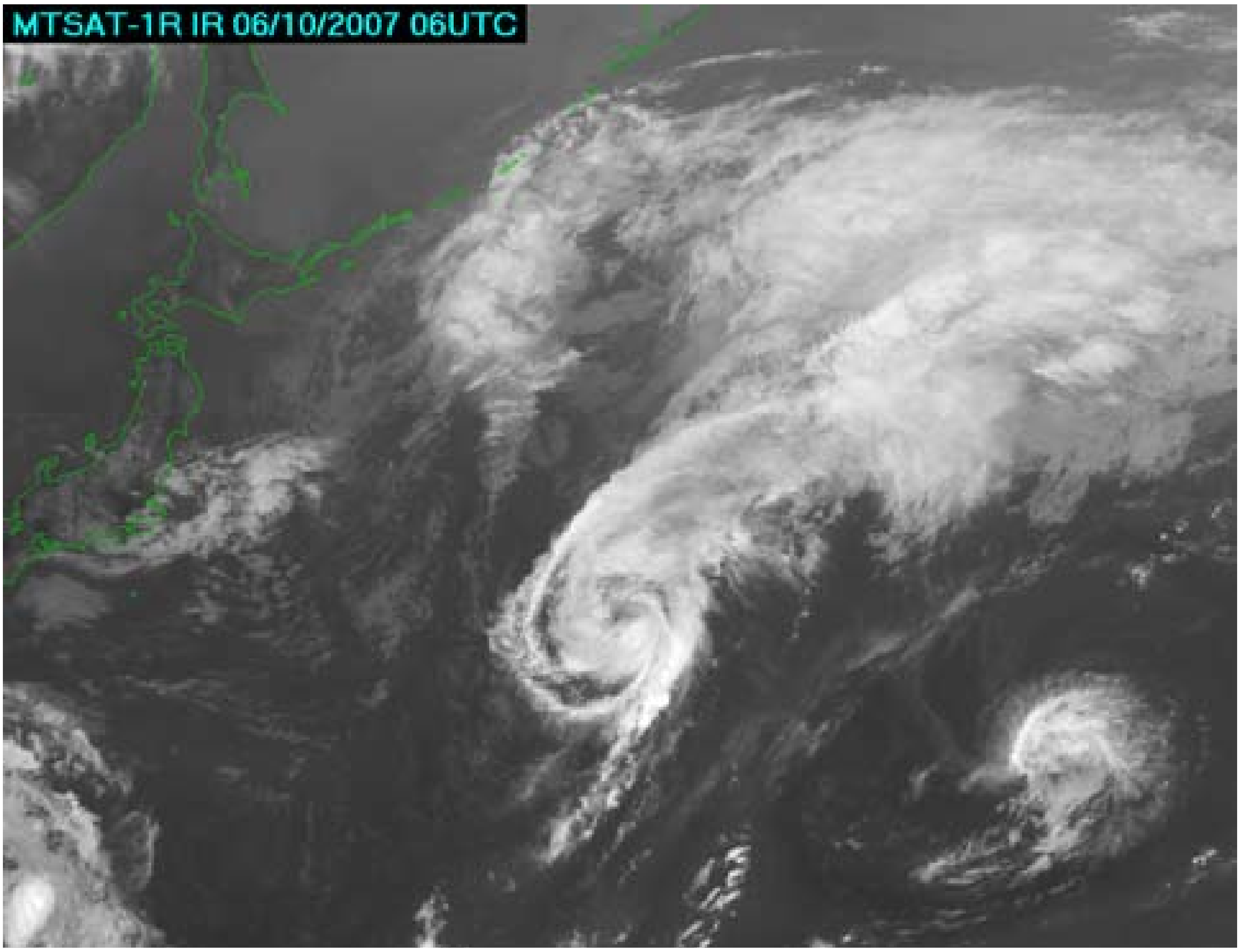


Figure 2.2.17a MTSAT - IR VS imagery of Podul (0717) at 06UTC on 06 October.
(Courtesy of Japan Meteorologyical Agency-JMA)

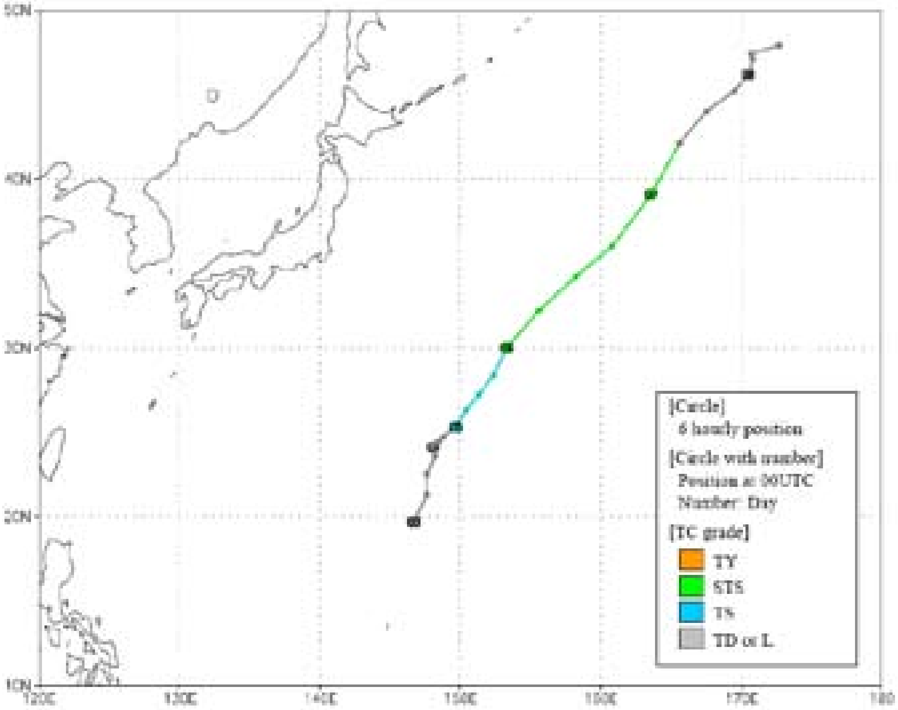


Figure 2.2.17b Track of Podul (0717).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.18 LINGLING (0718)
10 – 15 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 10/10	06UTC 11/10
TS	18UTC 11/10	00UTC 12/10
TD	-	18UTC 13/10
TS	-	06UTC 14/10
TD	-	00UTC 15/10
LOW	06UTC 15/10	-

LINGLING (0718) formed as a tropical depression over the sea east of Wake Island at 12UTC on 10 October 2007 and moved generally northwestwards. It intensified into a tropical storm at 18UTC the next day. Lingling attained its peak intensity with maximum wind of 83 km/h and a central pressure of 994 hPa at 12UTC on 12 October. Turning to move from northwestwards to northeastwards over the sea east of Japan, Lingling transformed into an extra-tropical cyclone at 06UTC on 15 October. Then it moved northeastward and crossed longitude 180 degrees east on the same day.

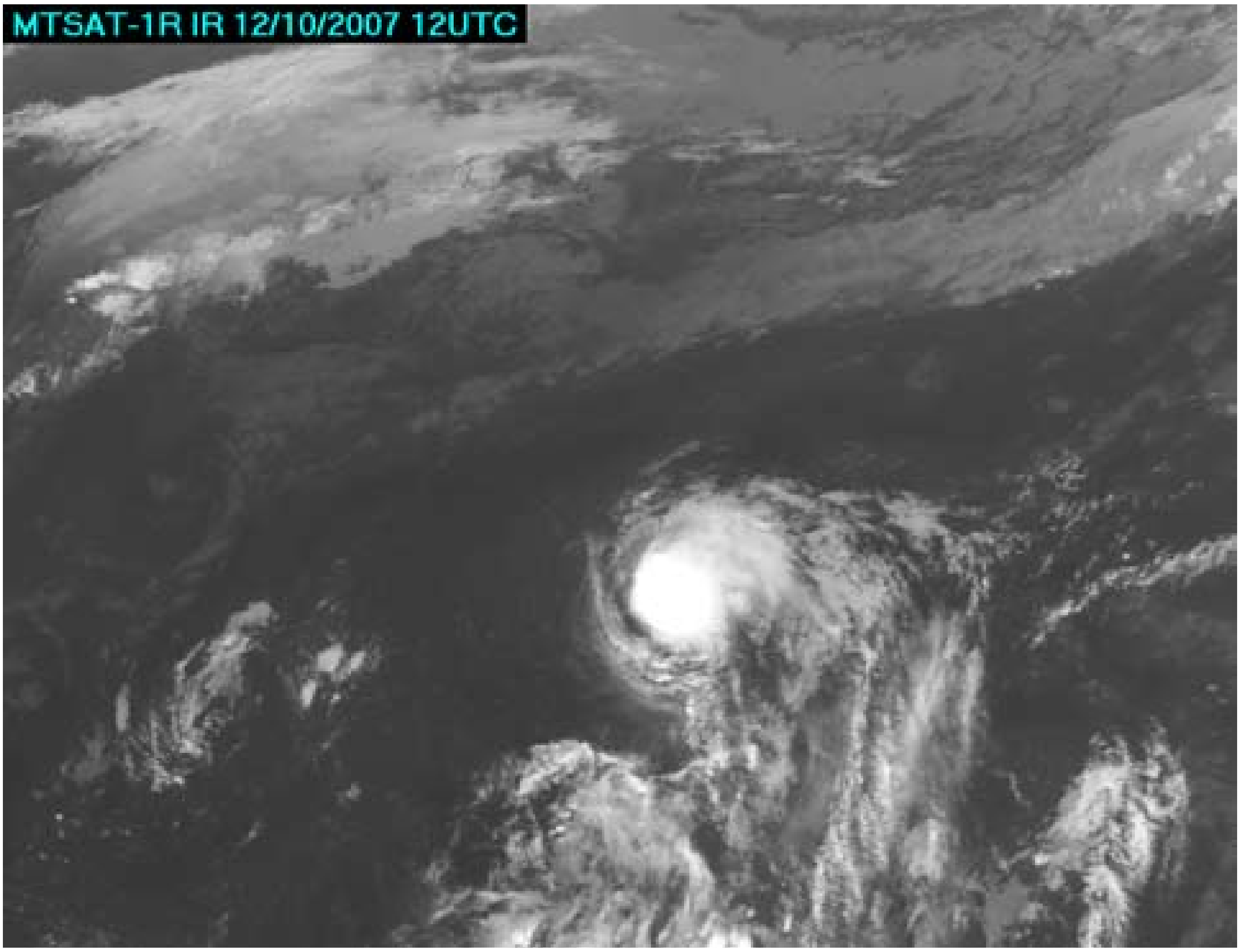


Figure 2.2.18a MTSAT - IR VS imagery of Lingling (0718) at 12UTC on 12 October.
(Courtesy of Japan Meteorologyical Agency-JMA)

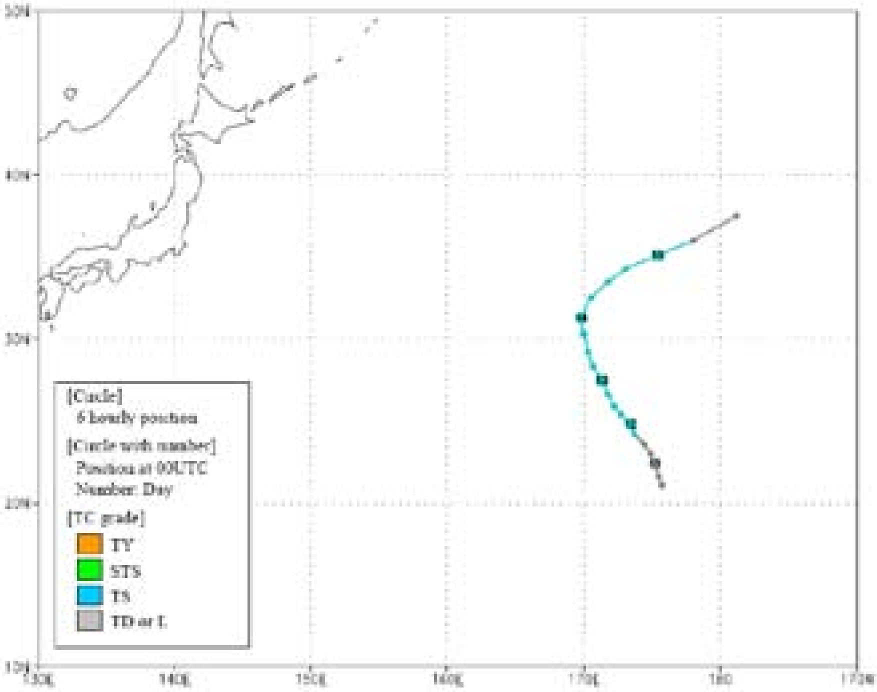


Figure 2.2.18b Track of Lingllng (0718).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.19 KAJIKI (0719)
18 – 23 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC18/10	12UTC 18/10
TS	00UTC 19/10	06UTC19/10
STS	12UTC19/10	18UTC 19/10
T	00UTC 20/10	00UTC 20/10
STS	18UTC 21/10	18UTC 21/10
LOW	06UTC 22/10	-

KAJIKI (0719) formed as a tropical depression over the western North Pacific around the northern part of the Mariana Islands at 12UTC on 18 October and moved generally northwestward. It intensified into a tropical storm at 00UTC and then a severe tropical storm at 12UTC on 19 October. Kajiki rapidly developed into a typhoon at 00UTC on 20 October and turned to move northwards. It attained its peak intensity with maximum wind of 167 km/h and a central pressure of 945 hPa at 18UTC on 20 October. It moved over the sea east of Japan and gradually turned to move eastwards and weakened into a severe tropical storm at 18UTC on 21 October. Later, Kajiki became an extra-tropical cyclone far east of Japan on 22 October.

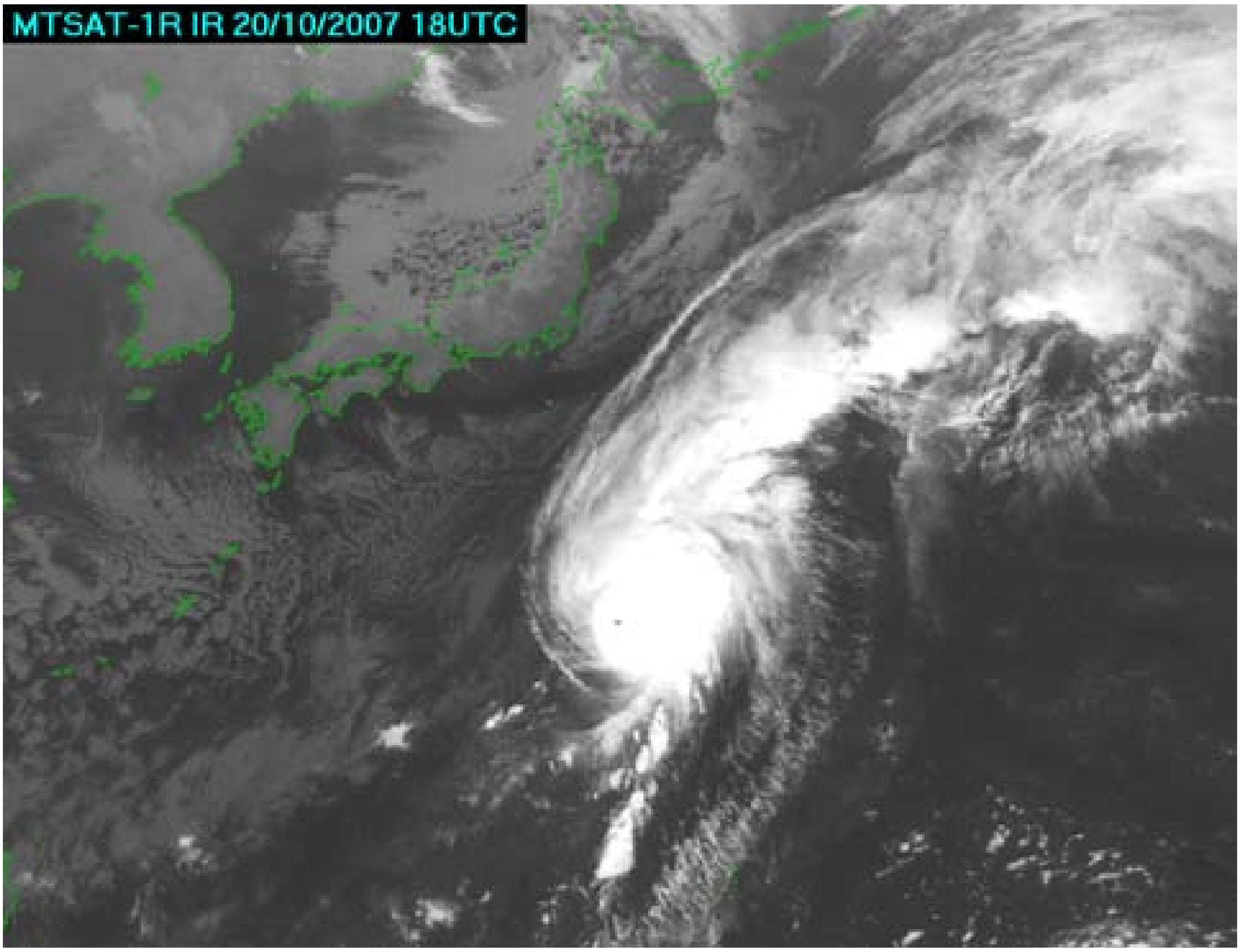


Figure 2.2.19a MTSAT - IR VS imagery of Kajiki (0719) at 18UTC on 20 October.
(Courtesy of Japan Meteorologyical Agency-JMA)

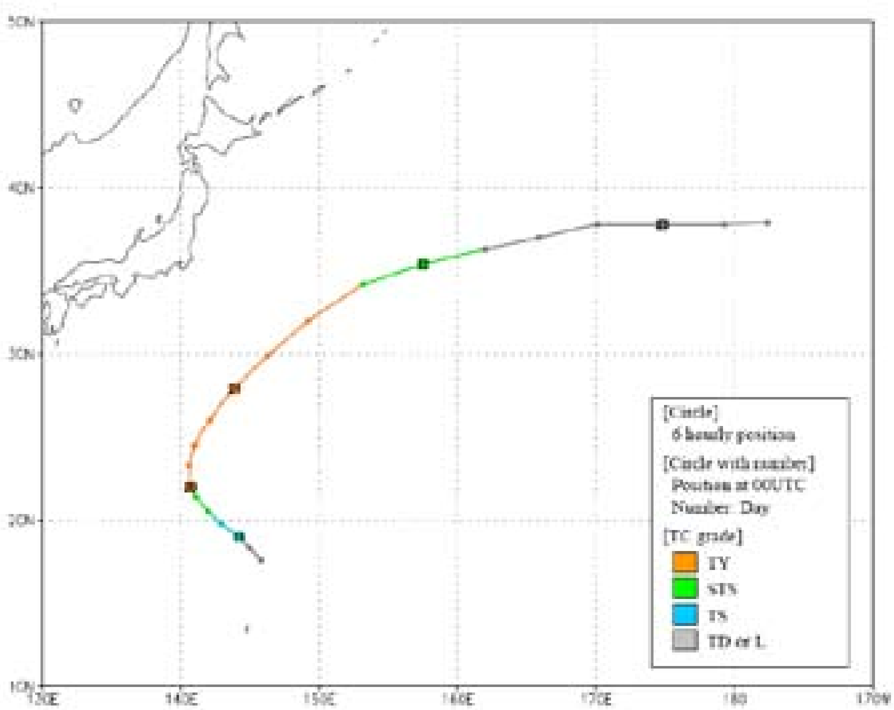


Figure 2.2.19b Track of Kajiki (0719).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.20 FAXAI (0720)
25 – 28 October

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	06UTC 25/10	06UTC 25/10
TS	00UTC 26/10	06UTC 26/10
STS	12UTC 26/10	00UTC 27/10
TS	-	12UTC 27/10
LOW	12UTC 27/10	-

FAXAI (0720) formed as a tropical depression over the sea east of the Philippines at 06UTC on 25 October and moved northwestwards. It intensified into tropical storm at 00UTC the next day and turned to move northwards. Turning to the northeast and accelerating, Faxai further intensified into a severe tropical storm at 12UTC on the same day. It attained its peak intensity with maximum wind of 102 km/h and a central pressure of 975 hPa at 00UTC on 27 October. Keeping its northeastward track, Faxai passed around the Izu Islands and then became an extra-tropical cyclone over the sea east of Japan at 12UTC on 27 October.

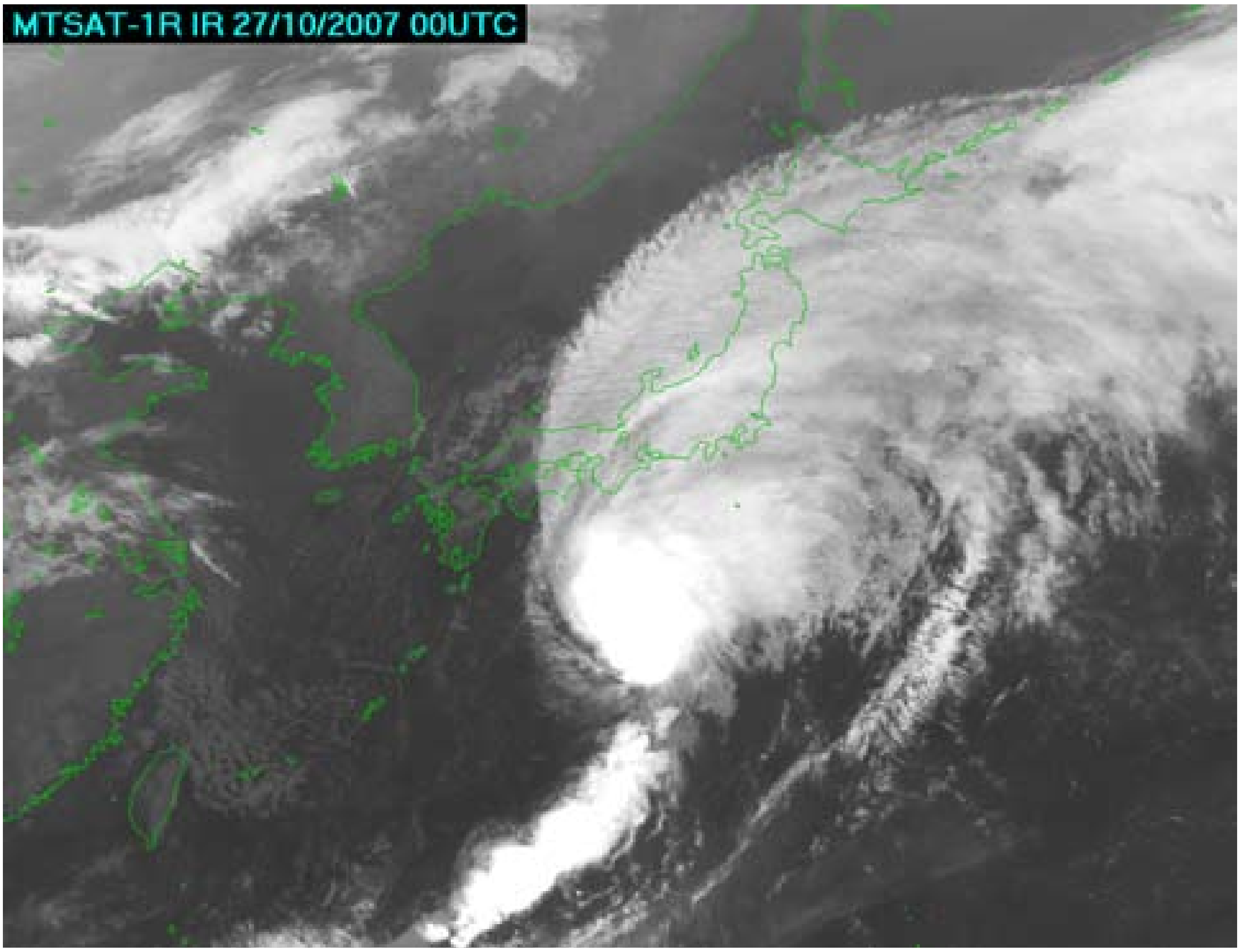


Figure 2.2.20a MTSAT - IR VS imagery of Faxai (0720) at 00UTC on 27 October.
(Courtesy of Japan Meteorologyical Agency-JMA)

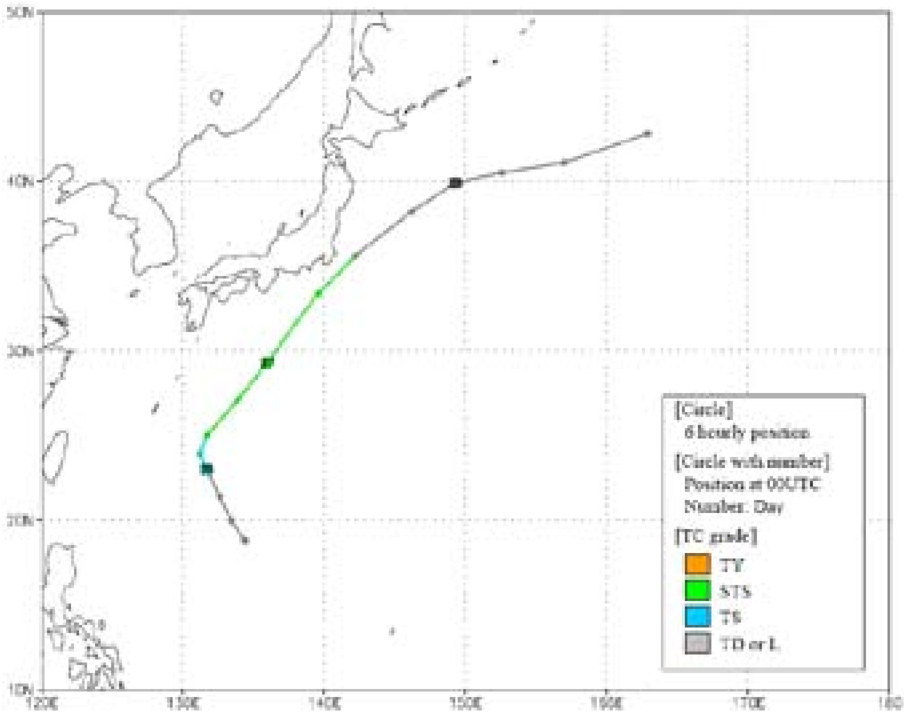


Figure 2.2.20b Track of Faxai (0720).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.21 PEIPAH (0721)
1 November – 10 November

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 01/11	06UTC 03/11
TS	12UTC 03/11	18UTC 03/11
STS	00UTC 04/11	06UTC 04/11
TS	06UTC 05/11	-
STS	12UTC 05/11	-
T	06UTC 06/11	06UTC 06/11
STS	06UTC 07/11	06UTC 07/11
TS	18UTC 07/11	12UTC 07/11
TD	18UTC 08/11	00UTC 09/11

PEIPAH (0721) formed as a tropical depression over the sea east of Philippines at 18UTC on 1 November 2007 and moved westwards. It intensified into a tropical storm at 12UTC on 3 November. Keeping its westward track, it was upgraded to a severe tropical storm at 00UTC on 4 November and crossed Luzon. Peipah caused 7 deaths in Philippines. Then it entered the South China Sea on 5 November and weakened to a tropical storm at 06UTC. Then Peipah slowed down and intensified again into a typhoon at 06UTC on 6 November. It attained its peak intensity with maximum wind of 130 km/h and a central pressure of 970 hPa at 12UTC on 6 November. Peipah turned to move southwestwards and weakened into a tropical storm at 18UTC on 7 November. After weakening into a tropical depression at 18UTC on 8 November, it hit the southern part of Vietnam on 10 November and then dissipated at 18UTC the same day.

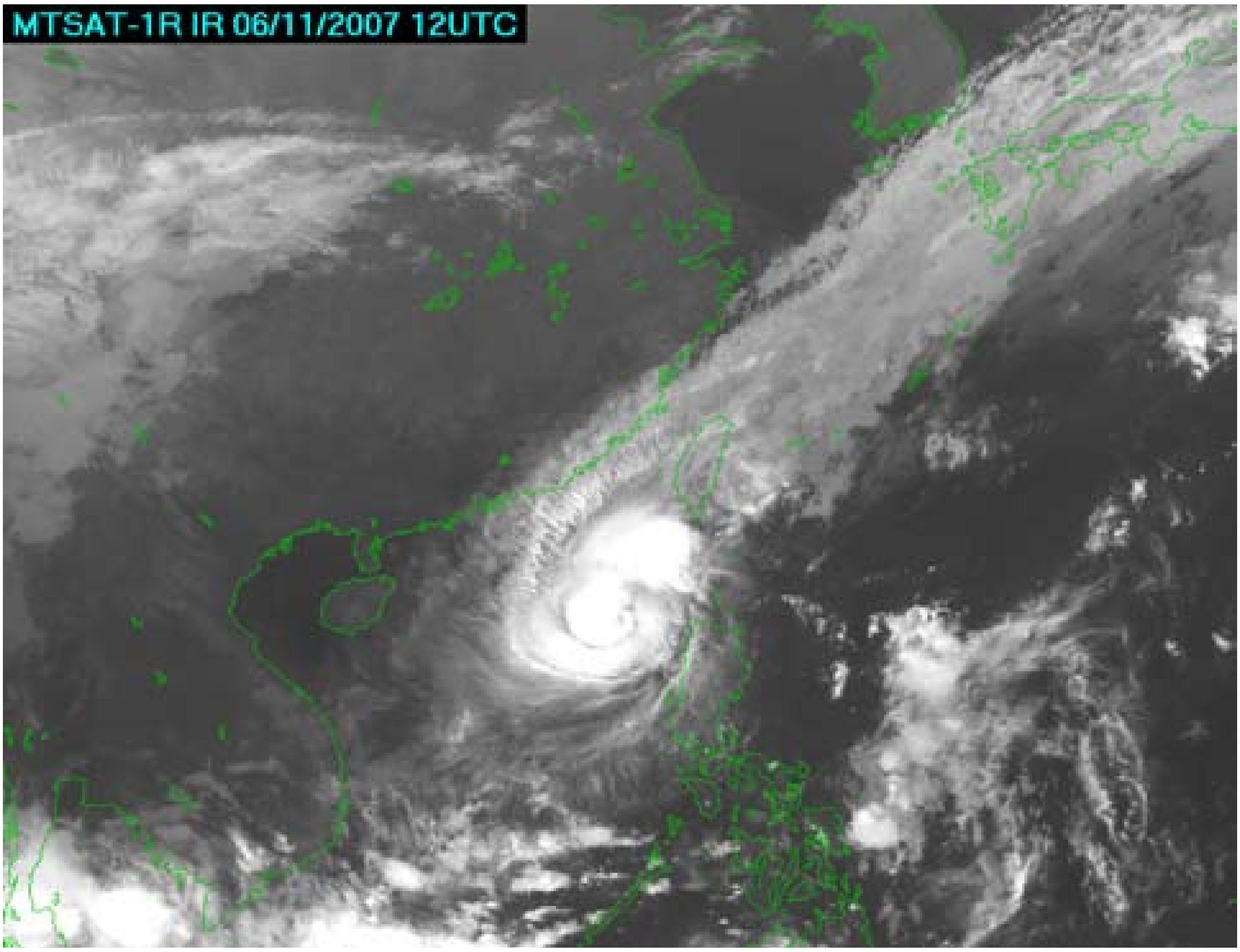


Figure 2.2.21a MTSAT - IR VS imagery of Peipah (0721) at 12UTC on 06 November.
(Courtesy of Japan Meteorologyical Agency-JMA)

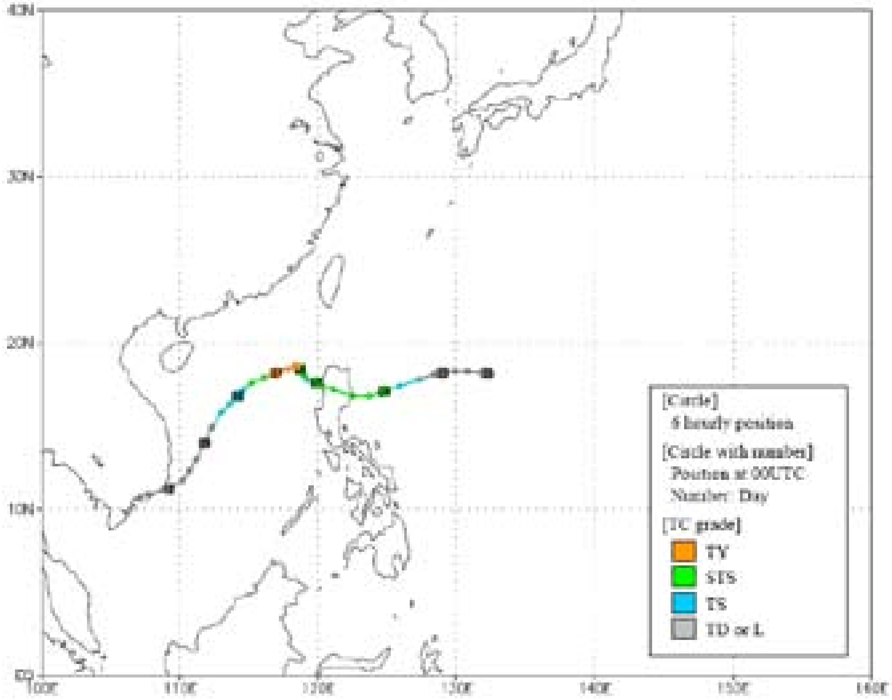


Figure 2.2.21b Track of Peipah (0721).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.22 TAPAH (0722)
11 – 13 November

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	12UTC 11/11	12UTC 11/11
TS	00UTC 12/11	00UTC 12/11
TD	00UTC 13/11	18UTC 112/11
DISSIPATED	06UTC 13/11	-

TAPAH (0722) formed as a tropical depression over the sea south of Iwojima Island at 12UTC on 11 November and moved generally northeastwards. It intensified into a tropical storm at 00UTC and attained its peak intensity with the maximum sustained wind of 65 km/h and central pressure of 996 hPa at 06UTC on 12 November. Tapah weakened into a tropical depression at 18 UTC the same day and then dissipated over the sea north of Minamitorishima on 13 November.

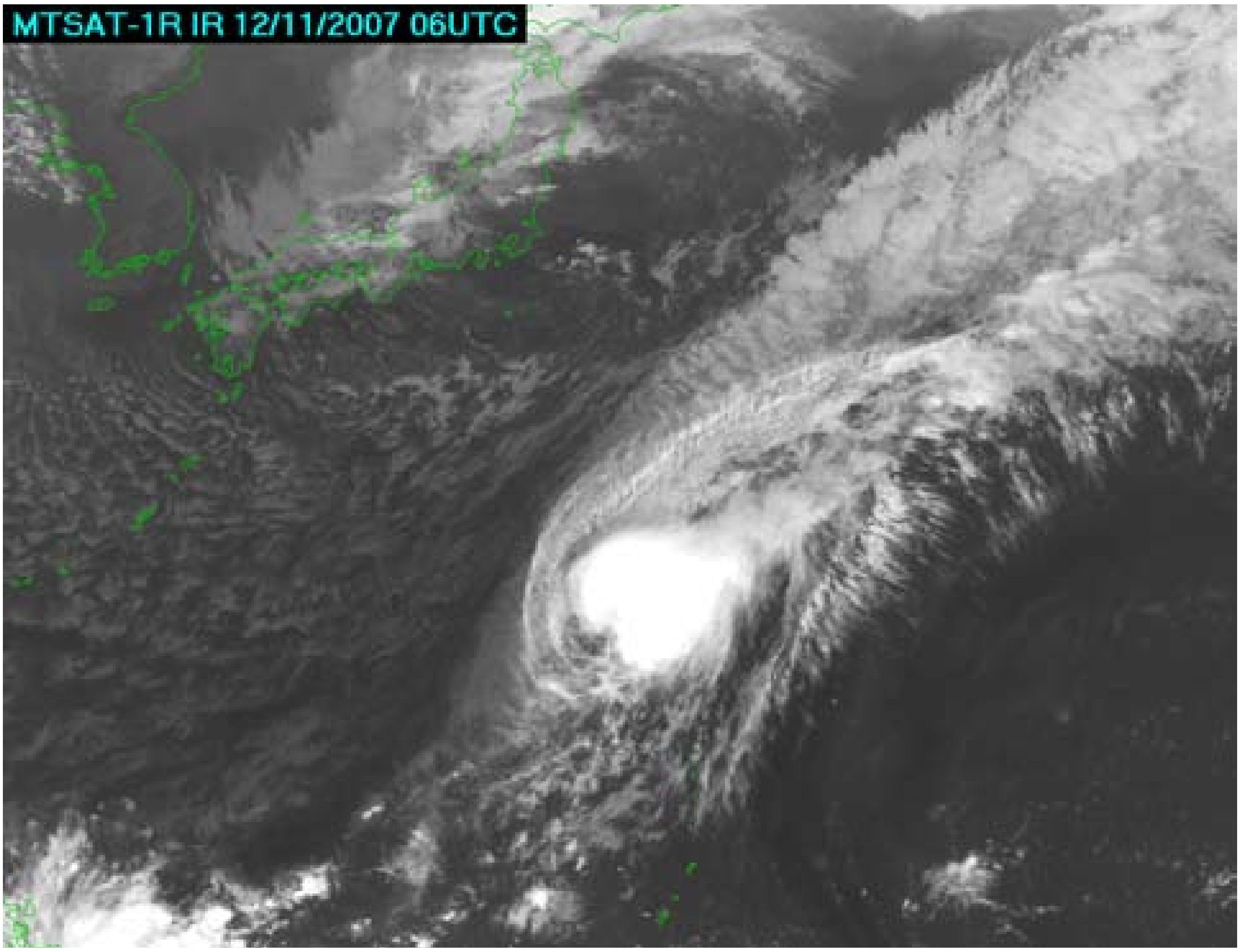


Figure 2.2.22a MTSAT - IR VS imagery of Tapah (0722) at 06UTC on 12 November.
(Courtesy of Japan Meteorologyical Agency-JMA)

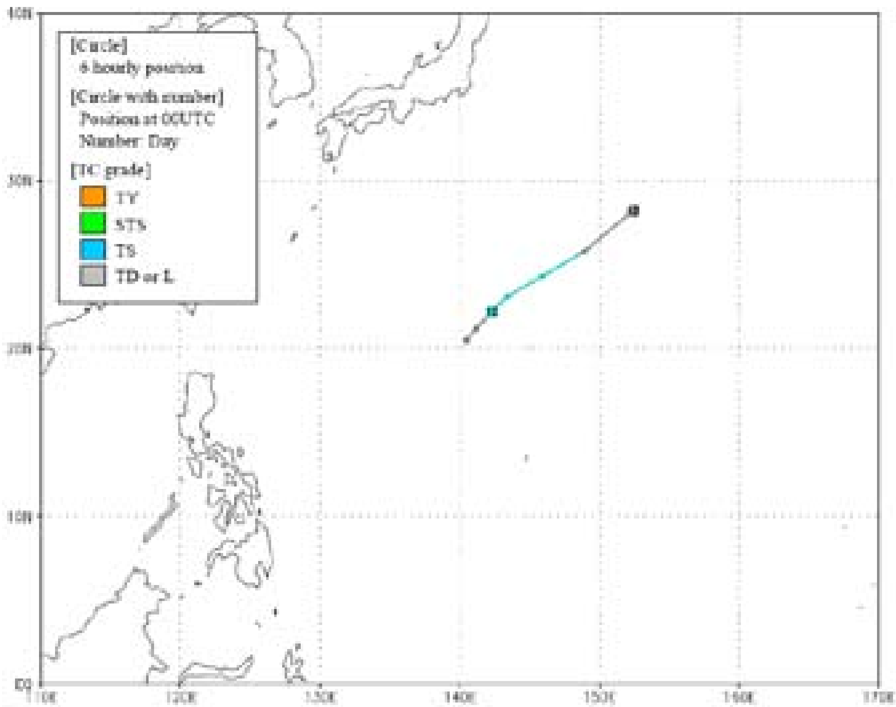


Figure 2.2.22b Track of Tapah (0722).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.23 MITAG (0723)
19 – 27 November

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 19/11	06UTC 2011
TS	12UTC 20/11	00UTC 21/11
STS	12UTC 21/11	18UTC 21/11
T	00UTC 22/11	06UTC 22/11
STS	00UTC 26/11	00UTC 27/11
TS	18UTC 26/11	06UTC 27/11
TD	12UTC 27/11	18UTC 27/11
DISSIPATED	18UTC 27/11	-

MITAG (0723) formed as a tropical depression over the sea east of the Philippines at 18UTC on 19 November and moved generally west-northwestwards. It developed into a tropical storm at 12UTC on 20 November. Keeping its westerly track, it intensified into a typhoon at 00UTC and attained the peak intensity with maximum sustained wind of 148 km/h and central pressure of 955 hPa at 12UTC on 22 November. It turned to move northwest on 23 November and crossed Luzon on 26 November then moved northwestwards. Mitag caused 3.8 million US dollars worth of damage to farmlands, houses and infrastructure and killed at least 12 people in the Philippines. It gradually weakened into severe tropical storm at 00UTC, then a tropical storm at 18UTC on the same day. It was downgraded to a tropical depression at 12UTC and then dissipated on 27 November.

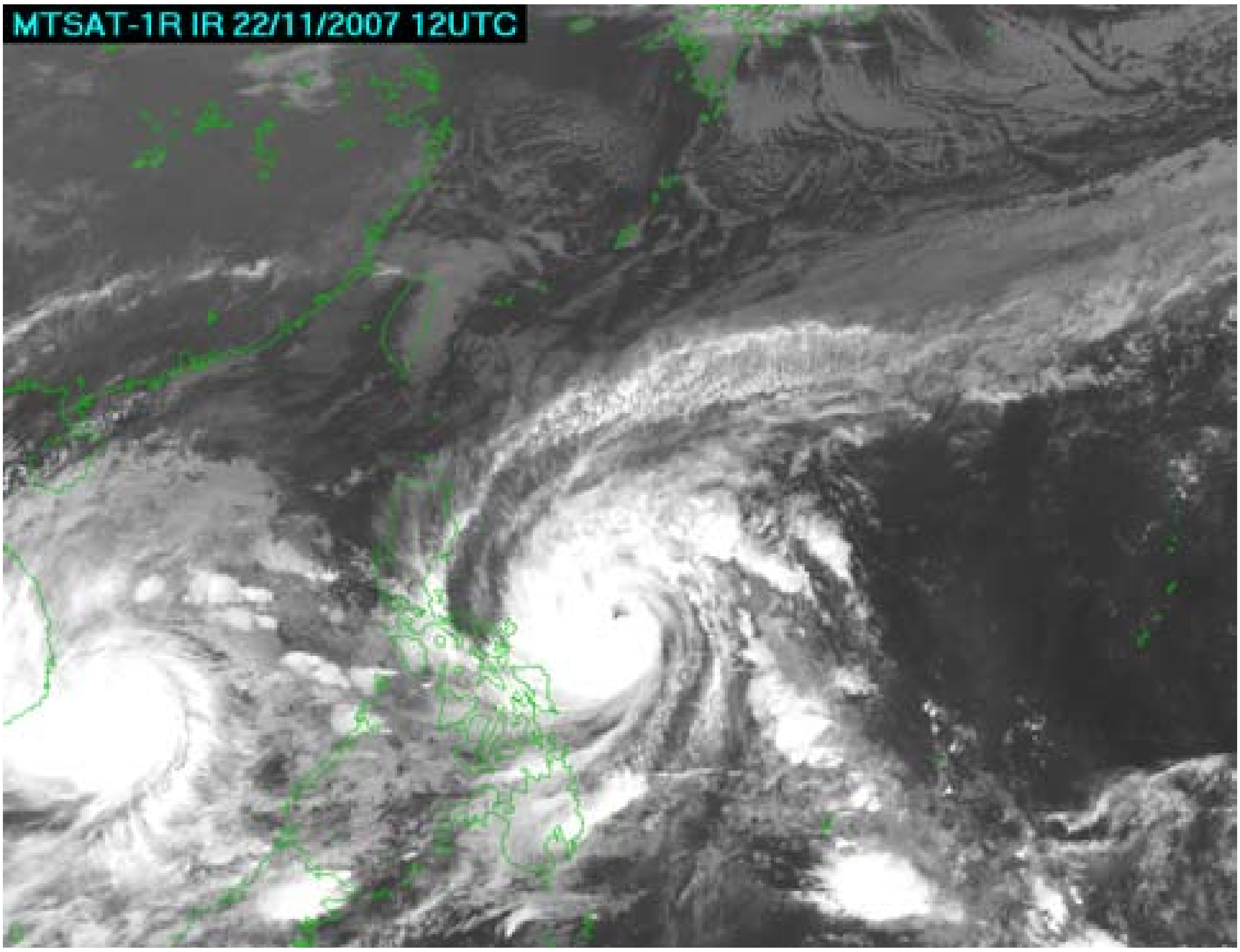


Figure 2.2.23a MTSAT - IR VS imagery of Mitag (0723) at 12UTC on 22 November.
(Courtesy of Japan Meteorologyical Agency-JMA)

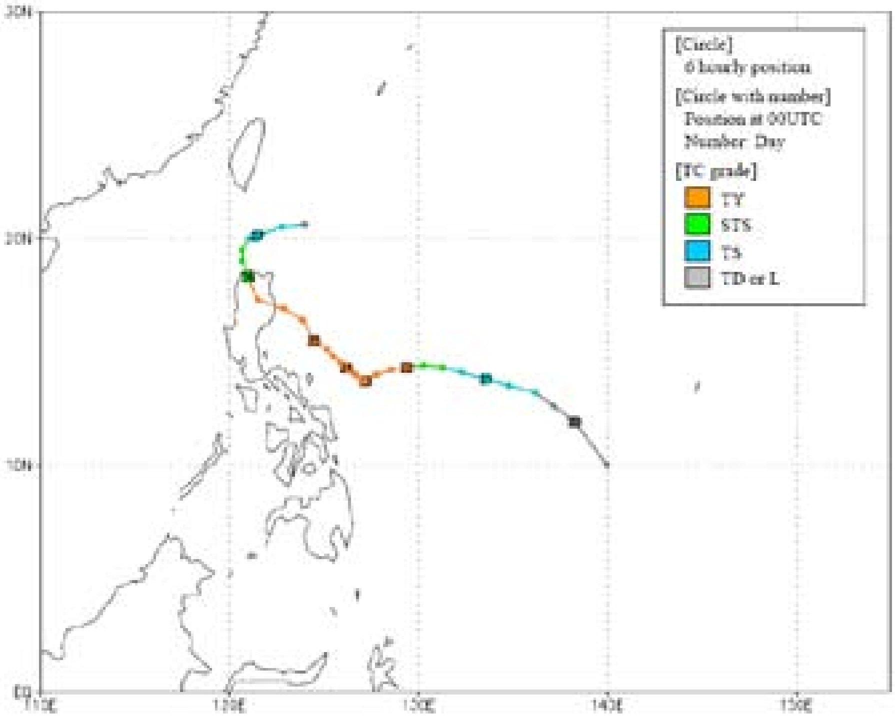


Figure 2.2.23b Track of Mitag (0723).
(Courtesy of Japan Meteorologyical Agency-JMA)

2.2.24 HAGIBIS (0724)
18 – 27 November

Stage	Times from Available Post Analysis	
	JAPAN	HONG KONG
TD	18UTC 18/11	12UTC 20/11
TS	18UTC 20/11	00UTC 21/11
STS	12UTC 21/11	18UTC21/11
T	00UTC 22/11	-
STS	18UTC 23/11	-
TS	00UTC 25/11	00UTC 25/11
TD	12UTC 27/11	00UTC 28/11
LOW	00UTC 28/11	-

HAGIBIS (0724) formed as a tropical depression over the sea east of Mindanao Island at 18UTC on 18 November and moved westward to cross the Philippines on 19 November. It intensified into tropical storm at 18UTC on 20 November, then severe tropical storm at 12UTC on 21 November. After turning to the west-northwest, it intensified further into a typhoon at 00UTC at attained its peak intensity with maximum sustained wind of 130 km/h and a central pressure of 970 hpa at 06UTC on 22 November. Hagibis turned to move to the east on 23 November and then weakened into tropical storm at 00UTC on 25 November. After crossing the central Philippines on 27 November, it weakened into a tropical depression at 12UTC on 27 November and dissipated over the sea east of Luzon the next day. In the Philippines, 14 people were killed under the influence of Hagibis.

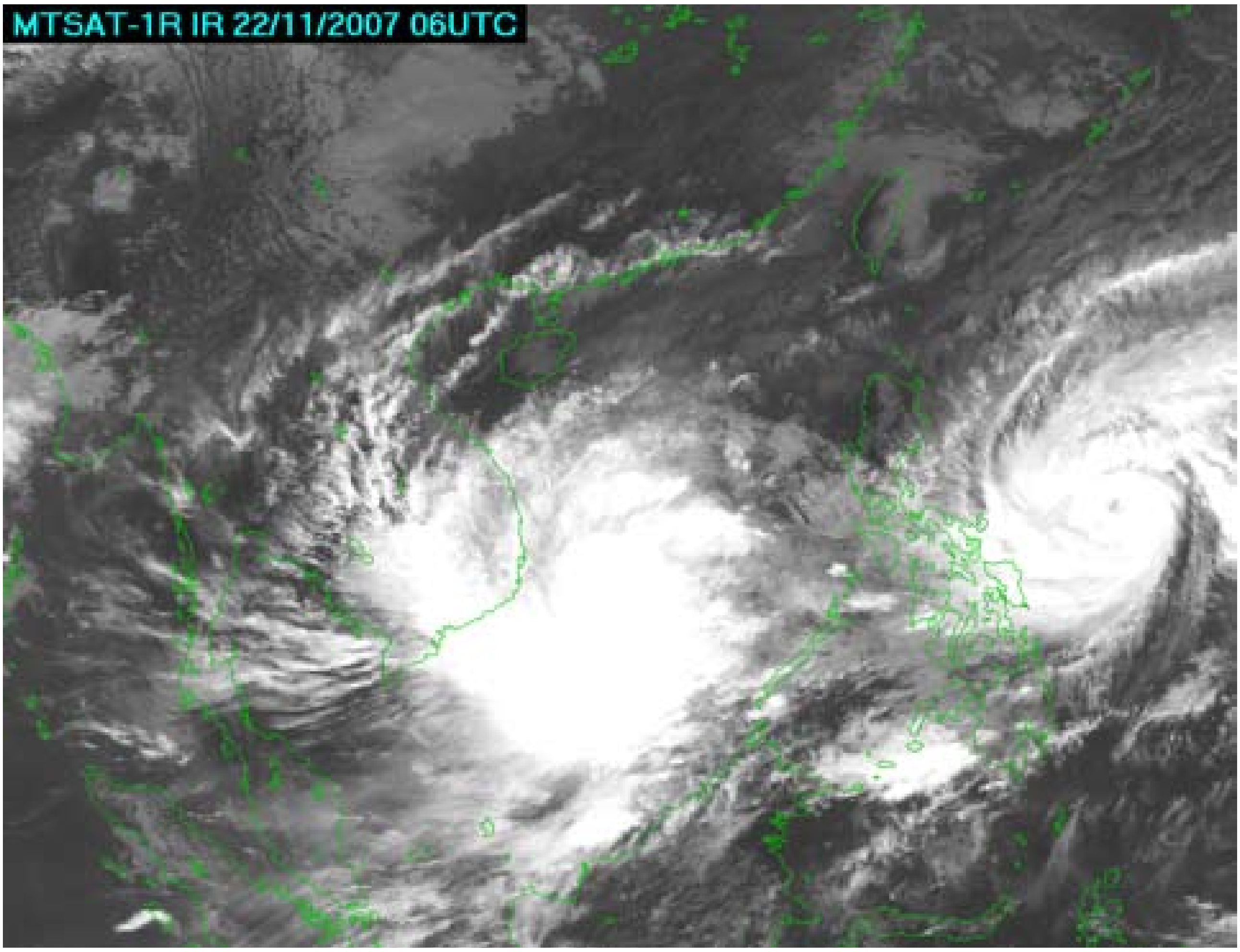


Figure 2.2.24a MTSAT - IR VS imagery of Hagibis (0724) at 06UTC on 22 November.
(Courtesy of Japan Meteorologyical Agency-JMA)

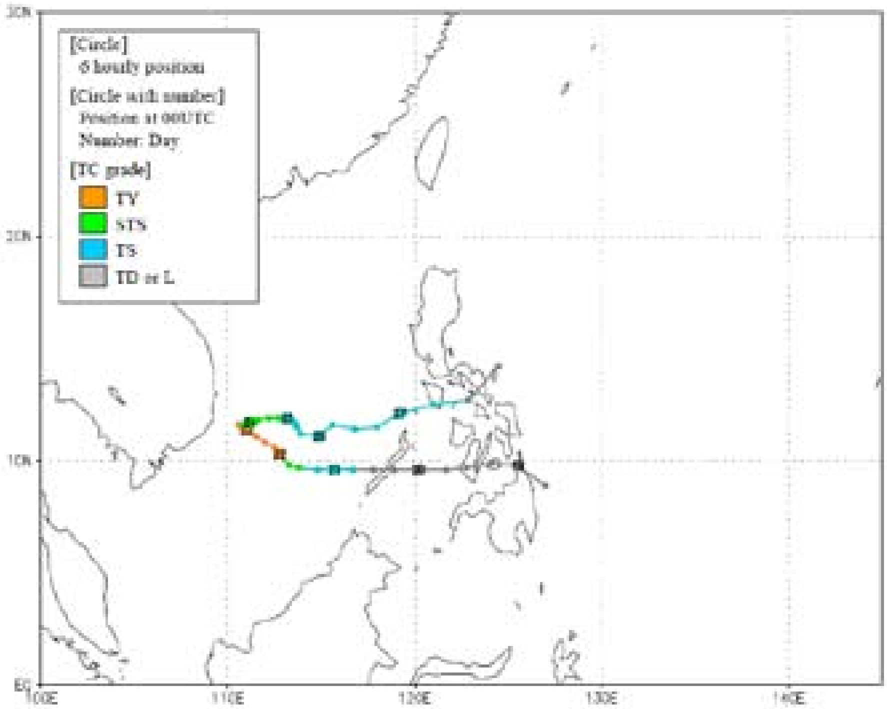
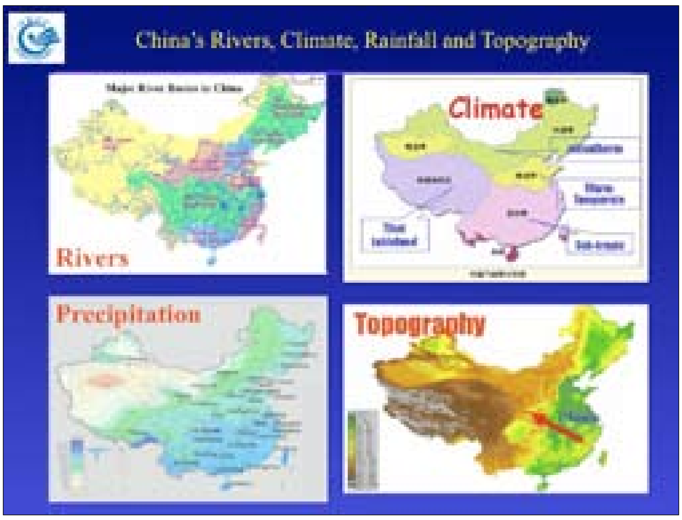
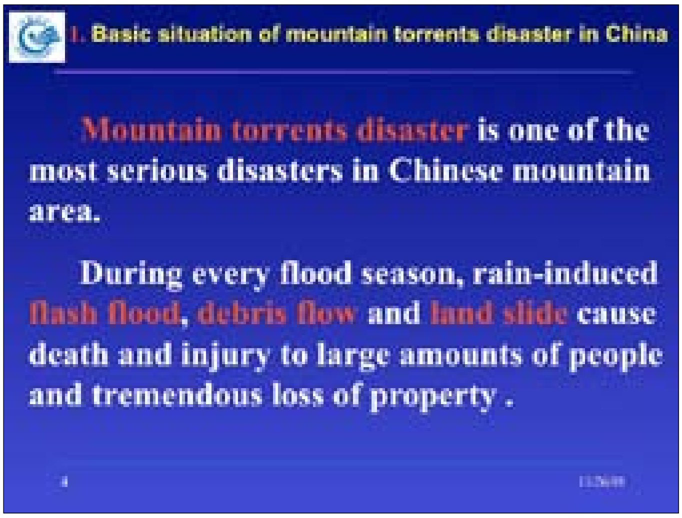


Figure 2.2.24b Track of Hagibis (0724).
(Courtesy of Japan Meteorologyical Agency-JMA)

Mountain Torrents Disaster and Mountain Flood Monitoring and Warning System in China

LIU Zhiyu
Bureau of Hydrology, Ministry of Water Resources of China



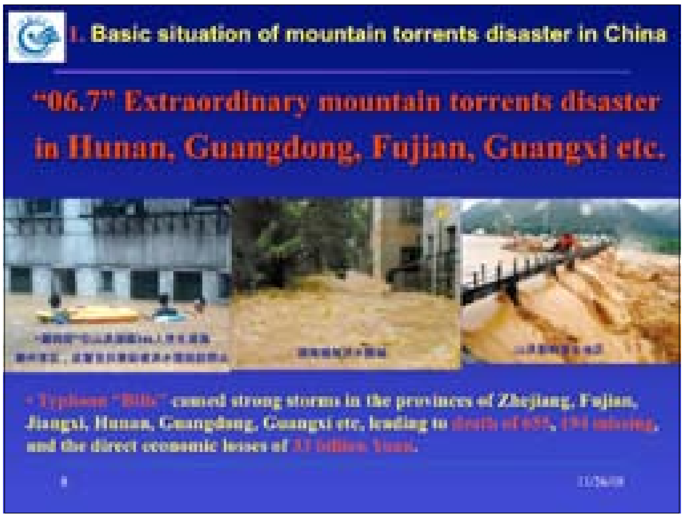


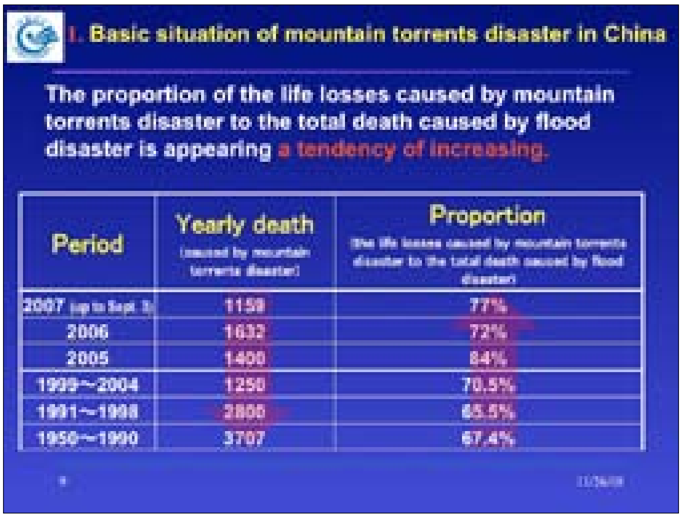

1. Basic situation of mountain torrents disaster in China
"02.6" Extraordinary mountain flood in Foping
• Disastrous rain storm occurred on 10 June, 2002 in counties of Foping and Ningshan, Southern Shanxi; Max. daily P 489mm for Foping (1000-year).
• 455 people lost their lives or were missing due to flash flood and debris flow.
11/26/08


1. Basic situation of mountain torrents disaster in China
"04.9" Great mountain torrents disaster in Sichuan, Chongqing
• Catastrophic storm hit Sichuan and Chongqing in early September 2004.
• 233 people died or were missing in the the rain-induced mountain torrents disaster.
6
11/26/08


1. Basic situation of mountain torrents disaster in China
"04.9" Great mountain torrents disaster in Sichuan, Chongqing
• Catastrophic storm hit Sichuan and Chongqing in early September 2004.
• 233 people died or were missing in the the rain-induced mountain torrents disaster.
6
11/26/08


1. Basic situation of mountain torrents disaster in China
"05.6" Extraordinary flash flood
in Shalan Town, Heilongjiang
• On June 10, 2005, a 200-year rain storm attacked Shalan river in Heilongjiang Province, which caused a catastrophic flash flood in Shalan Town, Ning'an County, 117 people died, including 105 pupils, and the direct loss was roughly estimated to hit US$. 17.6 million
7
11/26/08


1. Basic situation of mountain torrents disaster in China
"06.7" Extraordinary mountain torrents disaster in Hunan, Guangdong, Fujian, Guangxi etc.
• Typhoon "Bilis" caused strong storms in the provinces of Zhejiang, Fujian, Jiangxi, Hunan, Guangdong, Guangxi etc, leading to death of 655, 194 missing, and the direct economic losses of 33 billion Yuan.
8
11/26/08


1. Basic situation of mountain torrents disaster in China
The proportion of the life losses caused by mountain torrents disaster to the total death caused by flood disaster is appearing a tendency of increasing.
Period
Yearly death
(caused by mountain torrents disaster)
Proportion
(the life losses caused by mountain torrents disaster to the total death caused by flood disaster)
2007 (up to Sept. 3) | 1159 | 77%
2006 | 1632 | 72%
2005 | 1400 | 84%
1999~2004 | 1250 | 70.5%
1991~1998 | 2800 | 65.5%
1950~1990 | 3707 | 67.4%
9
11/26/08

2. Causing-factors of mountain torrents disaster

Based on the actuality of mountain torrents disaster in China, considering of physical factor and social factor, it was found that three major factors which cause Chinese mountain torrents disaster that is rain-storm, geological and topographical condition, and mans activity.

2. Causing-factors of mountain torrents disaster

(1) Rainstorm

Rainfall, especially the heavy and long duration is the domain element which cause mountain flood.

Mountain floods occur in east monsoon area account for [illegible] of the total: flash flood 76%, debris flow 77%, landslide 88%.

2. Causing-factors of mountain torrents disaster

Rain intensity:

High-intensity rain is one of the major causes of the mountain flood.

- July 1954, Baoguidong of Linyang, 24h P412.5mm, dam-breach flood.
- debris flow in western Sichuan, 1h P≈ 30mm,10min P ≈ 10mm; In Hunan, over 50mm/h and is related with API.
- On 14 June 1998, P=245.4mm, led to land slides in Maling, yanjiangwan and Dazhou power in western Hunan.

2. Causing-factors of mountain torrents disaster

Rain duration:

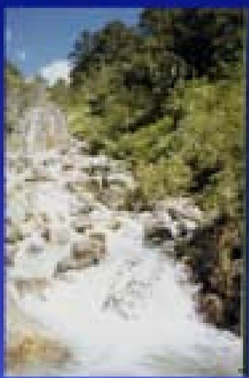
The occurrence of landslide disaster is much concerned in rain duration, and there is a general lag-off of landslide to rainstorm.

- According to the statistics of over [illegible] landslide events observed in the Three Gorges area since July 1982, the landslide generally happened [illegible] behind of rainstorm; the landslides occurred within 24 hours of rainstorm account for 16%, while those occurred after [illegible] hours of rainstorm account for 77%.

2. Causing-factors of mountain torrents disaster

(2) geological and topographical factors

- physiognomy type
- Roughness of the Ground-surface
- Geological structure
- Lithology of rock



2. Causing-factors of mountain torrents disaster

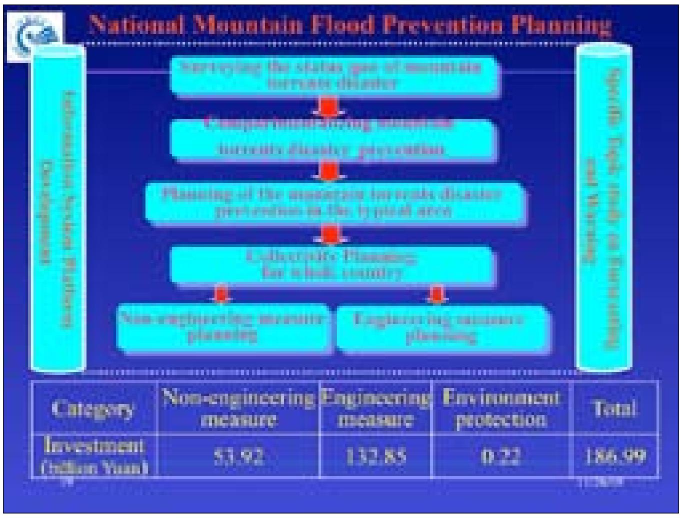
(3) Socio-economical factors (man activity)

- Unreasonable Development and Utilization of Natural Resources
- Unreasonable house building
- Unreasonable development of towns
- Reservoirs/dam breach


2. Causing-factors of mountain torrents disaster
Characteristics of mountain flood:
➢ wide-range distribution
➢ frequent happening
➢ sudden appearance
➢ hard to predict and prevent
➢ seasonally and regionally occurrence
➢ disaster fast and disastrous consequence


3. Countermeasures to mountain flood Prevention
Improvement of the legal framework
➢ Regulation on the Prevention and Control of Geologic Disasters, 2004
➢ Water Law, 1988, 2002;
➢ Flood Control Law, 1998;
➢ Law of Soil Water Conservation, 1991;
➢…


3. Countermeasures to mountain flood Prevention
National plans for mountain flood prevention have been approved
➢National Mountain Flood Prevention Planning was approved by the state council in Nov., 2006
➢National Emergency Plan for Flood Control and Drought Relief, 2005
➢Emergency plans for preventing floods and flood regulation for major rivers, 2005
➢…


National Mountain Flood Prevention Planning
Category | Non-engineering measure | Engineering measure | Environment protection | Total
Investment (billion Yuan) | 53.92 | 132.85 | 0.22 | 186.99

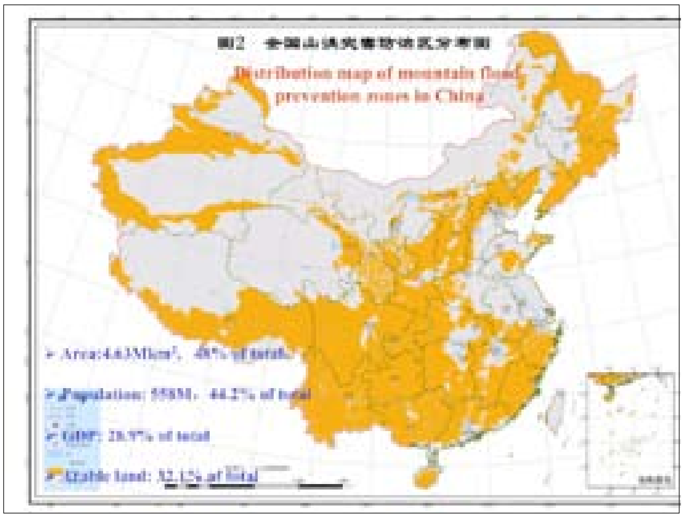
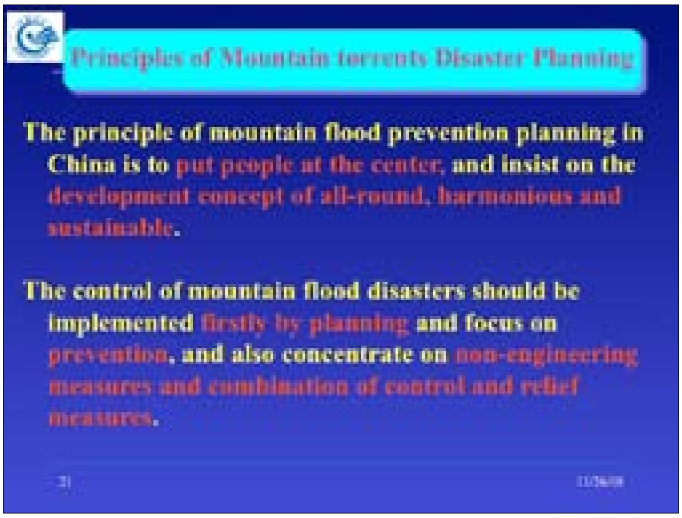


图2 全国山洪灾害防治区分布图
Distribution map of mountain flood prevention zones in China
➢ Area: 4.63Mkm², 48% of total
➢ Population: 558M, 44.2% of total
➢ GDP: 28.9% of total
➢ Arable land: 32.1% of total


Principles of Mountain torrents Disaster Planning
The principle of mountain flood prevention planning in China is to put people at the center, and insist on the development concept of all-round, harmonious and sustainable.
The control of mountain flood disasters should be implemented firstly by planning and focus on prevention, and also concentrate on non-engineering measures and combination of control and relief measures.

Non-engineering Structures Planning:

- Propaganda Education of Disaster Prevention Knowledge
- Monitoring, Communication and Warning System
- Disaster Prevention Pre-scheme and rescue measures
- Migration and Avoiding
- Policy and Regulation Development
- Disaster Prevention Management

Engineering Planning:

- Flash flood gully control works
- Debris flow gully erosion control works
- Landslides control works
- Dangerous reservoir's Stabilization for danger release
- Soil and water conservation

Mountain torrents Disaster Monitoring Plan

1) Meteorological monitoring system plan

- Auto meteorological monitoring network: 3886 new stations. The space would reach 20~40km in key prevention areas, 40~60km in other areas.
- Weather radar station: 44 new stations in eastern monsoon area to over 200 totally in all over the country
- Thunder orientation monitoring station: 118 new up to 162 totally
- EOS ground station: 11 new stations in key prevention areas
- Stationary weather Satellite ground stations: 225 new stations
- Wind monitoring: 69 new stations

Mountain torrents Disaster Monitoring Plan

2) Hydrological monitoring system plan

- River flow monitoring: newly-built 1345 stations. The density of river monitoring would reach 300~1000km2 per station in eastern key prevention area, 1000~2000km2 in other key prevention area.
- Rainfall monitoring: newly-built 8735 rainfall stations up to totally 23590 in the country.

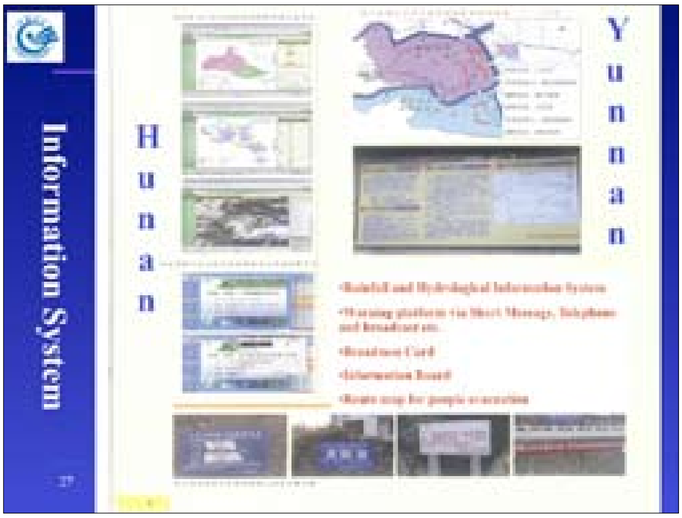
3) Disaster monitoring plan

- Early warning system: cover 16380 villages.
- Disaster monitoring: 1926 debris flow and mud flow sites and 2676 landslide prone areas would be monitored.

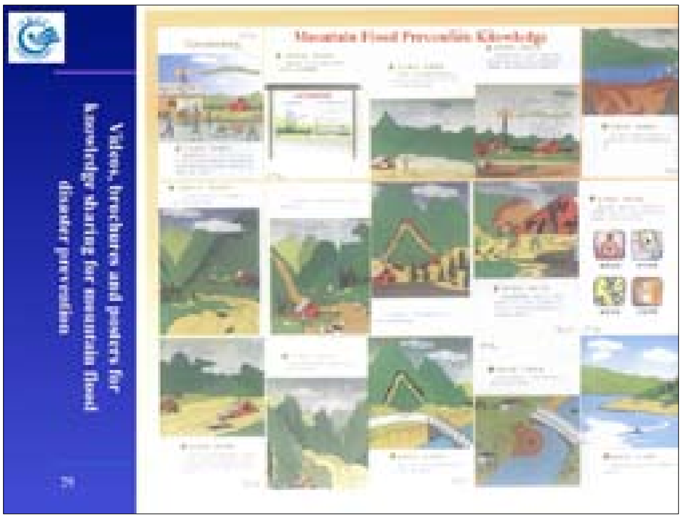
Mountain Torrents Disaster Prevention Pilot Study

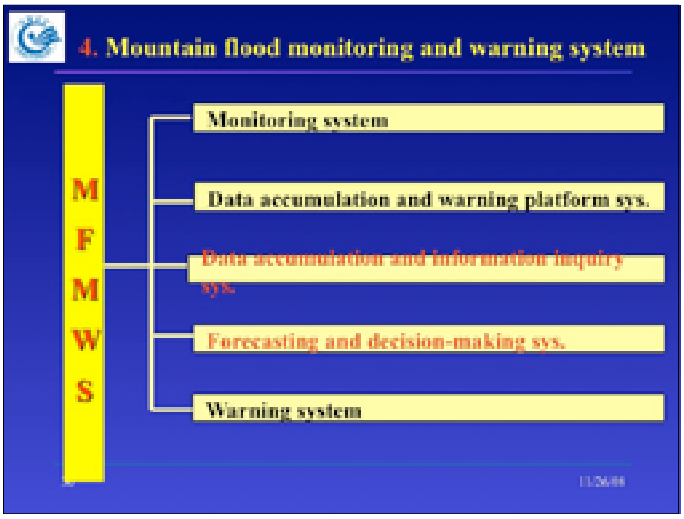
Pilot study up to 2006

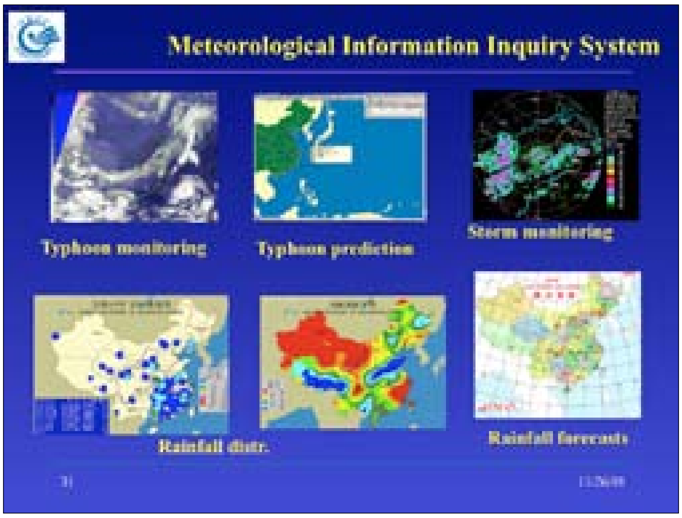
Pilot river basins		16
Total pilot area (km²)		4690
Population in pilot area		900,000
Monitoring establishment	Simple monitoring stations	1233
	Telemetering monitoring stations	106
Earning warning establishment		1409
Pre-scheme Formulation	County level	12
	Town level	83
	Village level	379
Broadcast card		81327
Nameplate (information board)		1969
Trainees		105749
Total investment		$3mil. USD



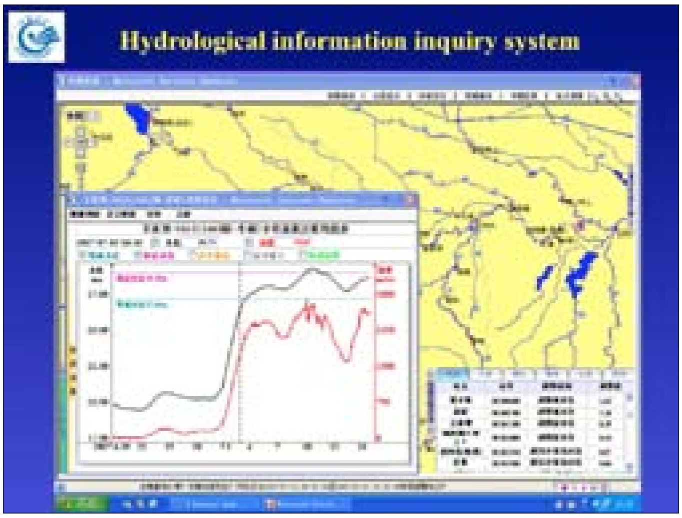

Monitoring and warning system
Data auto collection
Water level
alarm

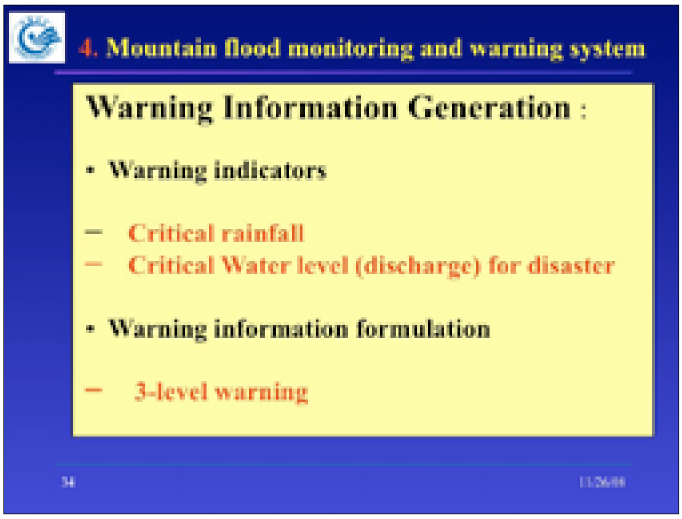

Videos, brochures and posters for knowledge sharing for mountain flood disaster prevention
Mountain Flood Prevention Knowledge


4. Mountain flood monitoring and warning system
MFMWS
Monitoring system
Data accumulation and warning platform sys.
Data accumulation and information inquiry sys.
Forecasting and decision-making sys.
Warning system

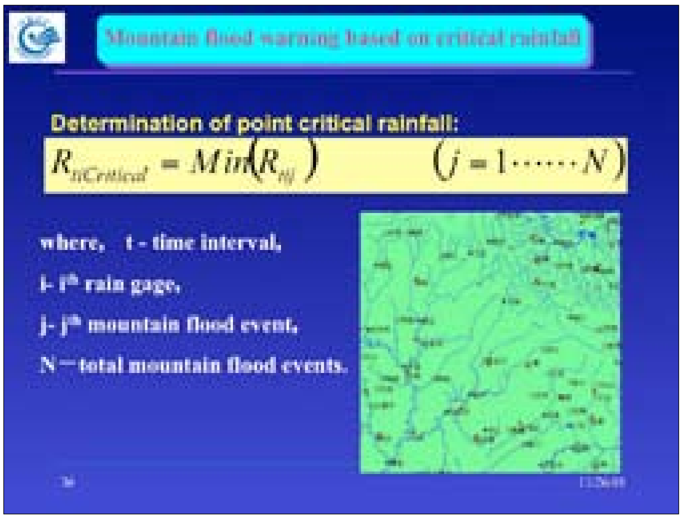

Meteorological Information Inquiry System
Typhoon monitoring
Typhoon prediction
Storm monitoring
Rainfall distr.
Rainfall forecasts

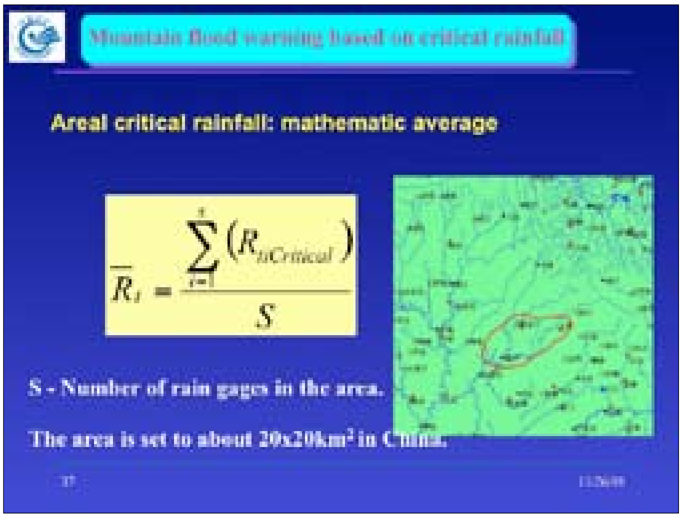

Hydrological Information Inquiry System

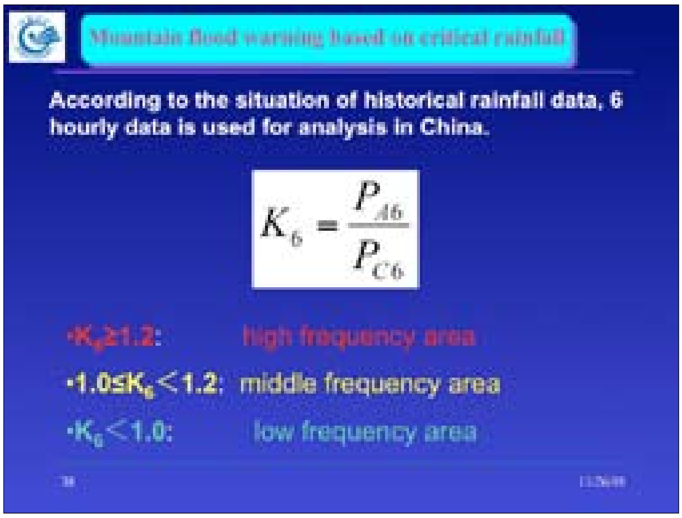

Hydrological information inquiry system

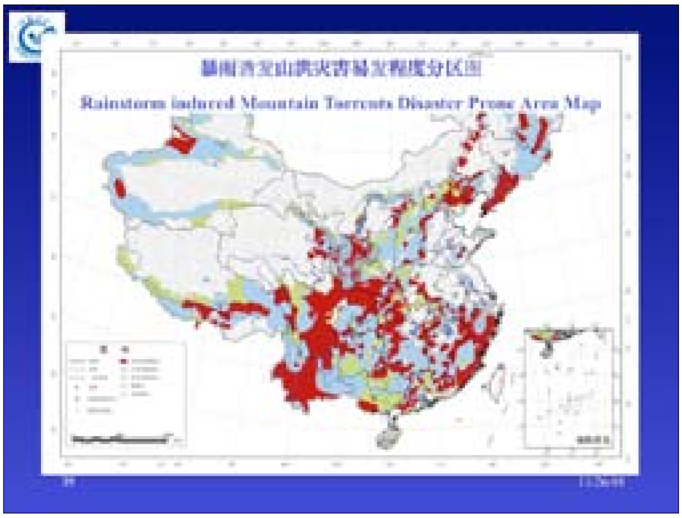

4. Mountain flood monitoring and warning system
Warning Information Generation :
• Warning indicators
— Critical rainfall
— Critical Water level (discharge) for disaster
• Warning information formulation
— 3-level warning


4. Mountain flood monitoring and warning system
Critical Rainfall Coefficient is introduced as the degree index for rainfall triggering mountain torrents disaster.
Critical Rainfall Coefficient = average period rainfall / critical rainfall
Key technique

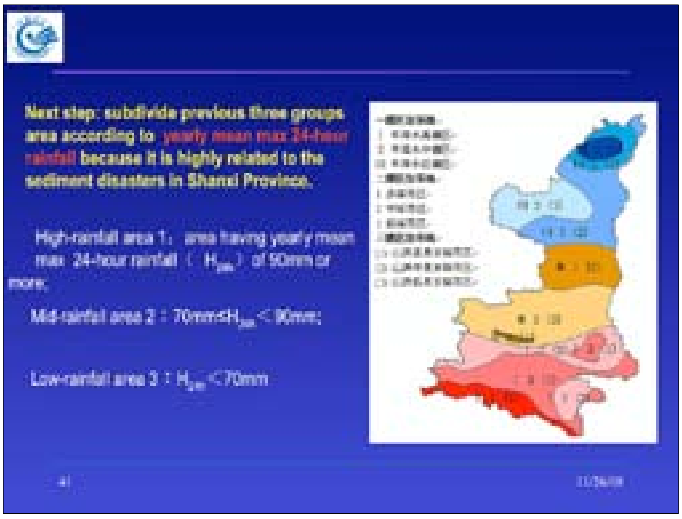

Mountain flood warning based on critical rainfall
Determination of point critical rainfall:
$R_{tiCritical} = Min(R_{tij}) \quad (j = 1 \cdots\cdots N)$
where, t - time interval,
i- i[th] rain gage,
j- j[th] mountain flood event,
N—total mountain flood events.

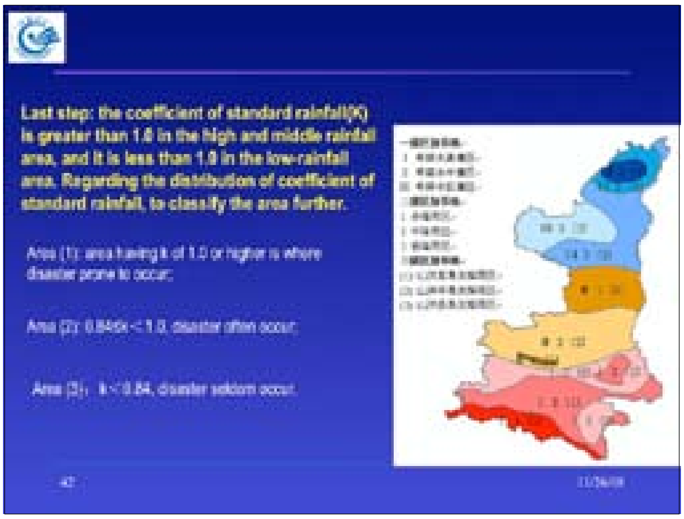

Mountain flood warning based on critical rainfall
Areal critical rainfall: mathematic average
$\overline{R}_t = \frac{\sum_{i=1}^{S}(R_{tiCritical})}{S}$
S - Number of rain gages in the area.
The area is set to about 20x20km² in China.


Mountain flood warning based on critical rainfall
According to the situation of historical rainfall data, 6 hourly data is used for analysis in China.
$K_6 = \frac{P_{A6}}{P_{C6}}$
•K6≥1.2: high frequency area
•1.0≤K6<1.2: middle frequency area
•K6<1.0: low frequency area

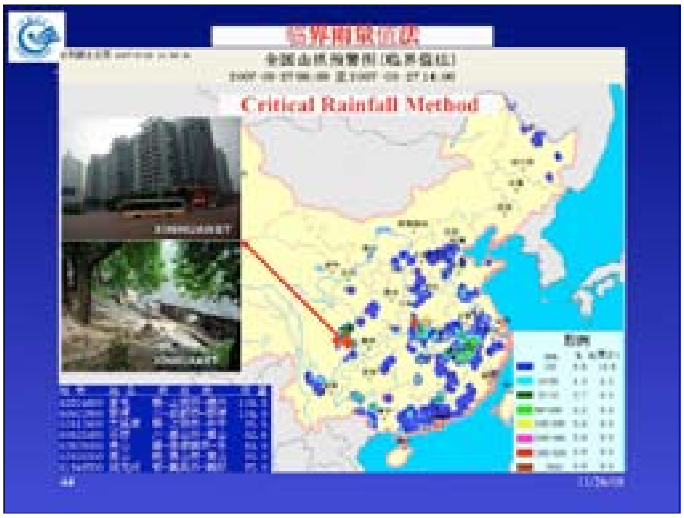

Rainstorm induced Mountain Torrents Disaster Prone Area Map

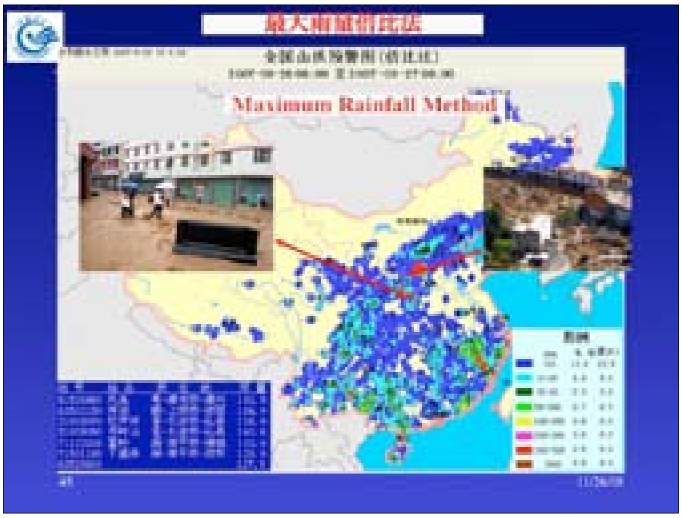

Take Shanxi province in west China as an example.
Survey of precipitation conditions
The area were classified using three kinds of rainfall index orderly.
First step: Classify the whole area into three groups based on the annual rainfall in each district.
High annual rainfall area Ⅰ: area having mean annual rainfall of 750mm or higher. Mainly in the south part of Shanxi.
Mid-annual rainfall area Ⅱ: 550mm≤mean annual rainfall < 750mm. Mainly in the middle part of shanxi.
Low annual rainfall Ⅲ: mean annual rainfall<550mm. Mainly in the north part of Shanxi.
40


Next step: subdivide previous three groups area according to yearly mean max 24-hour rainfall because it is highly related to the sediment disasters in Shanxi Province.
High-rainfall area 1: area having yearly mean max 24-hour rainfall (H24) of 90mm or more;
Mid-rainfall area 2 : 70mm≤H24 < 90mm;
Low-rainfall area 3 : H24 <70mm
41

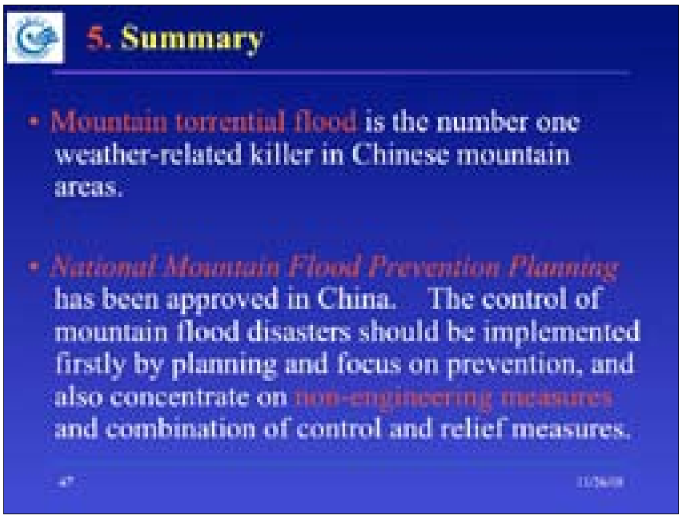

Last step: the coefficient of standard rainfall(K) is greater than 1.0 in the high and middle rainfall area, and it is less than 1.0 in the low-rainfall area. Regarding the distribution of coefficient of standard rainfall, to classify the area further.
Area (1): area having k of 1.0 or higher is where disaster prone to occur;
Area (2): 0.84≤k < 1.0, disaster often occur.
Area (3): k < 0.84, disaster seldom occur.
42

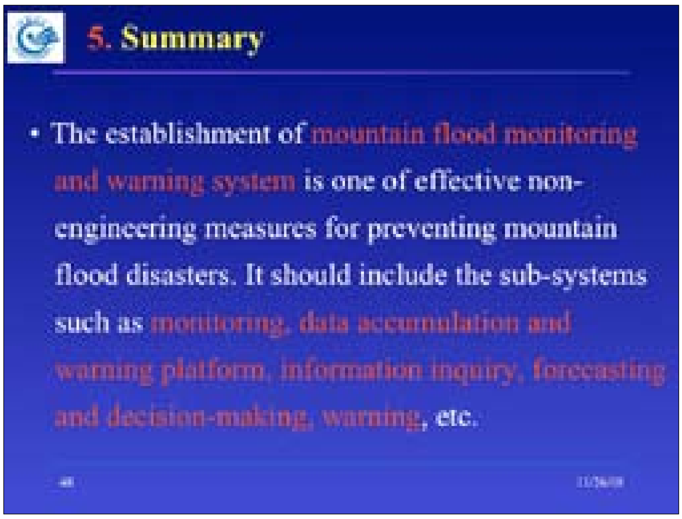

National Mountain Flood Warning Map
return period method
max. rainfall method
critical rainfall method
43

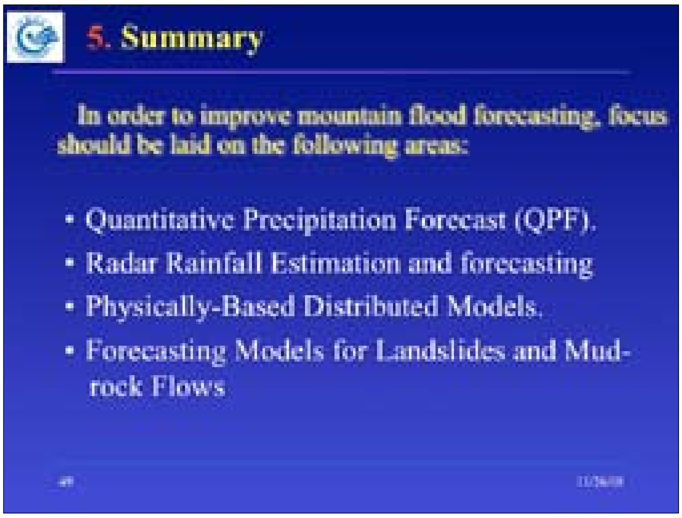

临界雨量信法
Critical Rainfall Method
44


最大雨量信比法
Maximum Rainfall Method
45


Return Period Method


5. Summary
• Mountain torrential flood is the number one weather-related killer in Chinese mountain areas.
• National Mountain Flood Prevention Planning has been approved in China. The control of mountain flood disasters should be implemented firstly by planning and focus on prevention, and also concentrate on non-engineering measures and combination of control and relief measures.

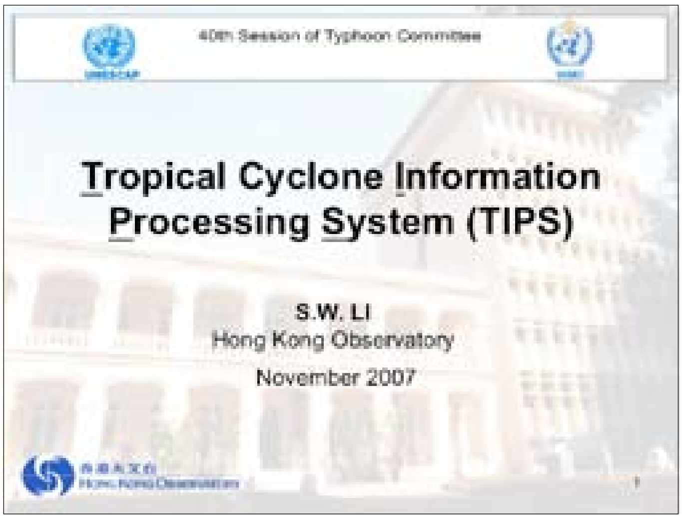

5. Summary
• The establishment of mountain flood monitoring and warning system is one of effective non-engineering measures for preventing mountain flood disasters. It should include the sub-systems such as monitoring, data accumulation and warning platform, information inquiry, forecasting and decision-making, warning, etc.

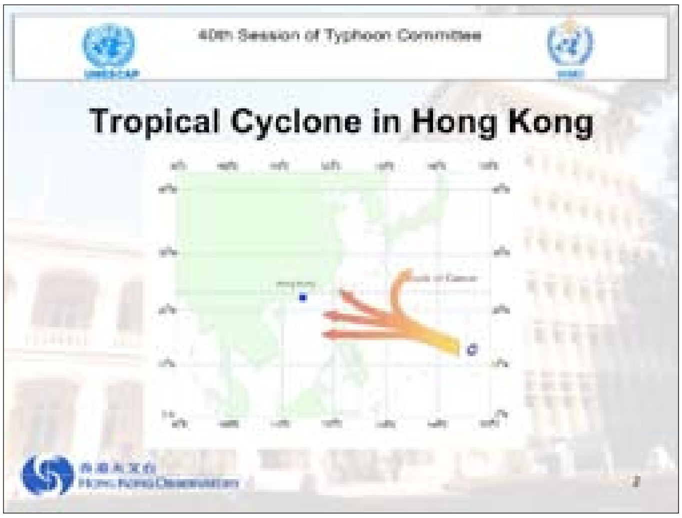

5. Summary
In order to improve mountain flood forecasting, focus should be laid on the following areas:
• Quantitative Precipitation Forecast (QPF).
• Radar Rainfall Estimation and forecasting
• Physically-Based Distributed Models.
• Forecasting Models for Landslides and Mud-rock Flows


Thanks and End
谢谢

Tropical Cyclone Information Processing System (TIPS)

S.W. LI
Hong Kong Observatory





40th Session of Typhoon Committee

Objectives of TIPS

- Automate ingestion and processing of TC data
- Present the results in a consolidated display
- Generate and dispatch products
- Reduce chance of human error and improve efficiency

5

40th Session of Typhoon Committee

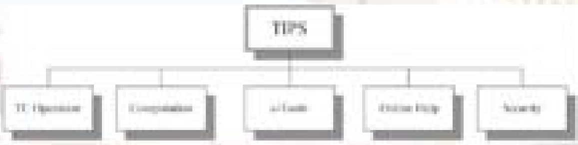
Functions of TIPS

- Integrate TC related information and data
- Assimilate data for TC track forecasts
- Compute key parameters for decision support
- Generate and dispatch forecasts and warning products

6

40th Session of Typhoon Committee

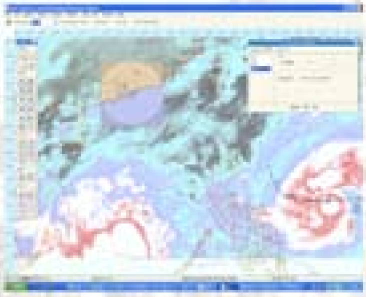
Modular Design



7

40th Session of Typhoon Committee

TC Operation -- TC Centre Location



8

40th Session of Typhoon Committee

TC Operation -- TC Centre Location

9

40th Session of Typhoon Committee

TC Operation -- Forecast TC Information

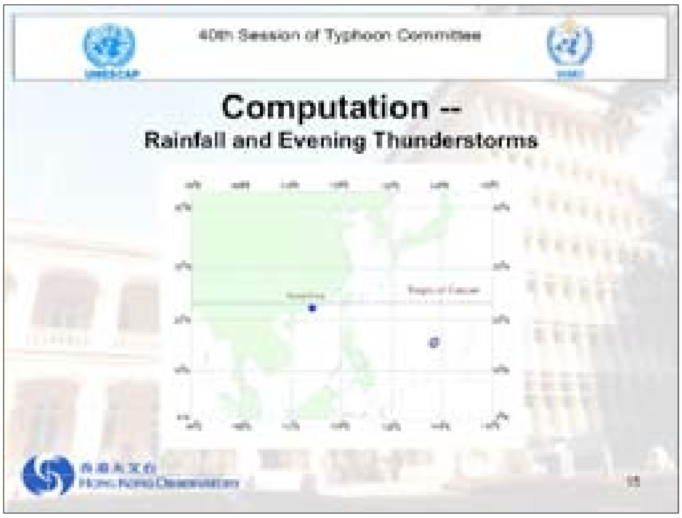
10

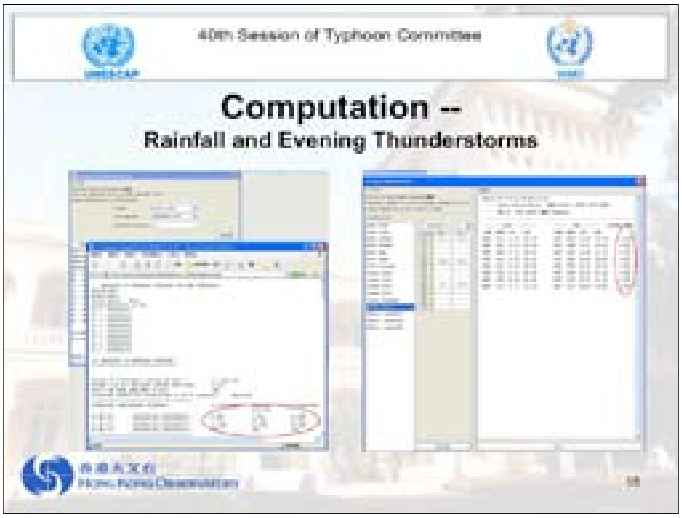

40th Session of Typhoon Committee
TC Operation --
Forecast and Warning Product
11


40th Session of Typhoon Committee
TC Operation --
Past Tracks
12


40th Session of Typhoon Committee
Computation --
Ensemble Track
13


40th Session of Typhoon Committee
Computation --
Forecast TC Track
14


40th Session of Typhoon Committee
Computation --
Rainfall and Evening Thunderstorms
15


40th Session of Typhoon Committee
Computation --
Rainfall and Evening Thunderstorms
16


40th Session of Typhoon Committee
Computation --
Local Wind Parameters
17


40th Session of Typhoon Committee
Computation --
Storm-Surge-Interface
18


40th Session of Typhoon Committee
E-Tools


40th Session of Typhoon Committee
Online Help
User Interface
20


40th Session of Typhoon Committee
Security
TIPS
21

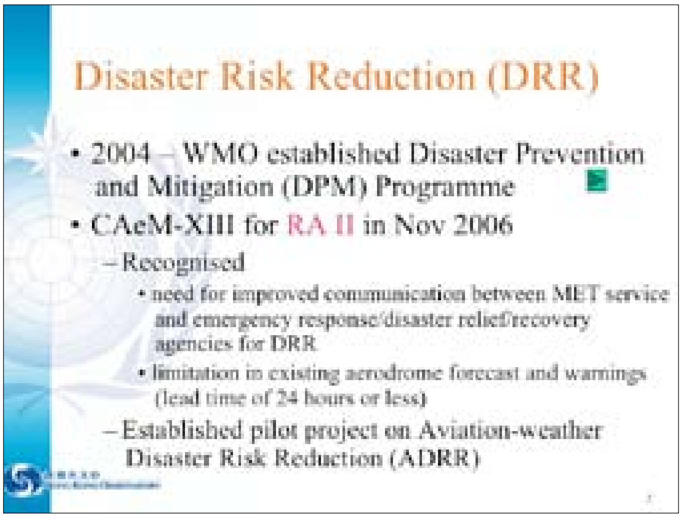

40th Session of Typhoon Committee
Future Work
An indispensable decision supporting tool in TC operation
Improvement in efficiency and reduction of human error
Pre-generated display in website for other users
More TC information, e.g. output from NWP models
More forecasting tools
Web-based interface to provide basic functions
22

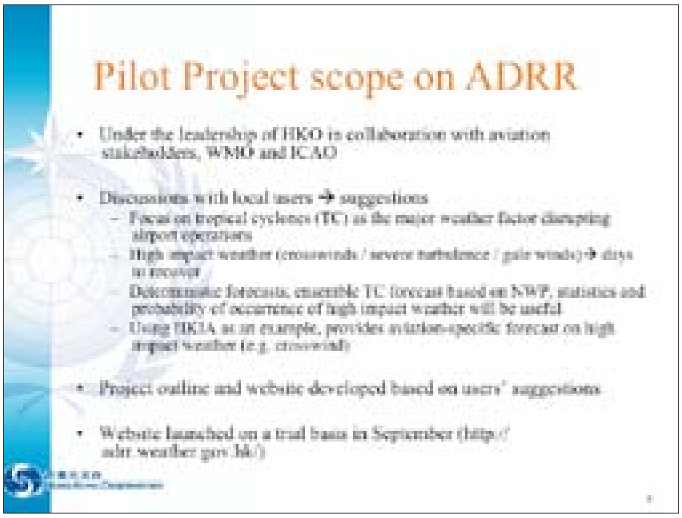

40th Session of Typhoon Committee
TIPS
http://severe.worldweather.org/tcc/lectures.htm
Thank you
23


40th Session of Typhoon Committee
TIPS Display in website
24

WMO CAeM Pilot Project on Aviation-weather Disaster Risk Reduction (ADRR)

Sandy Song
Hong Kong Observatory





Invite Participation

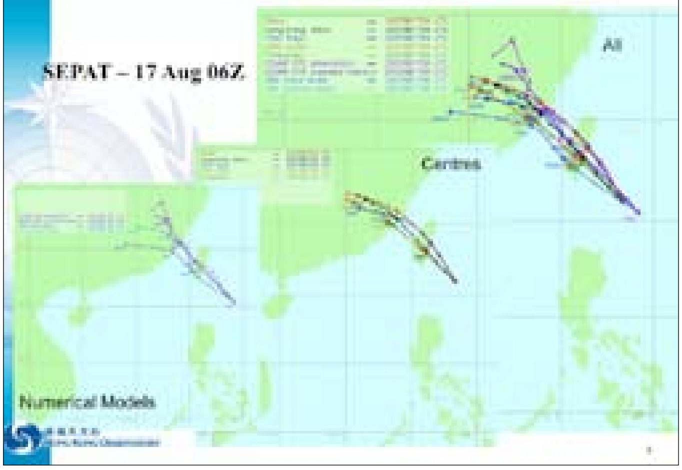
- HKO/other WMO members/centres:
  - Provide tropical cyclone track forecasts
  - Provide high impact weather forecasts (e.g. probability forecast, crosswind forecast)
- Airline users:
  - Access to forecasts
  - Provide feedback

Participants

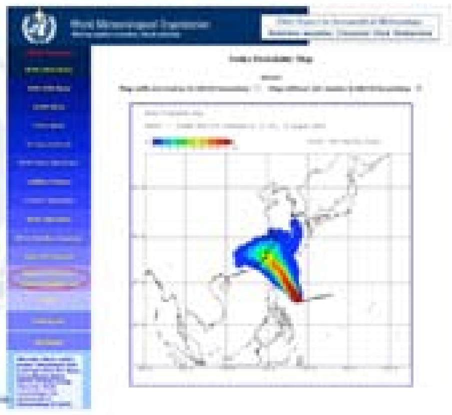
- Philippines invited to participate considering the significant impact of TC (extended to RA V)
- A number of Members and centres agreed to provide TC forecasts for the Pilot Project
  - NMHSs of China; Japan; Hong Kong, China; and the Philippines → official tropical cyclone forecasts and warnings
  - Tropical Cyclone Advisory Centre (TCAC) Tokyo of Japan and Joint Typhoon Warning Centre (JTWC) of the USA → regional tropical cyclone advisories and warnings
  - European Centre for Medium-Range Weather Forecasts (ECMWF) → numerical forecasts of tropical cyclone including ensemble products

TC Forecast Tracks and Intensity

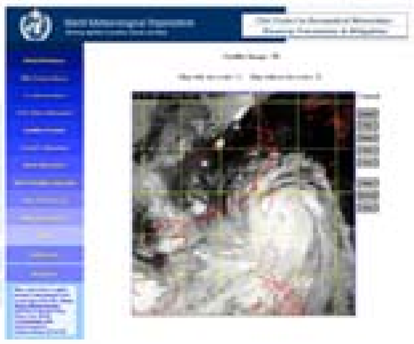
TC Forecast Tracks



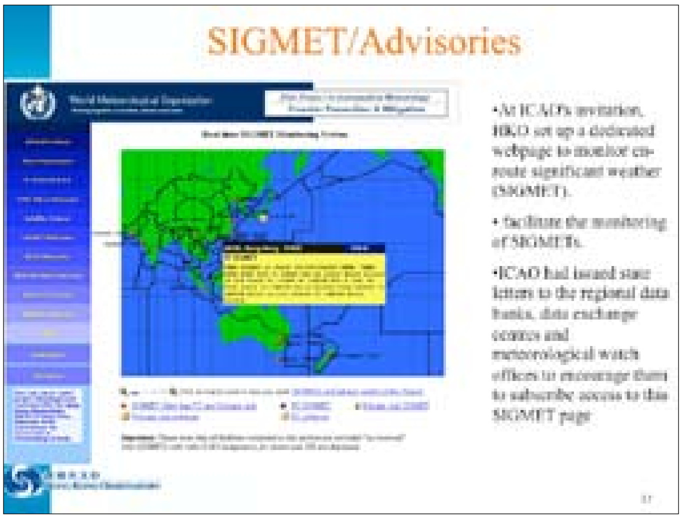
Strike Probability



Satellite Pictures




TCAC Tokyo Advisories

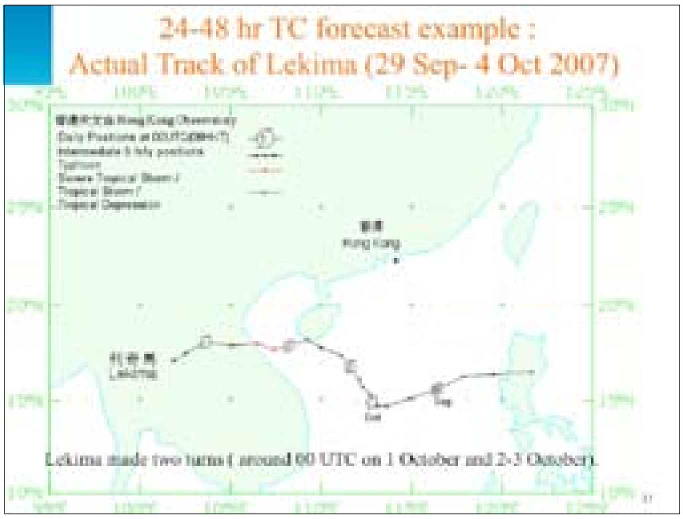

SIGMET/Advisories
•At ICAO's invitation, HKO set up a dedicated webpage to monitor en-route significant weather (SIGMET).
• facilitate the monitoring of SIGMETs.
•ICAO had issued state letters to the regional data banks, data exchange centres and meteorological watch offices to encourage them to subscribe access to this SIGMET page

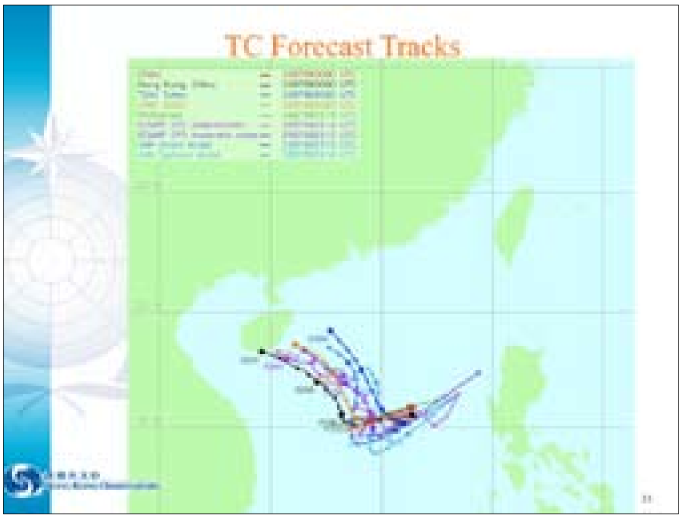

HKIA Specific Products

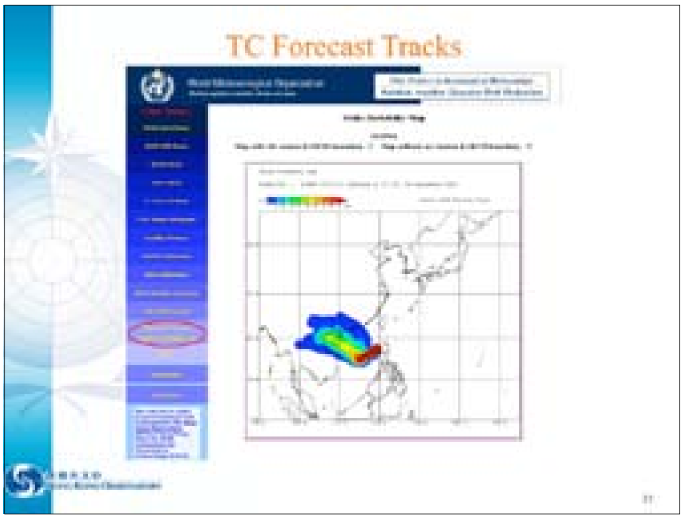

Weather Summary for HKIA

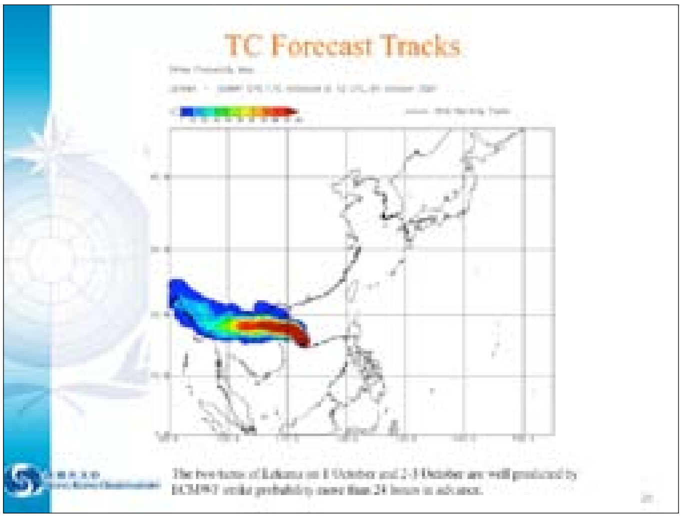

Take-off Forecast
Forecast based on statistics

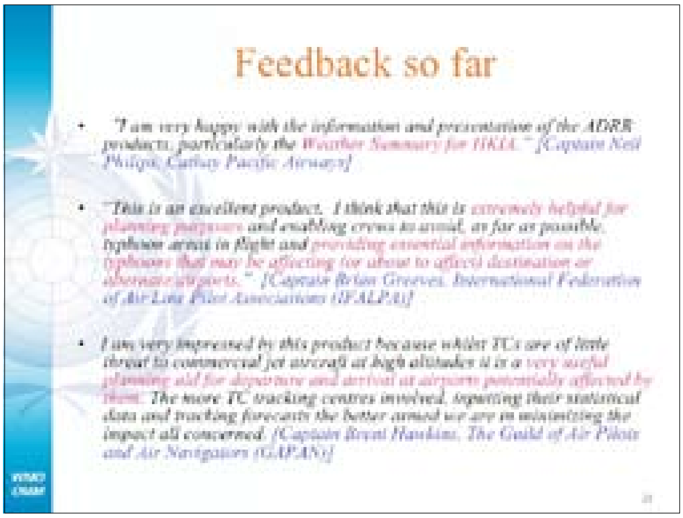

HKIA Neighbouring Aerodromes


24-48 hr TC forecast example :
Actual Track of Lekima (29 Sep- 4 Oct 2007)
香港
Hong Kong
Lekima made two turns (around 00 UTC on 1 October and 2-3 October).


TC Forecast Tracks

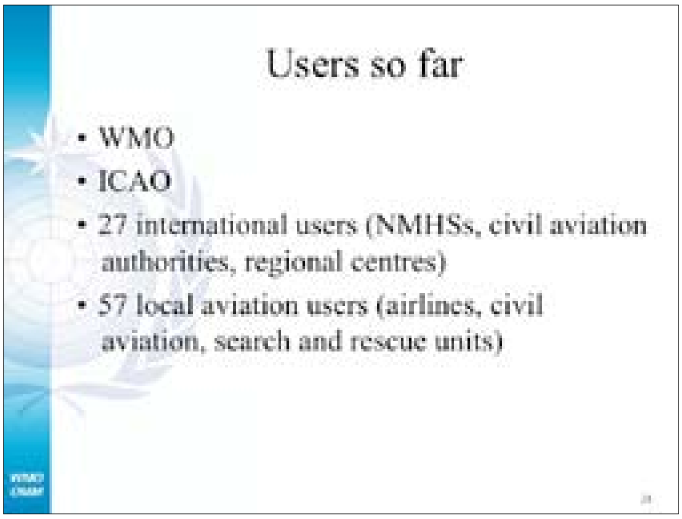

TC Forecast Tracks

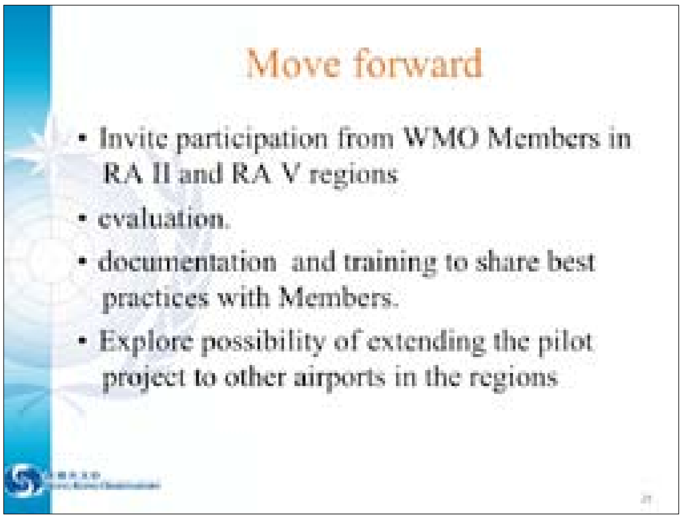

TC Forecast Tracks
The two turns of Lekima on 1 October and 2-3 October are well predicted by ECMWF strike probability more than 24 hours in advance.


Feedback so far
"I am very happy with the information and presentation of the ADRR products, particularly the Weather Summary for HKIA." [Captain Neil Philips, Cathay Pacific Airways]
"This is an excellent product. I think that this is extremely helpful for planning purposes and enabling crews to avoid, as far as possible, typhoon areas in flight and providing essential information on the typhoons that may be affecting (or about to affect) destination or alternate airports." [Captain Brian Greeves, International Federation of Air Line Pilot Associations (IFALPA)]
I am very impressed by this product because whilst TCs are of little threat to commercial jet aircraft at high altitudes it is a very useful planning aid for departure and arrival at airports potentially affected by them. The more TC tracking centres involved, inputting their statistical data and tracking forecasts the better armed we are in minimizing the impact all concerned. [Captain Brent Hawkins, The Guild of Air Pilots and Air Navigators (GAPAN)]

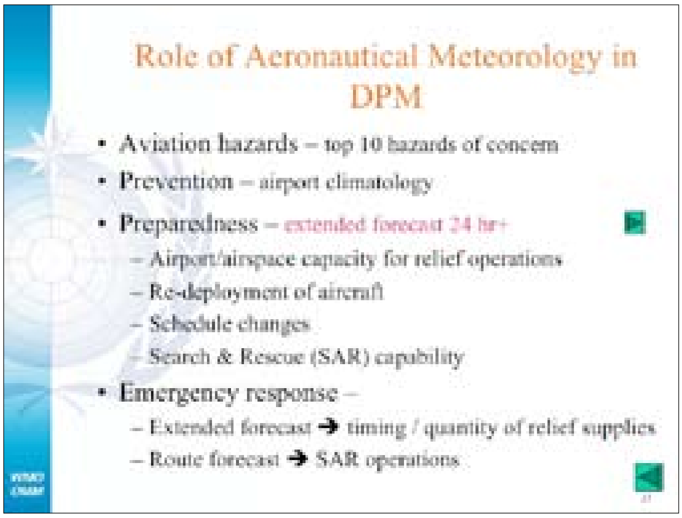

Since the website contains aviation-specific weather information, access to the website is currently limited using username / password control

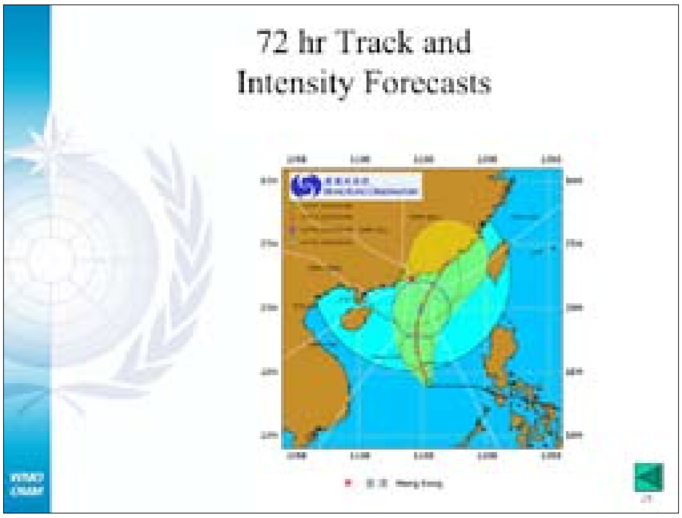

Application form
To: Director of the Hong Kong Observatory
(Attn: Mr. C.Y. Hong)
Mail address: 134A Nathan Road, Kowloon, Hong Kong
WMO CAeM Pilot Project in RA II and RA V
Application for Access to the Website on
"Aviation-weather Disaster Risk Reduction" (ADRR)
Name
Organization
Job title
Mail address
E-mail address
Tel
Fax
Date
Signature

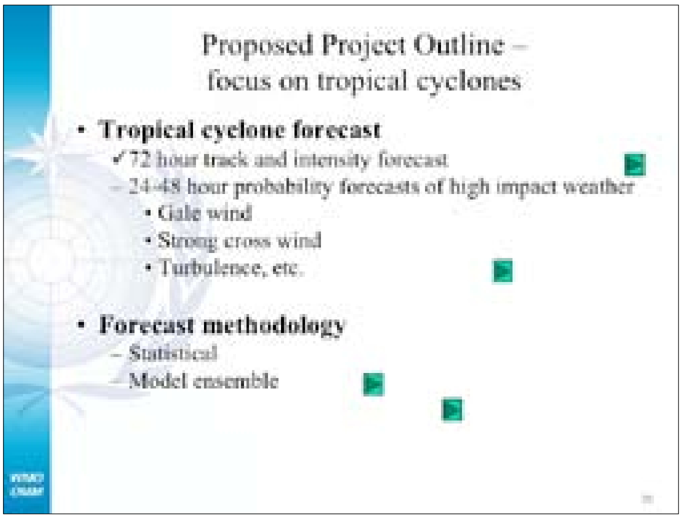

Users so far
• WMO
• ICAO
• 27 international users (NMHSs, civil aviation authorities, regional centres)
• 57 local aviation users (airlines, civil aviation, search and rescue units)


Move forward
• Invite participation from WMO Members in RA II and RA V regions
• evaluation.
• documentation and training to share best practices with Members.
• Explore possibility of extending the pilot project to other airports in the regions

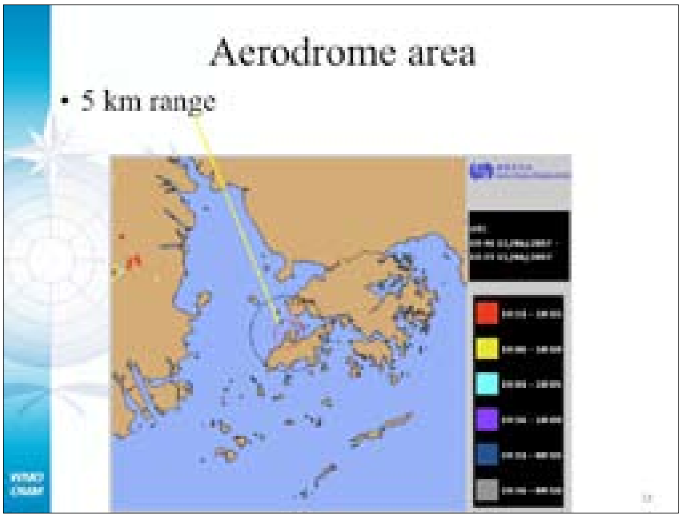

Look forward to your participation
Thank you!

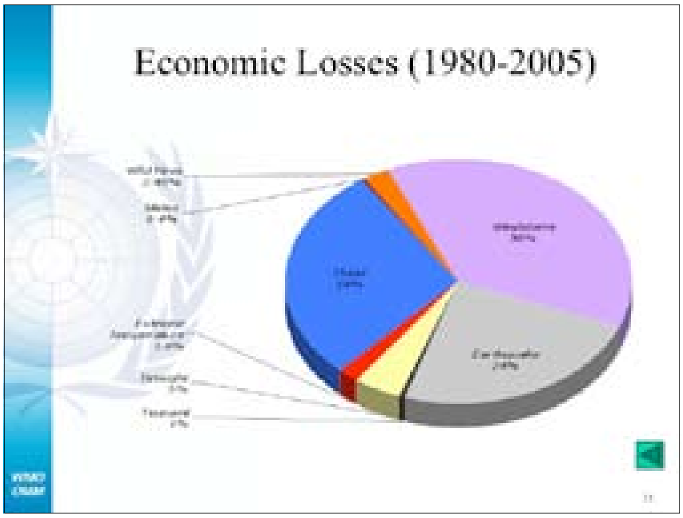

Role of Aeronautical Meteorology in DPM
• Aviation hazards – top 10 hazards of concern
• Prevention – airport climatology
• Preparedness – extended forecast 24 hr+
– Airport/airspace capacity for relief operations
– Re-deployment of aircraft
– Schedule changes
– Search & Rescue (SAR) capability
• Emergency response –
– Extended forecast → timing / quantity of relief supplies
– Route forecast → SAR operations

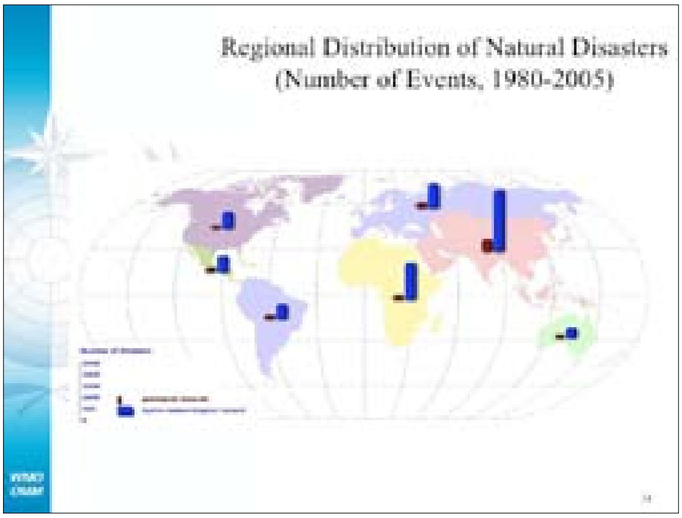

72 hr Track and Intensity Forecasts


Proposed Project Outline – focus on tropical cyclones
• Tropical cyclone forecast
✓72 hour track and intensity forecast
– 24-48 hour probability forecasts of high impact weather
• Gale wind
• Strong cross wind
• Turbulence, etc.
• Forecast methodology
– Statistical
– Model ensemble


Timeline
• 2007 Q1 – prepare project outline
• 2007 Q2 – recruit participating countries
• 2007 Q3 – techniques and procedures in place; quasi-operational test phase
• 2008 Q1 onwards – documentation and training for other countries

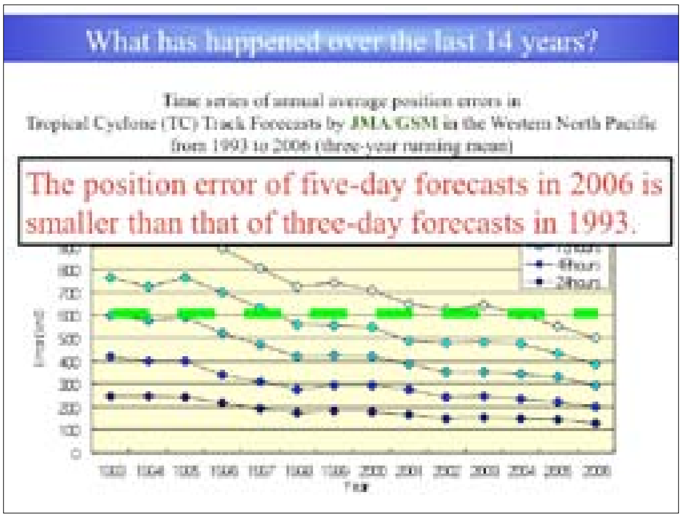

Aerodrome area
• 5 km range

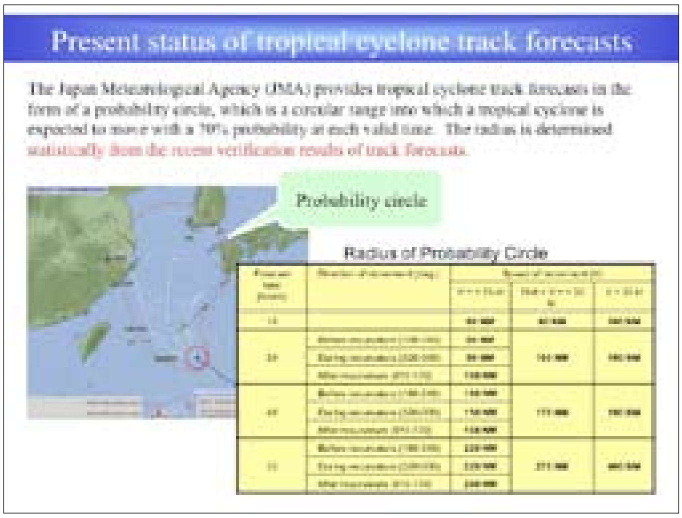

Economic Losses (1980-2005)

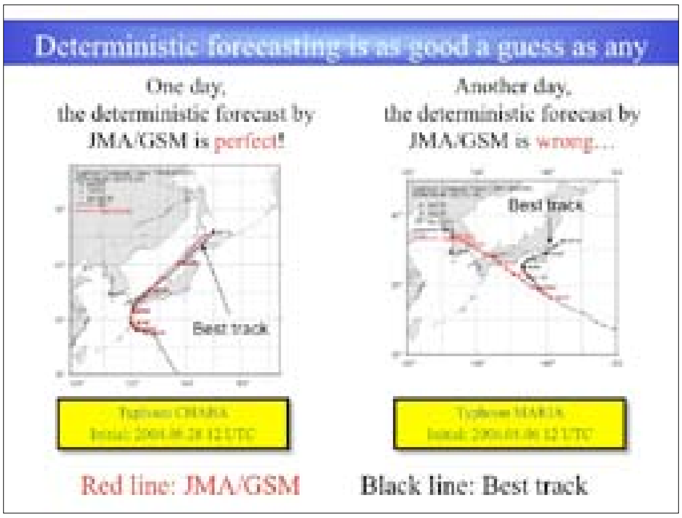

Regional Distribution of Natural Disasters
(Number of Events, 1980-2005)

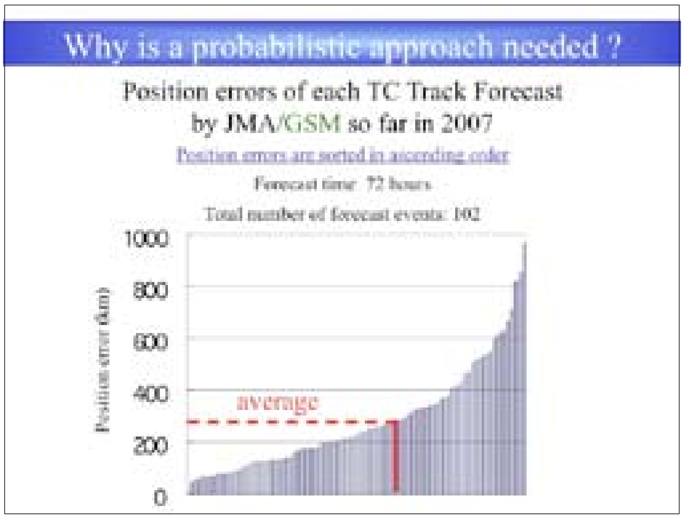
Typhoon Ensemble Prediction System developed at the Japan Meteorological Agency

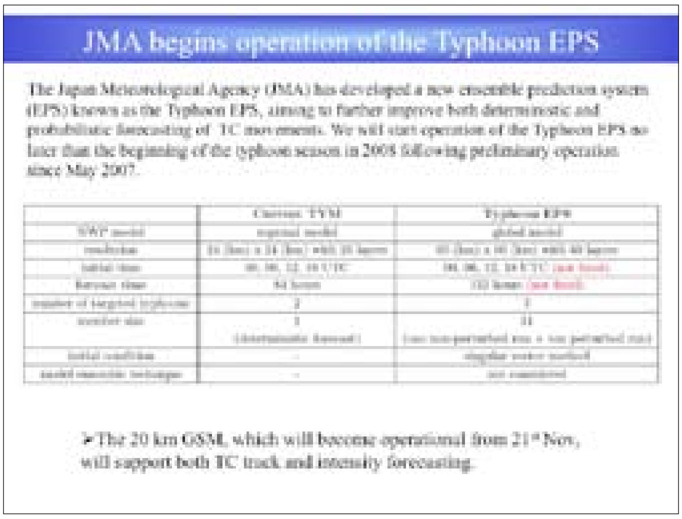
Kunio SAKURAI
Director-General of Forecast Department
Japan Meteorological Agency

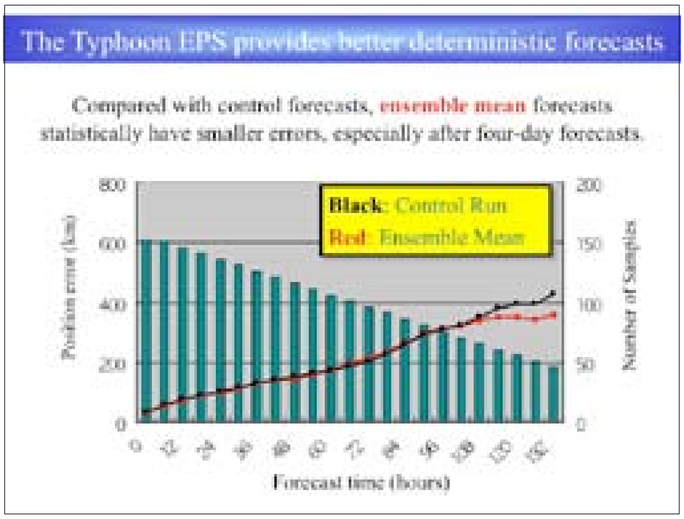


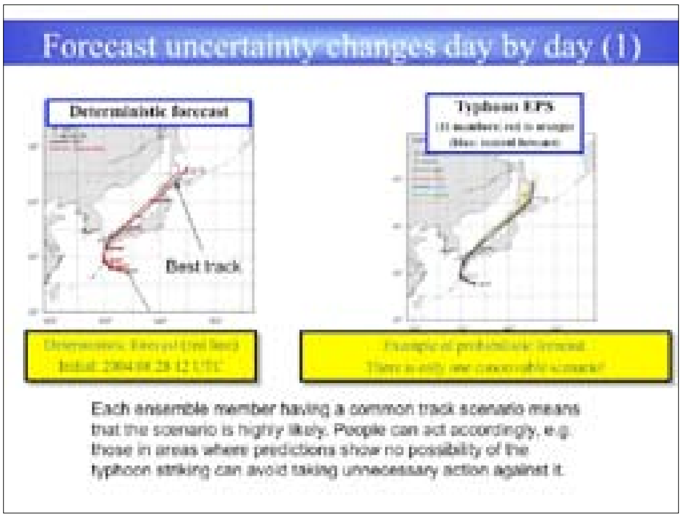


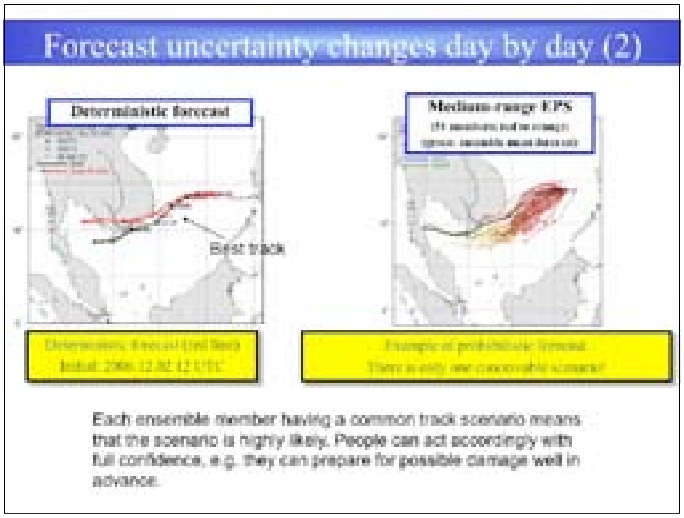


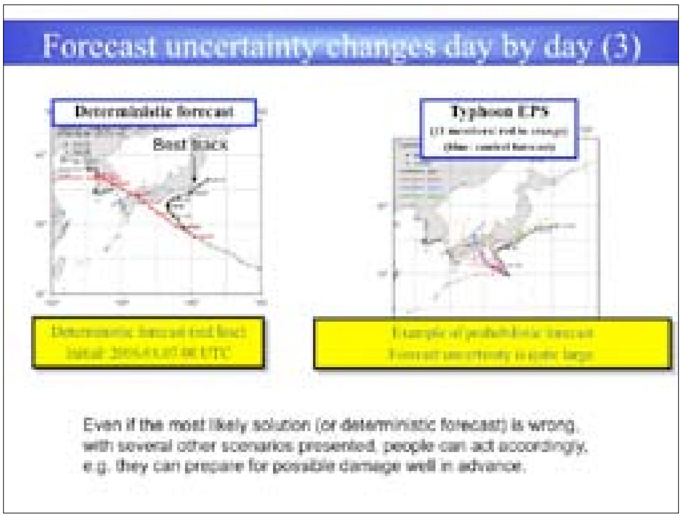

Why is a probabilistic approach needed ?
Position errors of each TC Track Forecast
by JMA/GSM so far in 2007
Position errors are sorted in ascending order
Forecast time: 72 hours
Total number of forecast events: 102
Position error (km)
1000
800
600
400
200
0
average

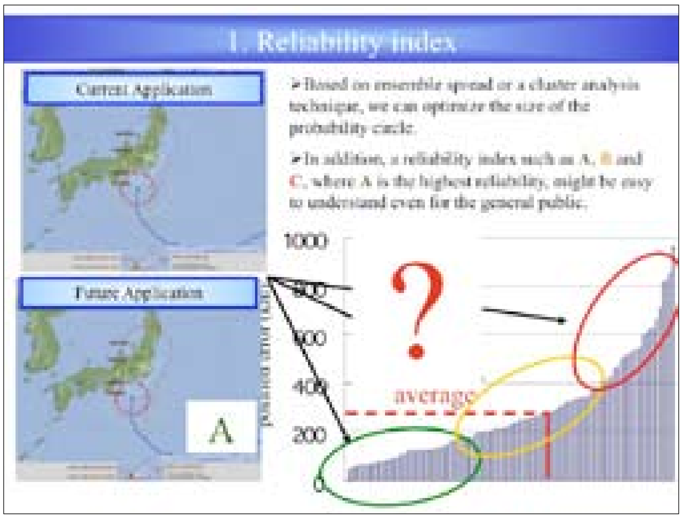

JMA begins operation of the Typhoon EPS
The Japan Meteorological Agency (JMA) has developed a new ensemble prediction system (EPS) known as the Typhoon EPS, aiming to further improve both deterministic and probabilistic forecasting of TC movements. We will start operation of the Typhoon EPS no later than the beginning of the typhoon season in 2008 following preliminary operation since May 2007.
Current TYM
Typhoon EPS
NWP model
regional model
global model
initial time
forecast time
84 hours
132 hours (not fixed)
member size
11
(deterministic forecast)
initial condition
singular vector method
not considered
➢The 20 km GSM, which will become operational from 21st Nov, will support both TC track and intensity forecasting.

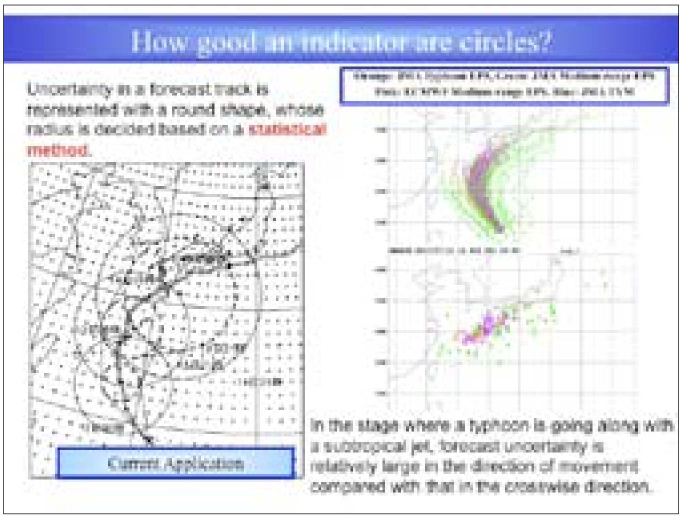

The Typhoon EPS provides better deterministic forecasts
Compared with control forecasts, ensemble mean forecasts statistically have smaller errors, especially after four-day forecasts.
Black: Control Run
Red: Ensemble Mean
Position error (km)
Number of Samples
800
600
400
200
0
200
150
100
50
0
Forecast time (hours)

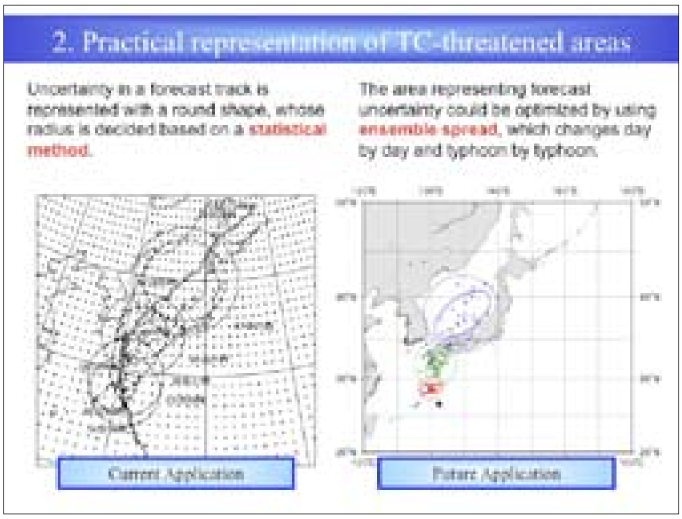

Forecast uncertainty changes day by day (1)
Deterministic forecast
Typhoon EPS
Best track
Each ensemble member having a common track scenario means that the scenario is highly likely. People can act accordingly, e.g. those in areas where predictions show no possibility of the typhoon striking can avoid taking unnecessary action against it.

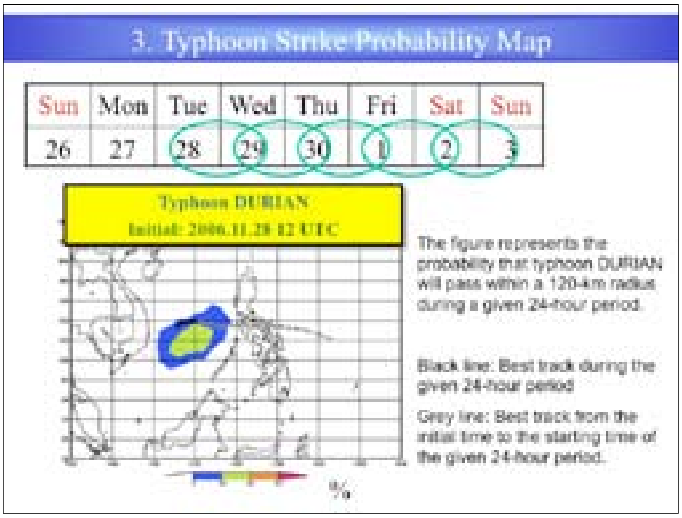

Forecast uncertainty changes day by day (2)
Deterministic forecast
Medium-range EPS
Best track
Each ensemble member having a common track scenario means that the scenario is highly likely. People can act accordingly with full confidence, e.g. they can prepare for possible damage well in advance.

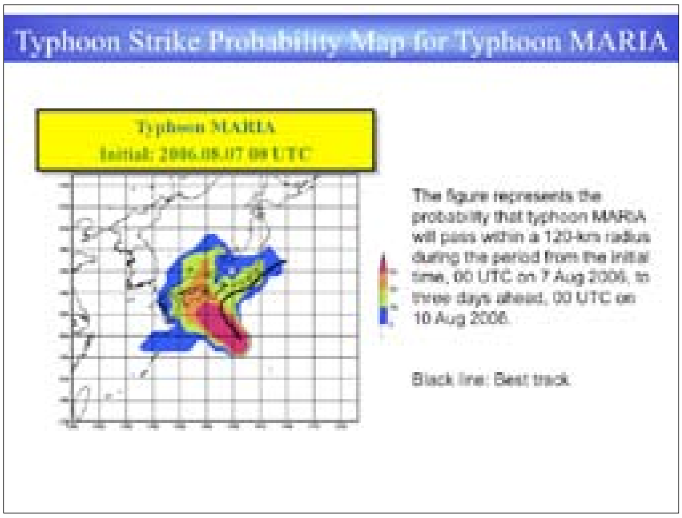

Forecast uncertainty changes day by day (3)
Deterministic forecast
Typhoon EPS
Best track
Even if the most likely solution (or deterministic forecast) is wrong, with several other scenarios presented, people can act accordingly, e.g. they can prepare for possible damage well in advance.

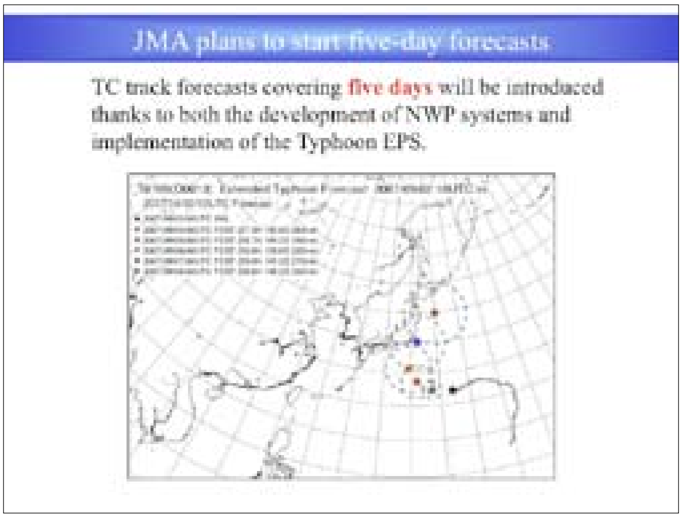

1. Reliability index
Current Application
Future Application
A
➢Based on ensemble spread or a cluster analysis technique, we can optimize the size of the probability circle.
➢In addition, a reliability index such as A, B and C, where A is the highest reliability, might be easy to understand even for the general public.
1000
800
600
400
200
0
?
average


How good an indicator are circles?
Uncertainty in a forecast track is represented with a round shape, whose radius is decided based on a statistical method.
Current Application
In the stage where a typhoon is going along with a subtropical jet, forecast uncertainty is relatively large in the direction of movement compared with that in the crosswise direction.


2. Practical representation of TC-threatened areas
Uncertainty in a forecast track is represented with a round shape, whose radius is decided based on a statistical method.
The area representing forecast uncertainty could be optimized by using ensemble spread, which changes day by day and typhoon by typhoon.
Current Application
Future Application


3. Typhoon Strike Probability Map
Sun Mon Tue Wed Thu Fri Sat Sun
26 27 28 29 30 1 2 3
Typhoon DURIAN
Initial: 2006.11.28 12 UTC
The figure represents the probability that typhoon DURIAN will pass within a 120-km radius during a given 24-hour period.
Black line: Best track during the given 24-hour period
Grey line: Best track from the initial time to the starting time of the given 24-hour period.
%


Typhoon Strike Probability Map for Typhoon MARIA
Typhoon MARIA
Initial: 2006.08.07 00 UTC
The figure represents the probability that typhoon MARIA will pass within a 120-km radius during the period from the initial time, 00 UTC on 7 Aug 2006, to three days ahead, 00 UTC on 10 Aug 2006.
Black line: Best track


JMA plans to start five-day forecasts
TC track forecasts covering five days will be introduced thanks to both the development of NWP systems and implementation of the Typhoon EPS.

Future Issues

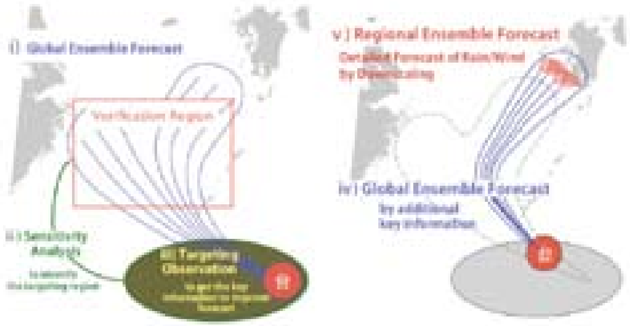
Future issues to be addressed include the following two points:

1. Further discussion on how to use uncertainty information associated with TC track forecasts

2. Further understanding as to what causes forecast uncertainties in TC track forecasts
→ T-PARC

T-PARC

At T-PARC, we aim to reduce forecast uncertainties in TC track forecasts by performing **airborne adaptive observations**.



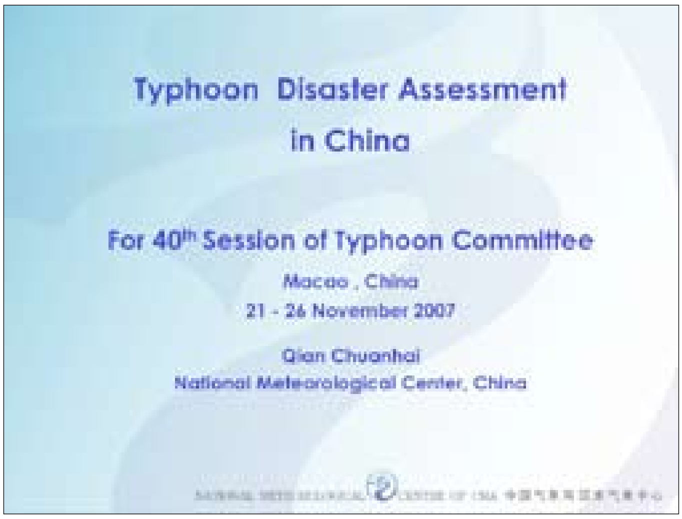
Summary

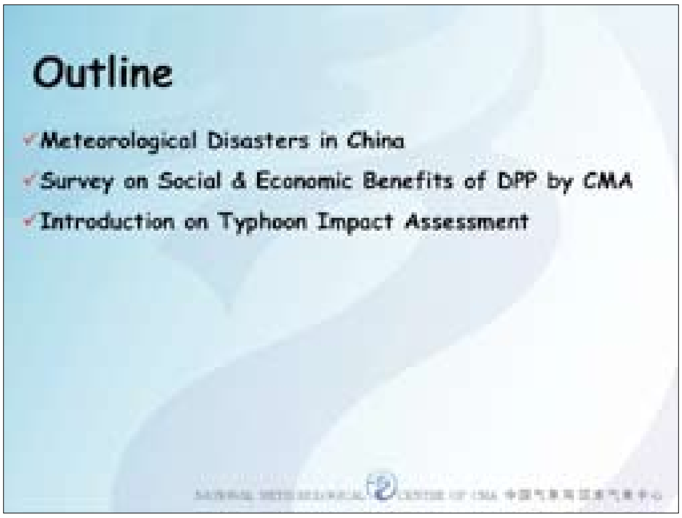
- JMA will start the **Typhoon EPS** no later than the beginning of the typhoon season in 2008.
- TC track forecasts covering **five days** will be introduced thanks to both the development of NWP systems and implementation of the Typhoon EPS.
- **Uncertainty information** associated with TC track forecasts will be provided using the Typhoon EPS.
- **T-PARC** will help us to further address TC predictability and improve NWP systems.
- We would like to enhance our relationships more in order to consider more beneficial use of probabilistic TC forecasts.

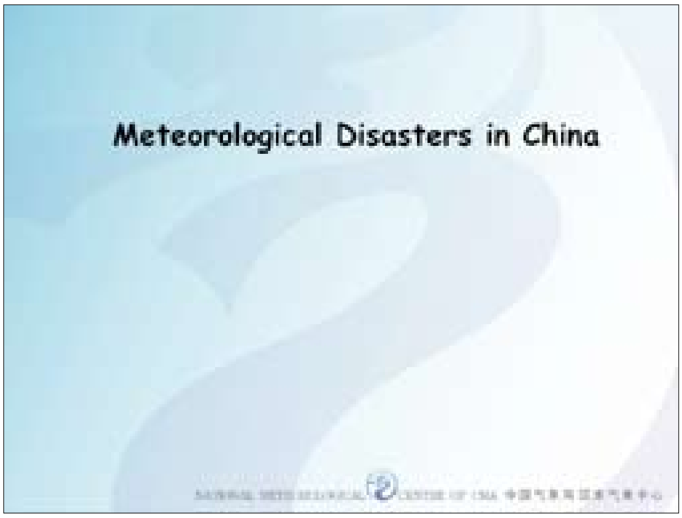
謝謝

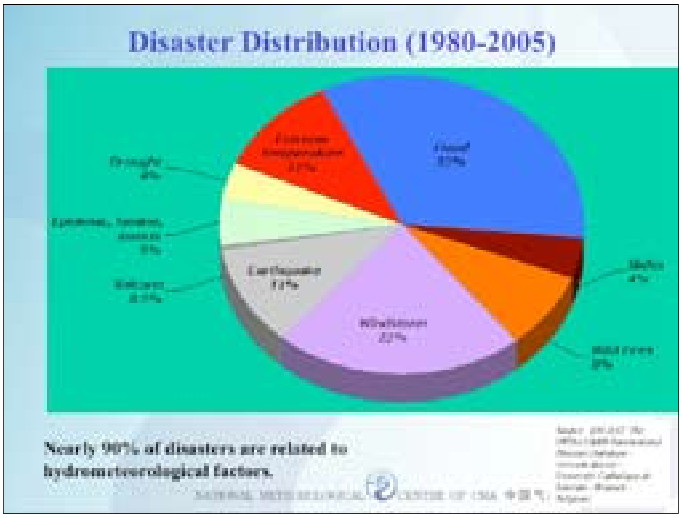
Typhoon Disaster Assessment in China

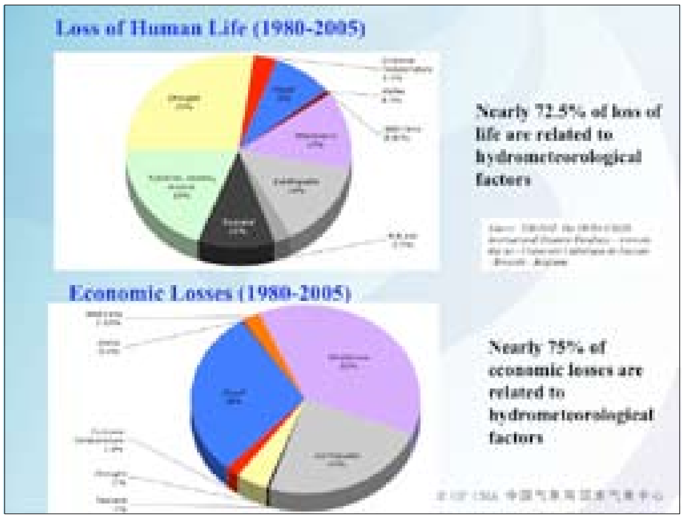
Qian Chuanhai
National Meteorological Center, China



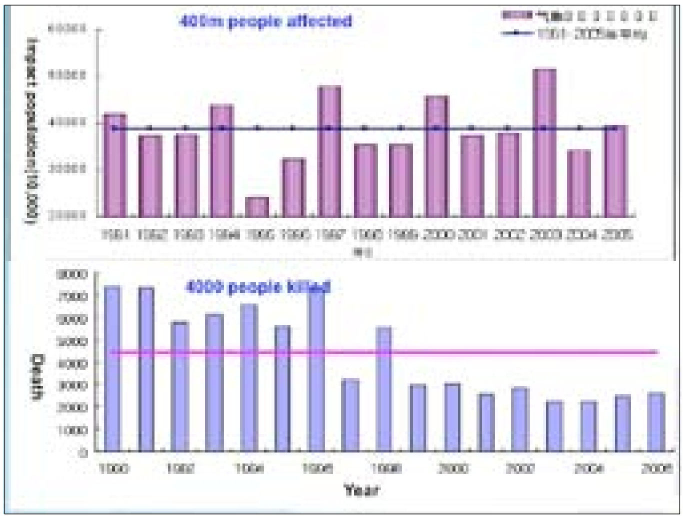


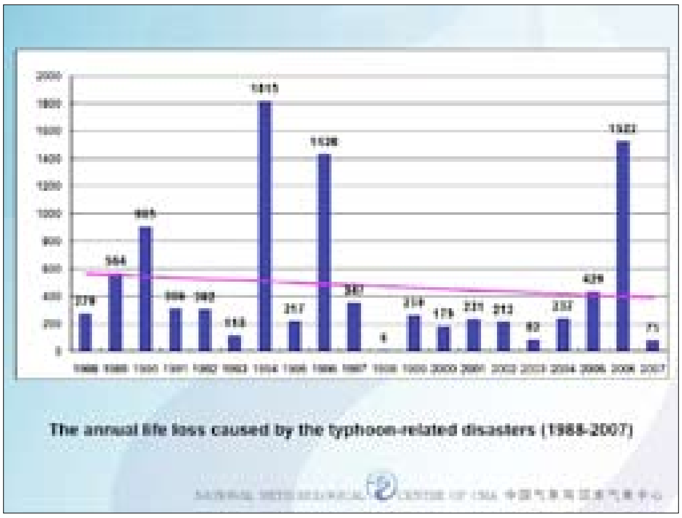


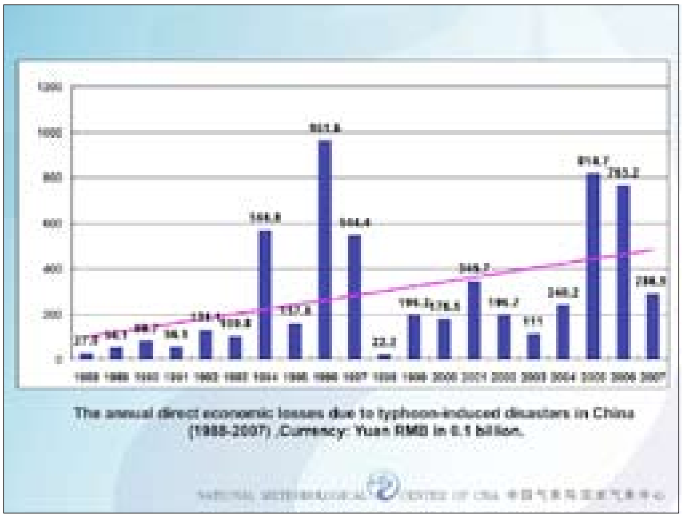



Loss of Human Life (1980-2005)
Nearly 72.5% of loss of life are related to hydrometeorological factors
Economic Losses (1980-2005)
Nearly 75% of economic losses are related to hydrometeorological factors


Economic loss/0.1 B
Economic loss
1990-2006 average
Year
186 billion RMB
Percentage
average
Year
2.8% of GDP

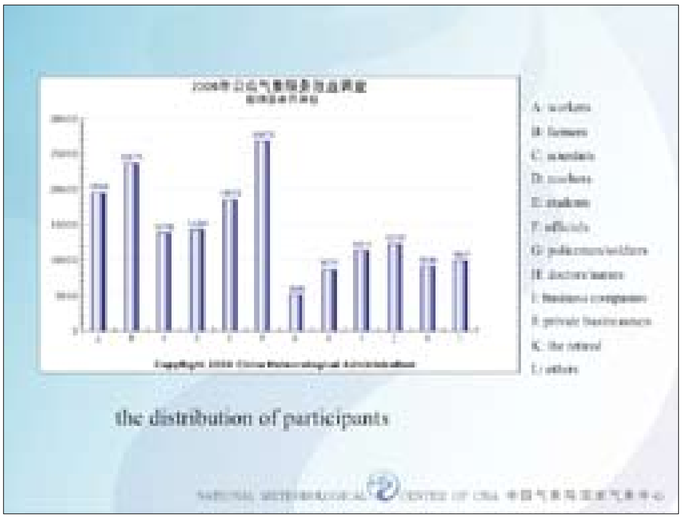

400m people affected
Impact population(10,000)
4000 people killed
Death
Year

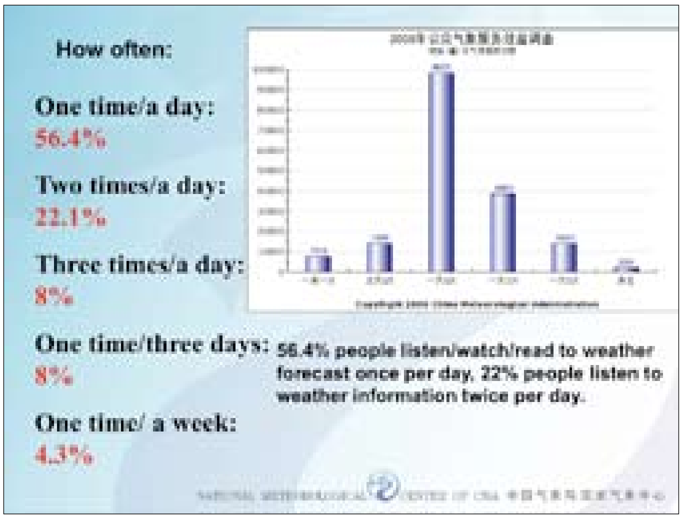

The annual life loss caused by the typhoon-related disasters (1988-2007)

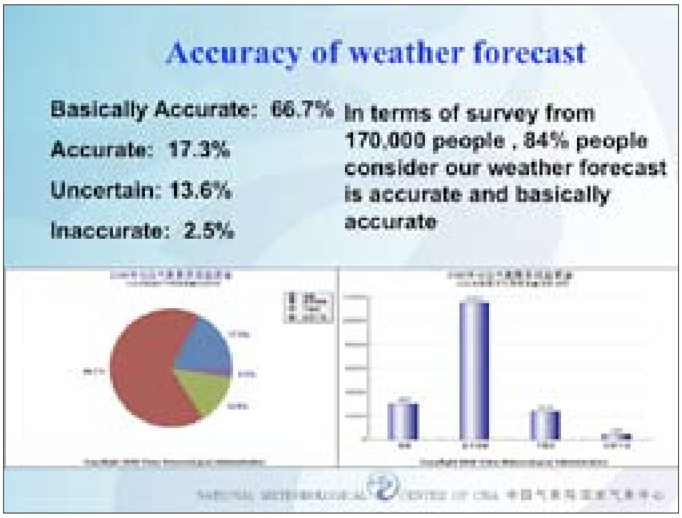

The annual direct economic losses due to typhoon-induced disasters in China (1988-2007) .Currency: Yuan RMB in 0.1 billion.

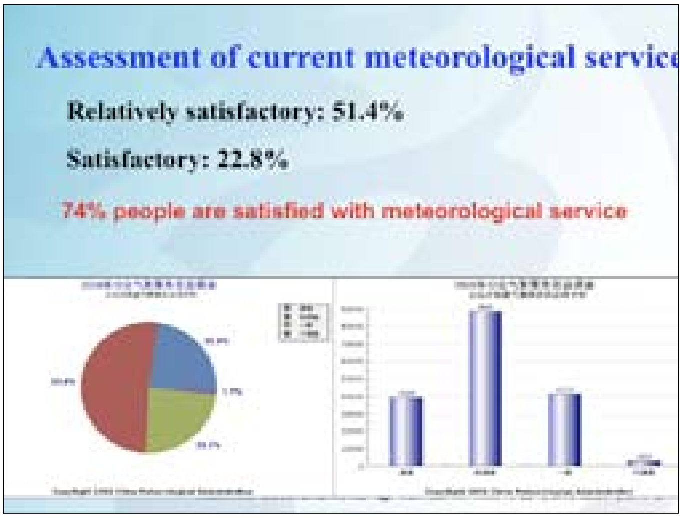

Survey on Social & Economic Benefits of DPP by CMA

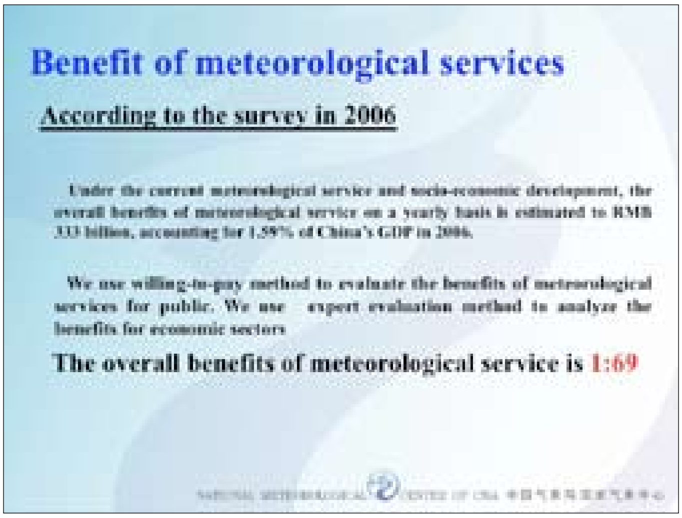

During the second half of 2006,CMA conducted a nationwide survey on the social and economic benefits from the meteorological forecasts and warnings. 174,441 returned questionnaires proved to be in validity.

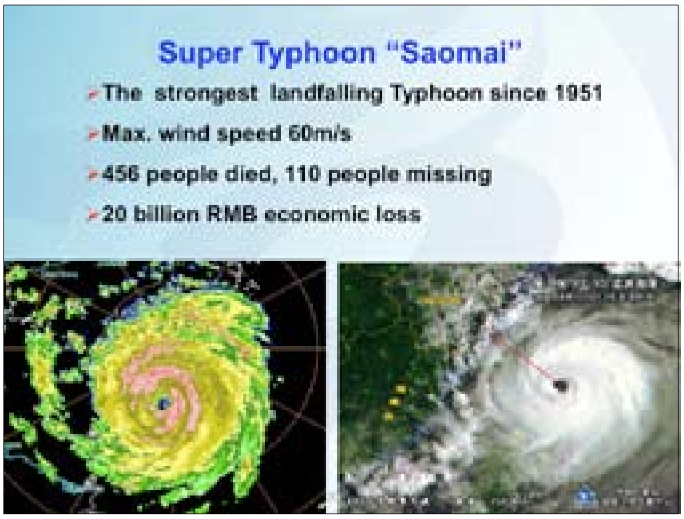

the distribution of participants

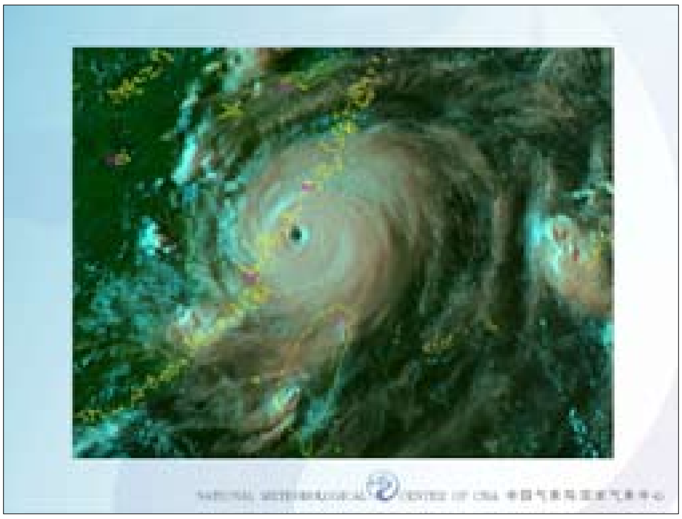

How often:
One time/a day: 56.4%
Two times/a day: 22.1%
Three times/a day: 8%
One time/three days: 8%
One time/ a week: 4.3%
56.4% people listen/watch/read to weather forecast once per day, 22% people listen to weather information twice per day.


Accuracy of weather forecast
Basically Accurate: 66.7%
Accurate: 17.3%
Uncertain: 13.6%
Inaccurate: 2.5%
In terms of survey from 170,000 people , 84% people consider our weather forecast is accurate and basically accurate


Assessment of current meteorological service
Relatively satisfactory: 51.4%
Satisfactory: 22.8%
74% people are satisfied with meteorological service

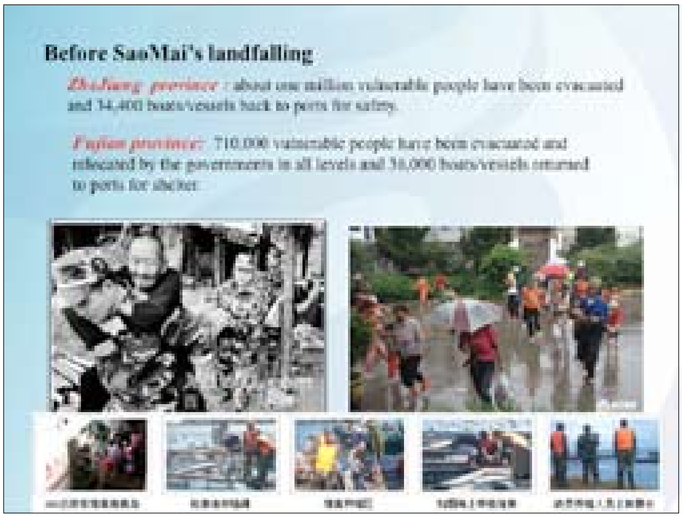

Benefit of meteorological services
According to the survey in 2006
Under the current meteorological service and socio-economic development, the overall benefits of meteorological service on a yearly basis is estimated to RMB 333 billion, accounting for 1.59% of China's GDP in 2006.
We use willing-to-pay method to evaluate the benefits of meteorological services for public. We use expert evaluation method to analyze the benefits for economic sectors
The overall benefits of meteorological service is 1:69


Super Typhoon "Saomai"
The strongest landfalling Typhoon since 1951
Max. wind speed 60m/s
456 people died, 110 people missing
20 billion RMB economic loss




GOES-12 visible image of Hurricane Katrina over the central Gulf of Mexico at 1745 UTC 28 August 2005, near the time of its peak intensity of 150 kt.
gusts of 75.8m/s recorded


The Actions in DPP During Super Typhoon Saomai
Level 1 of Emergency Response initiated
Issued at 09:30UTC Aug. 10 before Saomai landing over China.
1.8 million people evacuated.
Over 70,000 fishermen back to ports/harbors for safety.
红
RED


Before SaoMai's landfalling
ZheJiang province : about one million vulnerable people have been evacuated and 34,400 boats/vessels back to ports for safety.
Fujian province: 710,000 vulnerable people have been evacuated and relocated by the governments in all levels and 38,000 boats/vessels returned to ports for shelter.


Destruction brought by strong wind

highway toll station

SaoMai brought calamity
to shacheng port

Introduction on Typhoon Impact Assessment

Tools: Fuzzy Mathematics

- Typhoon impact is, of course, a fuzzy concept.
- Assessment model could be established in the way of fuzzy mathematics, and also based on the selected factors.

Mathematics Method

If N objects need to be assessed, then there will exist object sets X and impact factor sets U:

$X=\{x_1,x_2,\ldots\ldots,x_n\}$

$U=\{u_1,u_2,\ldots\ldots,u_m\}$

W is the weight distribution of factor, it is written:

$W=\{w_1,w_2,\ldots\ldots,w_m\}$,

here, $w_i \geq 0$, $i=1,2,\ldots,m$, $\sum_{i=1}^{m} w_i = 1$

the assessment set of every factor for N objects

$Bi=(ri1, ri2, \ldots, rin)$, $i=1,2,\ldots,m$.

Then, we can get the assessment matrix as follows:

$$R=\begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

The final assessment subset B is what we want:

$B = WOR$

O is the generalized fuzzy arithmetic operator.

B is the coefficient set for fuzzy assessment of N objects, the larger value of B, the more severe disaster.

Assessment Model Establishment

The key points:

- ✓ determination of membership function
- ✓ distribution of the weighting of impact factors
- ✓ selection of impact factors

the determination of membership function

The membership function is always obtained on control experiment, with subjectivity and experience, to some extend. commonly used methods in determining the membership function are fuzzy statistical method, typical function method and so on.

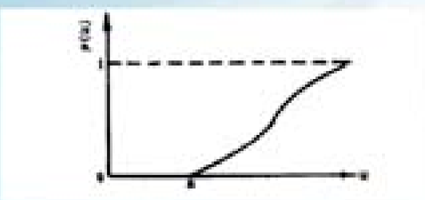
the typical function method is written as:

$$f(u)=\begin{cases}0 & (u\le c)\\ \dfrac{1}{1+[a(u-c)]^{-b}} & (u>c)\end{cases}$$

a, b, c are parameters, and a>0, b>0, c>0, it is regulated that b=2; $c=u_{min}$ are the minimum of u.

f(u) are the membership function of u, it can be used to described the different degree of typhoon disaster. when the impact factor reached some value, the disaster would occur, otherwise, it wouldn't be.

The curve of low type membership function



The determination of weighting for impact factor

Common methods are: expert consultation, statistic method, correlation analysis method and so on. But these methods are depended on human's subjective judgment and experience, or need to collect and select enough statistical data.

Selection of optimal weight factors is very good in fact, it can be more objective and accurate in determination of weight value. It can be written in:

$$w_i = d\frac{\sum r_{ij}}{\sum\sum r_{ij}}, \quad i=1,2,\ldots,p$$

P is objective weight, and d is the weight submission of undetermined factors. When all the weight of factors are unknown, p=m, d=1.

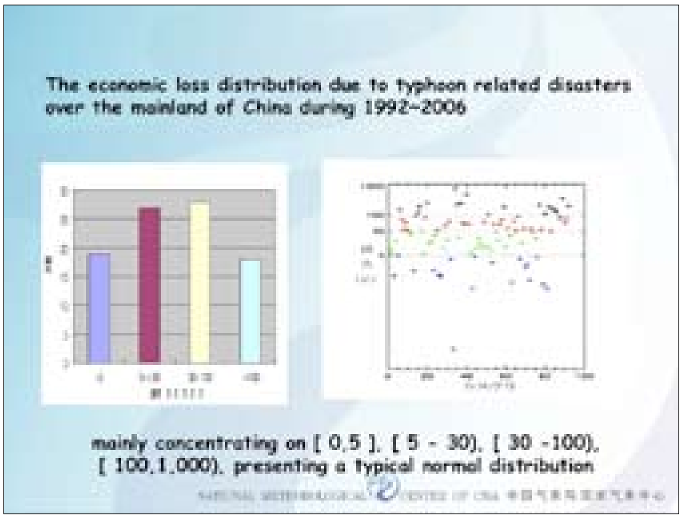
weight had relationship with all case and factors, we choose as much as possible the representative case, fix a reasonable weight, and it can be used directly in calculation.

10 impact factors are selected:

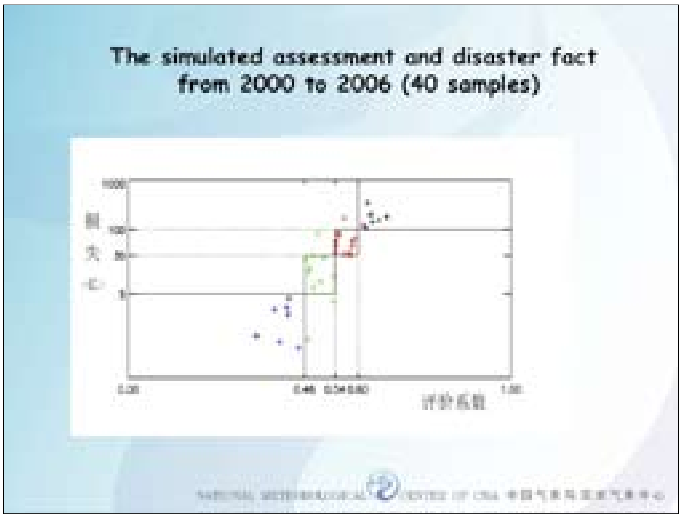
A1: the maximum precipitation of the total process
A2: 24h maximum precipitation
A3: the maximum wind speed during TC landfalling
A4: the minimum surface pressure during TC landfalling
A5: the duration after TC landfalling (hours)
A6: the impacted scope (the coverage with precipitation more than 50mm and wind speed higher than 6 force grade)
A7: the vulnerability of the impacted area
A8: the fatalness of geological disaster over impacted area
A9: the tides over impacted area
A10: the index of DPP over impacted area

Method Dealing with Affecting Factors

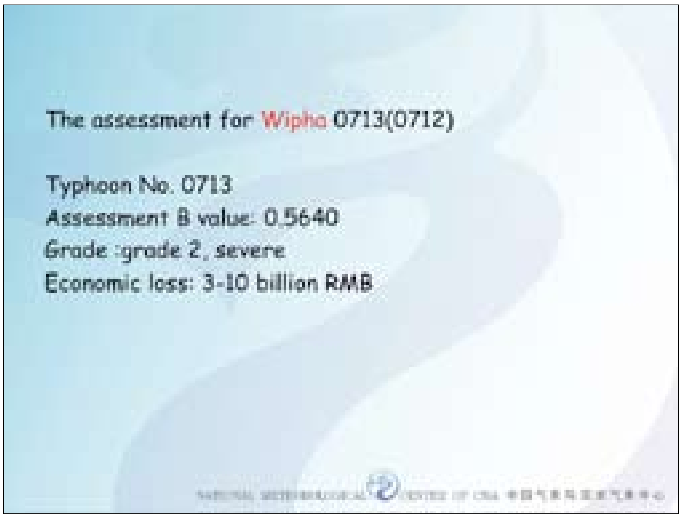
- The maximum rainfall is based on observation or forecast.
- Vulnerability of different regions and the fatalness of geological disaster is based on the research from Liuli; the DPP capability index of different risk regions are adopted the results from nature disaster group's research in 1998.
- Vulnerability can be divided into economical and social index.
- The effect of the tides only considered when tropical cyclone makes landfall on 1, 2, 3, 15, 16, 17 in lunar calendar.


The economic loss distribution due to typhoon related disasters over the mainland of China during 1992~2006
mainly concentrating on [0,5], [5 - 30), [30 -100), [100,1,000), presenting a typical normal distribution


the classification of assessment coefficient
Based on the calculation and statistics, typhoon disasters divided into four levels:
grade 1 (very severe) : B ≥0.6 (economic loss≥10 billion)
grade 2 (severe) : 0.54≤B <0.6 (economic loss:3-10 billion)
grade 3 (heavy) : 0.46≤B <0.54 (economic loss:0.5-3 billion)
grade 4 (moderate): B <0.46 (economic loss<0.5 billion)
The economic loss=Σactual economic loss × annual price ascending exponential ÷the period


The simulated assessment and disaster fact from 2000 to 2006 (40 samples)
评价系数


• For the 40 selected typhoons, the simulated results fit 36 cases, accounting for 92.5%of the whole cases.

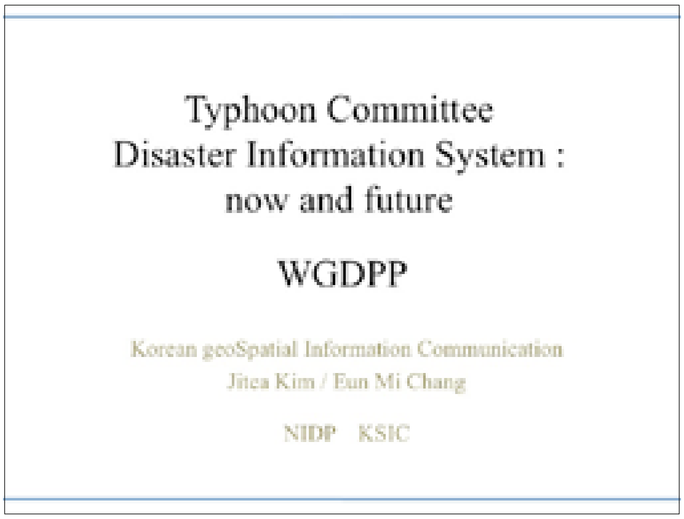

The assessment for Wipha 0713(0712)
Typhoon No. 0713
Assessment B value: 0.5640
Grade :grade 2, severe
Economic loss: 3-10 billion RMB

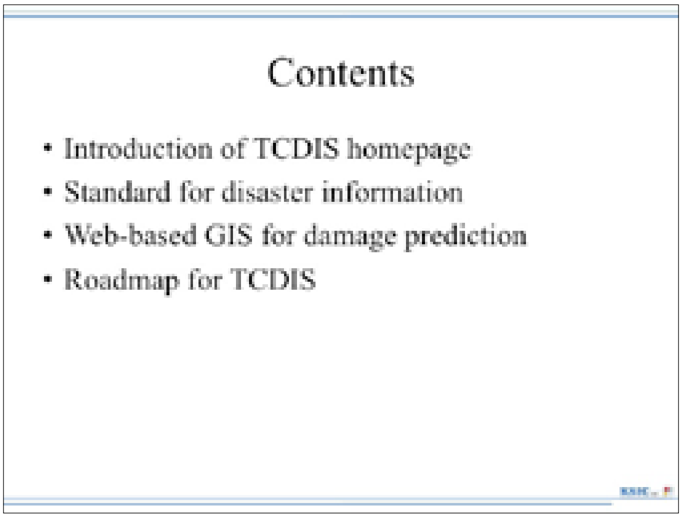

The assessment for Krosa 0716(0715) on 8 Oct. 2007
Typhoon No. 0716
Assessment B value: 0.5320
Grade: grade 3, heavy
Economic loss: 0.5-5 billion RMB

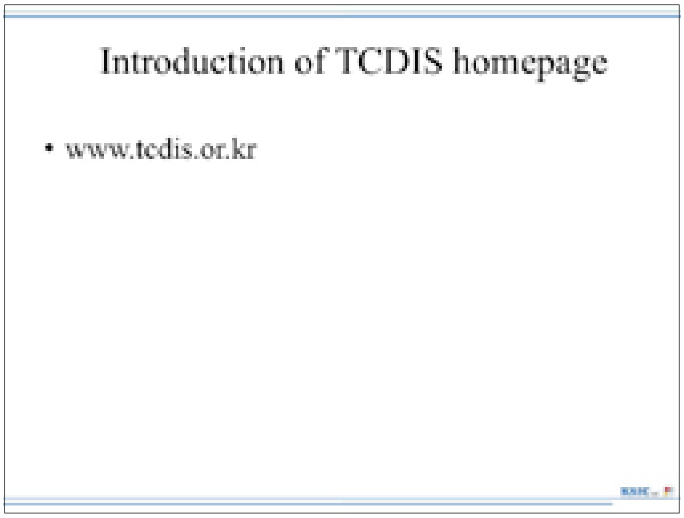

Thanks for Your Attention

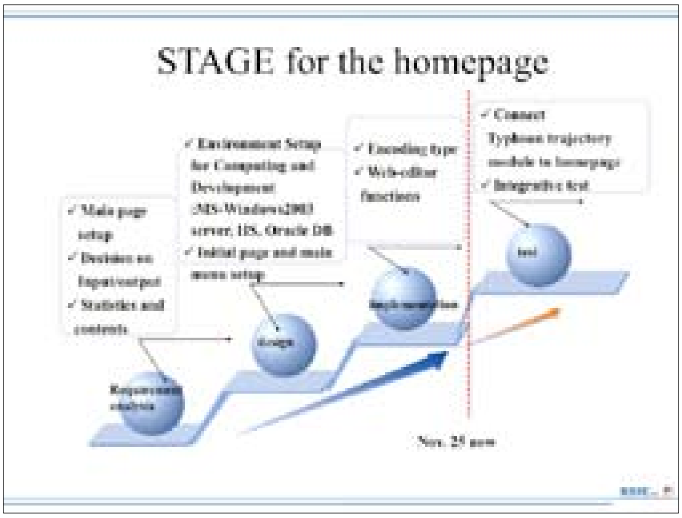
Typhoon CommitteeDisaster Information System : now and future

Jitea Kim / Eun Mi Chang
Korean geoSpatial Information Communication
NIDP　KSIC



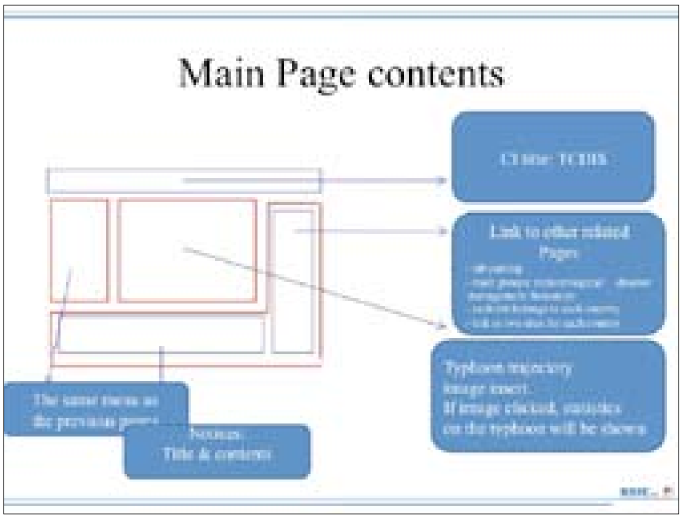




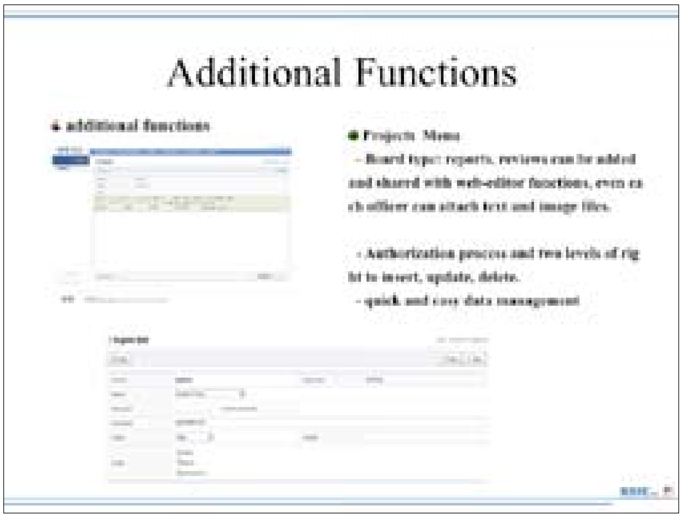


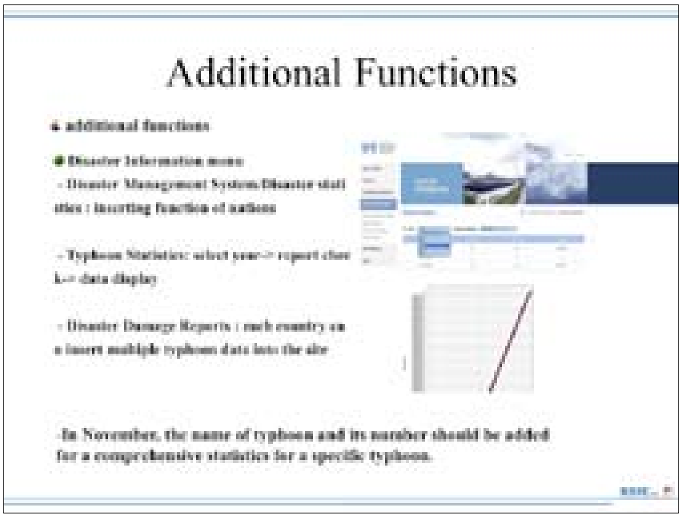

Main page setup
main page
Design prototype

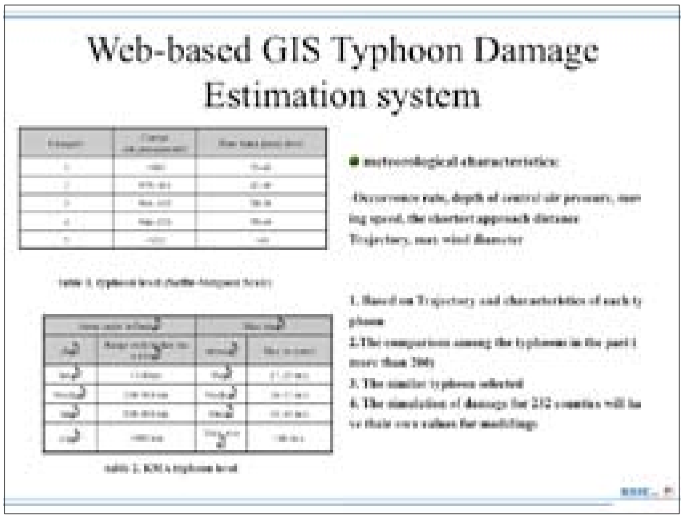

TCDIS leaflet design prototype
TCDIS

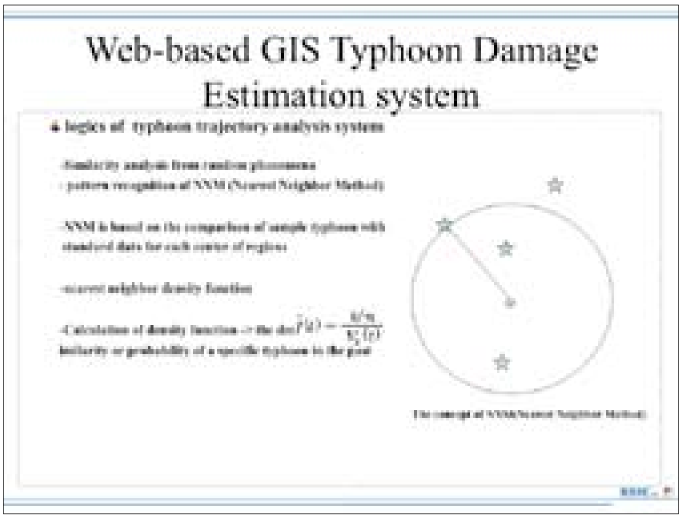

Main Page contents
Link to other related Pages
Typhoon trajectory image insert. If image clicked, statistics on the typhoon will be shown
Notices Title & contents

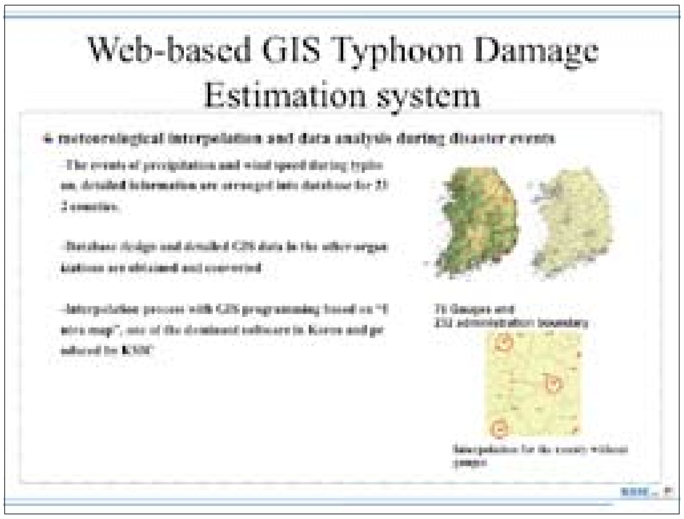

Homepage contents
additional functions
sub-categories setup
Disaster Statistics
->Typhoon Statistics and Damage Statistics
Warning Criteria / Early Warning System: sub-category for each country
authorization of users per each country, trouble shooter function for exceptional cases due to encoding problems.

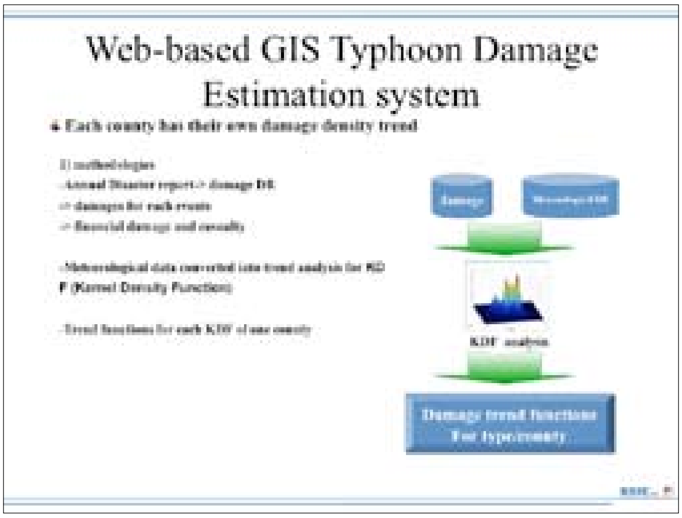

Additional Functions
additional functions
Projects Menu
- Board type: reports, reviews can be added and shared with web-editor functions, even each officer can attach text and image files.
- Authorization process and two levels of right to insert, update, delete.
- quick and easy data management

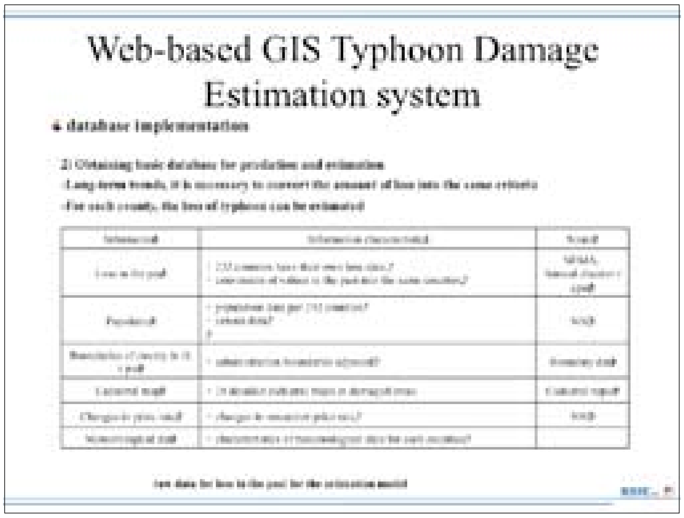

Additional Functions
additional functions
Disaster Information menu
- Disaster Management System,Disaster statistics : inserting function of nations
- Typhoon Statistics: select year-> report click-> data display
- Disaster Damage Reports : each country can insert multiple typhoon data into the site
-In November, the name of typhoon and its number should be added for a comprehensive statistics for a specific typhoon.

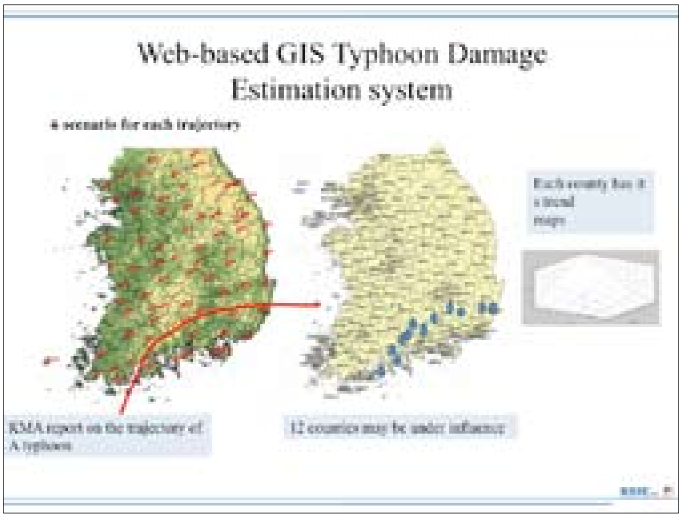

Web-based GIS Typhoon Damage Estimation system
meteorological characteristics

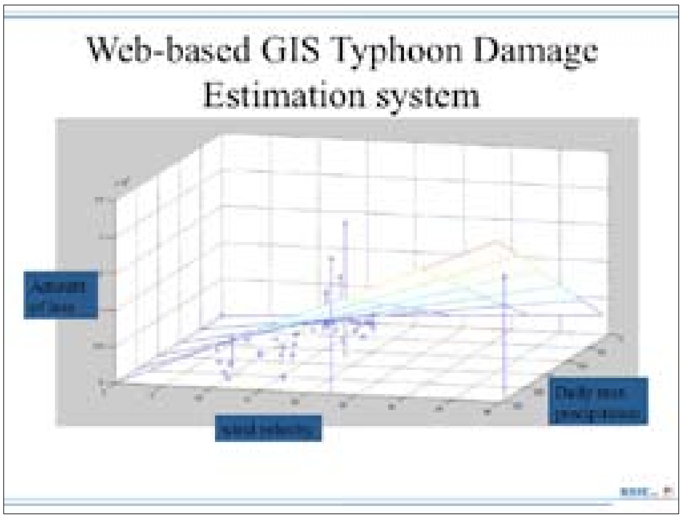

Web-based GIS Typhoon Damage Estimation system
logics of typhoon trajectory analysis system

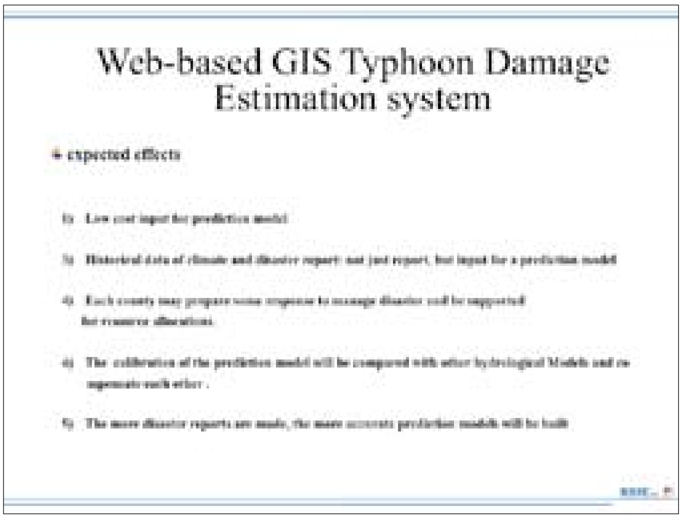

Web-based GIS Typhoon Damage Estimation system
meteorological interpolation and data analysis during disaster events

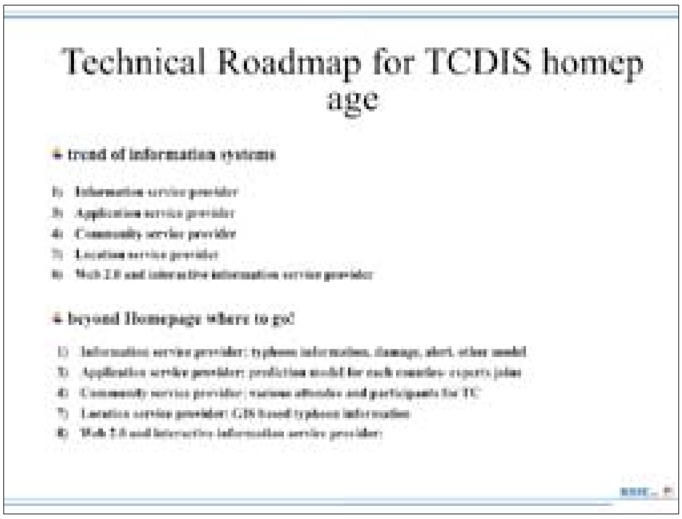

Web-based GIS Typhoon Damage Estimation system
Each county has their own damage density trend
KDF analysis

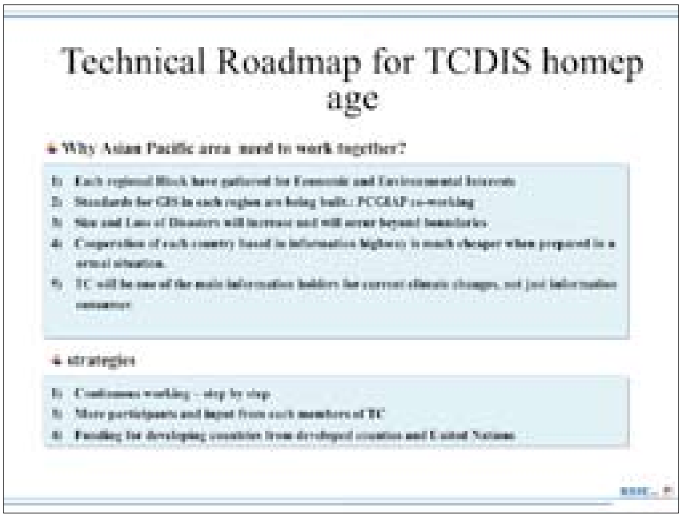

Web-based GIS Typhoon Damage Estimation system
database implementation


Web-based GIS Typhoon Damage Estimation system
scenario for each trajectory
KMA report on the trajectory of A typhoon
12 counties may be under influence


Web-based GIS Typhoon Damage Estimation system
Amount of loss
Daily max precipitation
wind velocity


Web-based GIS Typhoon Damage Estimation system
expected effects

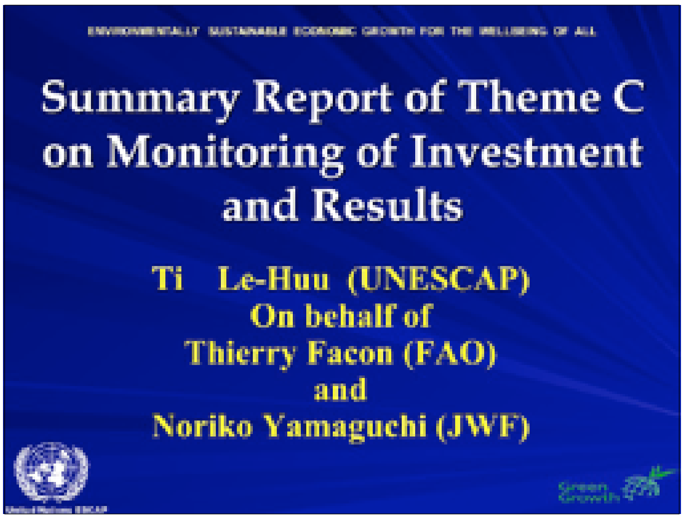

Technical Roadmap for TCDIS homepage
trend of information systems
Information service provider
Application service provider
Community service provider
Location service provider
Web 2.0 and interactive information service provider
beyond Homepage where to go!


Technical Roadmap for TCDIS homepage
Why Asian Pacific area need to work together?
strategies
Continuous working - step by step

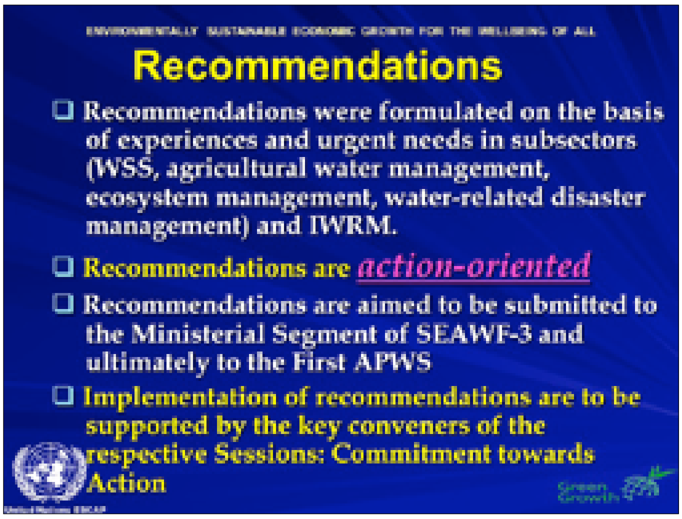

Questions and Answers
Funded by NIDP
Thank you very much!
Dr. Chang , Eunmi
82-2-3274-2245
Dr. Kim, Jitae

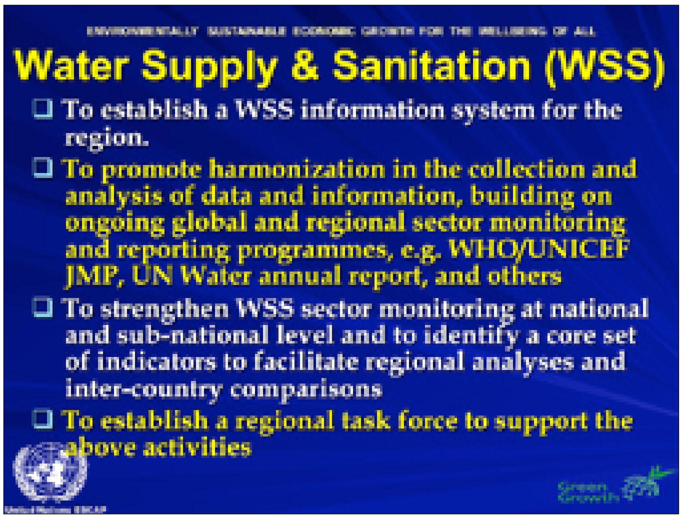
Summary Report of Theme C on Monitoring of Investment and Results

Ti Le-Huu (UNESCAP)
On behalf of Thierry Facon (FAO) and Noriko Yamaguchi (JWF)




ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Monitoring: Lessons of SPM
Monitoring provides a structured approach for focusing on strategies and performance indicators
On system status, monitoring leads to improvement foresight and anticipation; improves ability to detect change, enables rapid change of course corrections
Monitoring data facilitate identification of both optimal and less-effective practices
Monitoring enables prioritizing the allocation of program resources and assists budget preparation
Monitoring provides a mechanism for reporting performance
Monitoring facilitates the involvement of key stakeholders, including civil societies in the planning process.


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Recommendations
Recommendations were formulated on the basis of experiences and urgent needs in subsectors (WSS, agricultural water management, ecosystem management, water-related disaster management) and IWRM.
Recommendations are action-oriented
Recommendations are aimed to be submitted to the Ministerial Segment of SEAWF-3 and ultimately to the First APWS
Implementation of recommendations are to be supported by the key conveners of the respective Sessions: Commitment towards Action


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Water Supply & Sanitation (WSS)
To establish a WSS information system for the region.
To promote harmonization in the collection and analysis of data and information, building on ongoing global and regional sector monitoring and reporting programmes, e.g. WHO/UNICEF JMP, UN Water annual report, and others
To strengthen WSS sector monitoring at national and sub-national level and to identify a core set of indicators to facilitate regional analyses and inter-country comparisons
To establish a regional task force to support the above activities


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Agricultural water management
Urgent needs to improve the irrigation services and the need to maintain infrastructure investment at an adequate level
Governments are urged to adopt farmers-based approach and private-sector-driven initiatives to improve the efficiency of agricultural water resources management
Governments are urged to monitor investment and results in irrigation to adjust investment strategies to meet food securities in basic food staples
To develop guidelines for MIR to harmonize irrigation approaches among donors and develop a set of common indicators.
To adopt service-oriented irrigation modernization concepts


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Ecosystem management
The current knowledge of status of rivers and ecosystems is not adequate to mobilize commitment from leadership nor effective participation of local population.
Governments with assistance of international organizations, such as IUCN and ARRN, are urged to establish a monitoring system on the status of rivers and ecosystems in their respective countries and to mobilize participation of local authorities in developing plans for rehabilitation and restoration.
Governments and international organizations are urged to develop common guidelines to harmonize local and national efforts in rehabilitation and restoration of rivers and ecosystems, including the adoption of complementary policies and strategies.

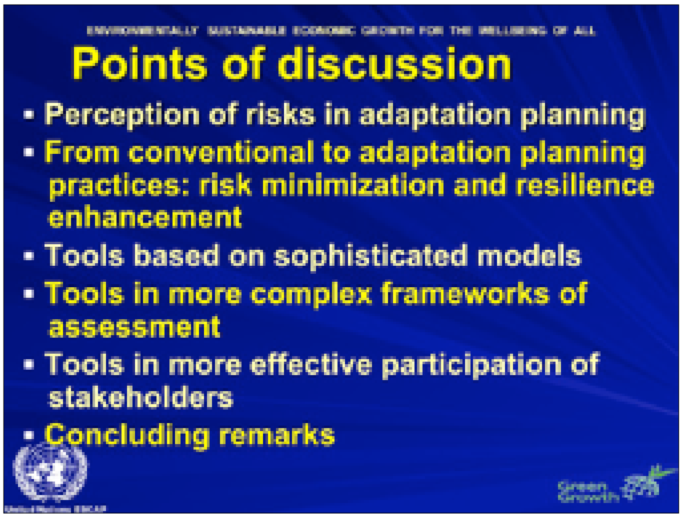

ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Water-related disasters
Governments are urged to adopt standardized methodologies to assess socio-economic impacts of water-related disasters to form a common basis for collaboration as part of a strategy on monitoring.
Governments are urged to increase investment in water-related disaster risk management from the current level of less than 0.01 per cent of GDP in most of developing countries to between 0.4 for the case of Malaysia and Republic of Korea ultimately to 1 per cent as in the case of Japan.

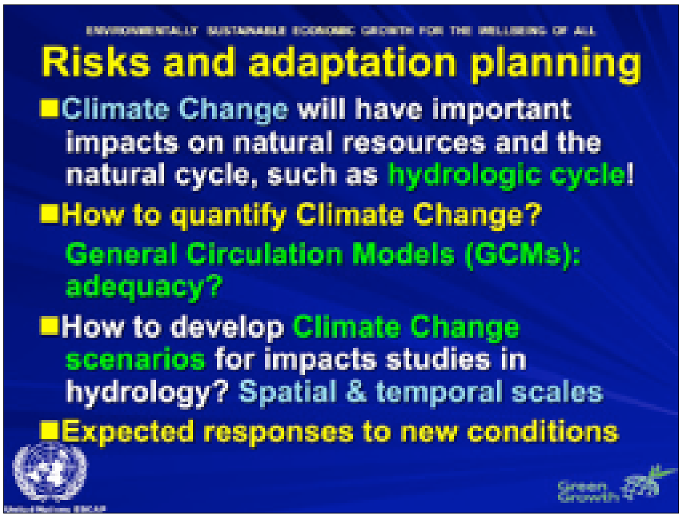

IWRM
Governments are urged to strengthen mechanisms for integrated monitoring of investment and results of IWRM by establishing either
a permanent mechanism for overall monitoring; or
a policy on overall monitoring, through which ad hoc mechanisms could be established at specific time
To expand the current framework of subregional Ministerial Conference on Water in South-East Asia to link to similar initiatives in other subregions towards the development of a Council of Ministers on Water for Asia-Pacific
To link findings of national MIR to priority water issues, such as water and climate change, water and food security and water and nature


Thank you
for more information on
Strategic Planning &
Management (SPM)
www.unescap.org/esd/water/
(UNESCAP website)
www.spm-water-ap.net
(FAO-UNESCAP website)

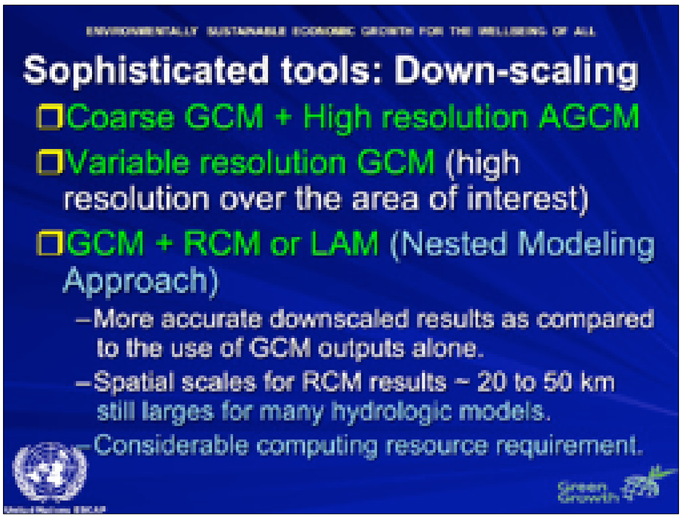
UNESCAP Experiences in Policy Tools and Practices in Adaptation Planning

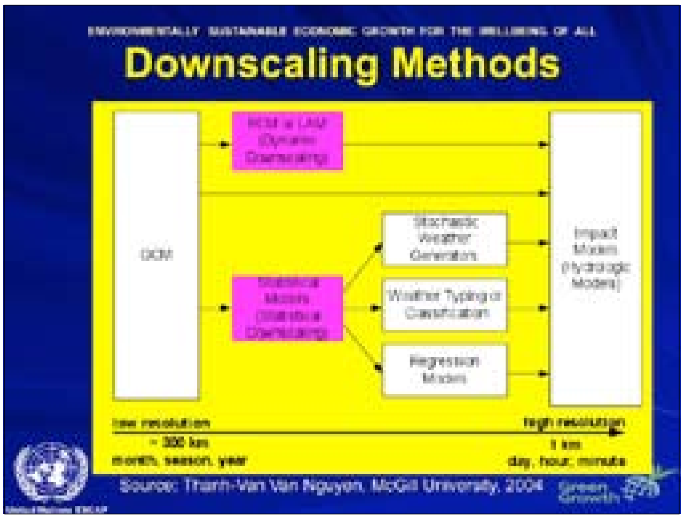
Ti Le-Huu
Sustainable Development and Water Resources Section
Environment and Sustainable Development Division
UNESCAP

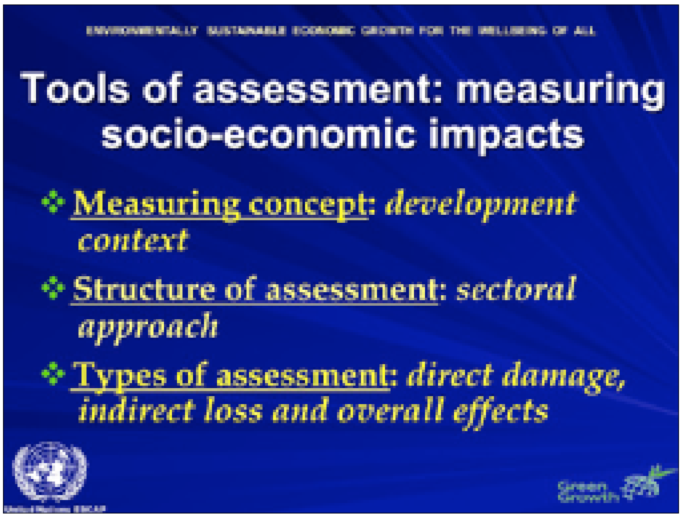




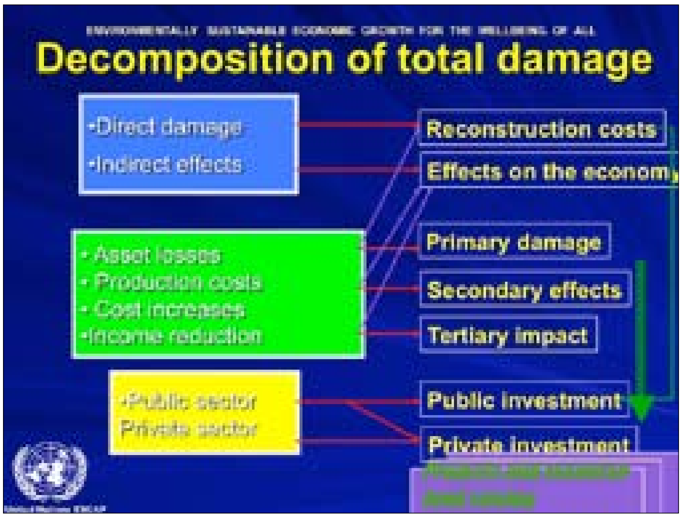

ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Conventional to adaptation planning
Conventional planning: well-established procedures, well-known detailed systemic behaviors and good framework of decision-making
Adaptation planning: reduction of uncertainties
External factors: scenario planning
Internal factors: extrapolation of systemic characteristics
Adaptation planning: resilience enhancement
Social aspects: better focused
Decision-making: more effective participation of stakeholders
Green Growth

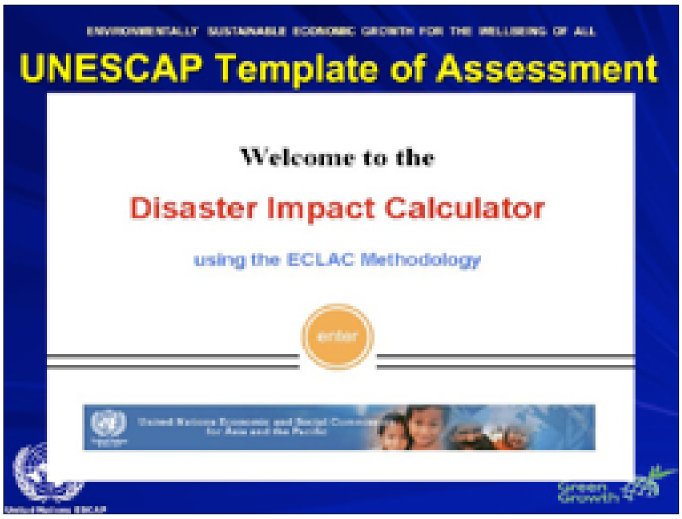

ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Sophisticated tools: Down-scaling
Coarse GCM + High resolution AGCM
Variable resolution GCM (high resolution over the area of interest)
GCM + RCM or LAM (Nested Modeling Approach)
–More accurate downscaled results as compared to the use of GCM outputs alone.
–Spatial scales for RCM results ~ 20 to 50 km still larges for many hydrologic models.
–Considerable computing resource requirement.
Green Growth

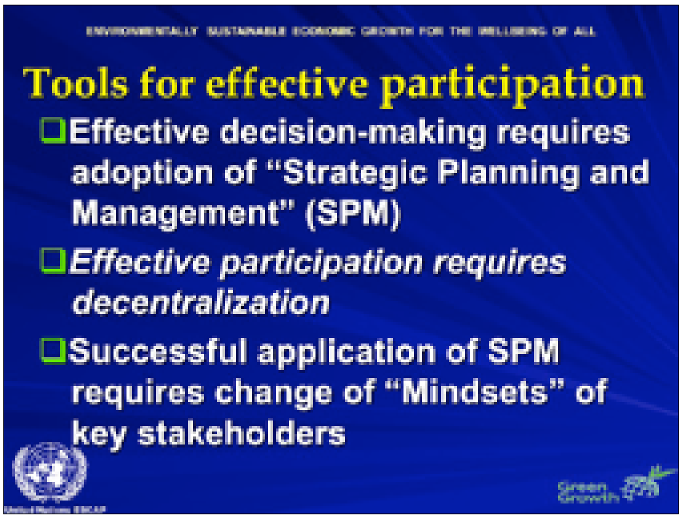

ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Downscaling Methods
GCM
Stochastic Weather Generators
Weather Typing or Classification
Regression Models
Impact Models (Hydrologic Models)
low resolution
~ 300 km
month, season, year
high resolution
1 km
day, hour, minute
Source: Thanh-Van Van Nguyen, McGill University, 2004
Green Growth


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Tools of assessment: measuring socio-economic impacts
Measuring concept: development context
Structure of assessment: sectoral approach
Types of assessment: direct damage, indirect loss and overall effects
Green Growth


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
ECLAC methodology and experiences of its application
Impact in the social sectors
Impact in infrastructure
Impact in the economic sectors
Global effects of damage
Green Growth


ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH FOR THE WELLBEING OF ALL
Decomposition of total damage
-Direct damage
-Indirect effects
- Asset losses
- Production costs
- Cost increases
-Income reduction
-Public sector
Private sector
Reconstruction costs
Effects on the econom
Primary damage
Secondary effects
Tertiary impact
Public investment
Private investment

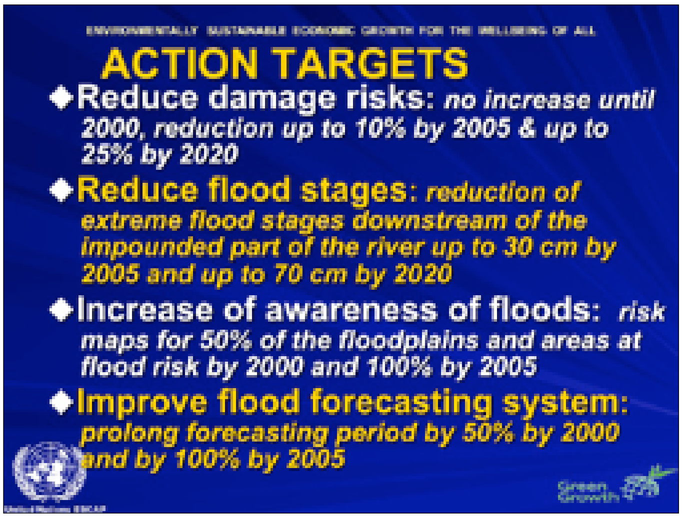

UNESCAP Template of Assessment
Welcome to the
Disaster Impact Calculator
using the ECLAC Methodology
enter

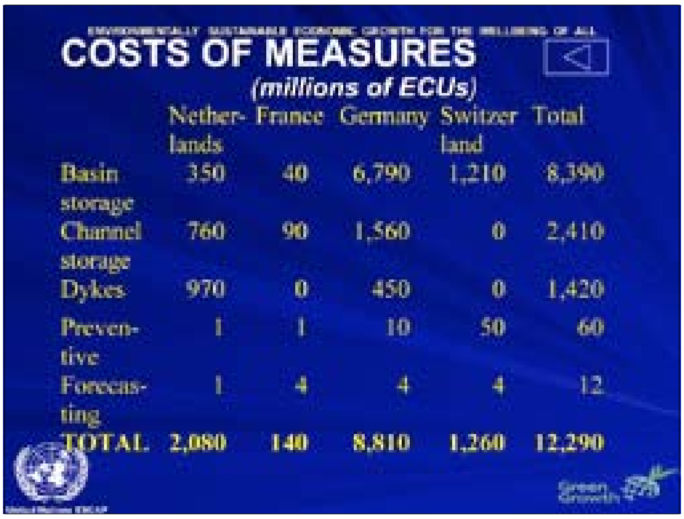

Tools for effective participation
Effective decision-making requires adoption of "Strategic Planning and Management" (SPM)
Effective participation requires decentralization
Successful application of SPM requires change of "Mindsets" of key stakeholders


Trends of SPM in water resources
Example of the River Rhine
Ecological recovery (from 1991): brings salmon back to the Rhine - Salmon 2000
Action Plan on Flood Defense (1998-2020): protect people and goods against flooding while integrate ecological improvements of the Rhine and its floodplains.

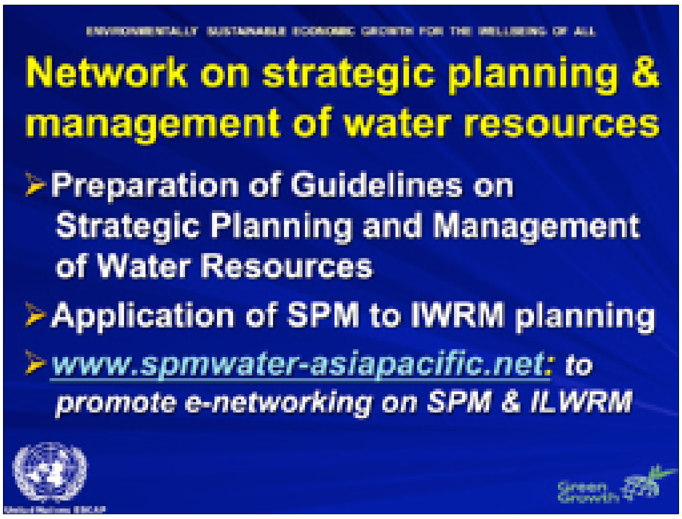

Development of Rhine Strategies
Strategic approaches to flood control and management: NEW PERCEPTION which involves also spatial planning and land use
Integration of flood control and management into national development process: PRINCIPLES
Establishment of a priority action plan: ACTION TARGETS

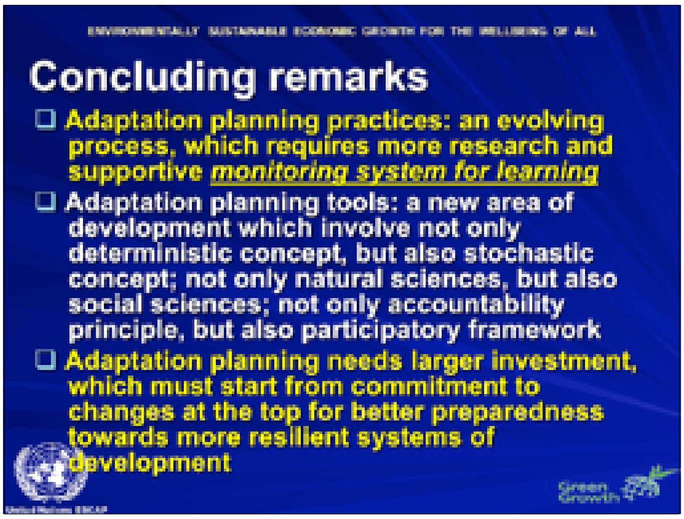

Principles
Integration of related sectoral measures: (i) water management, (ii) spatial planning and urban development, (iii) nature protection, and (iv) agriculture and forestry.
Integration of preventive measures: (i) water is part of the whole, (ii) store water, (iii) let the river expand, (iv) beware of the danger, and (v) integrated & concerted action.


ACTION TARGETS
Reduce damage risks: no increase until 2000, reduction up to 10% by 2005 & up to 25% by 2020
Reduce flood stages: reduction of extreme flood stages downstream of the impounded part of the river up to 30 cm by 2005 and up to 70 cm by 2020
Increase of awareness of floods: risk maps for 50% of the floodplains and areas at flood risk by 2000 and 100% by 2005
Improve flood forecasting system: prolong forecasting period by 50% by 2000 and by 100% by 2005



	Netherlands	France	Germany	Switzerland	Total
Basin storage	350	40	6,790	1,210	8,390
Channel storage	760	90	1,560	0	2,410
Dykes	970	0	450	0	1,420
Preventive	1	1	10	50	60
Forecasting	1	4	4	4	12
TOTAL	2,080	140	8,810	1,260	12,290





WMO Tropical Cyclone Programme

WMO Tropical Cyclone Programme News in 2007

4.1 Introduction

The WMO Tropical Cyclone Programme (TCP) carries out various activities under the guidance of WMO Congress (Cg) and Executive Council (EC) to contribute to the relevant objectives of the WMO Strategic Plan. The Programme comprises two components: a general component concerned with methodology and transfer of technology and a regional component devoted to the activities of five regional tropical cyclone bodies. The updated list of Members of these regional bodies is shown in Appendix I.

4.2 The 15th WMO Congress

The 15th WMO Congress was held in Geneva from 7 to 25 in May 2007. The Congress expressed its appreciation for the achievements and progress being made by both the general and regional components of TCP, especially in association with the International Strategy for Disaster Reduction (ISDR). Those include the progress in improving the operational system as a result of the comprehensive regional cooperation programmes of the TCP regional bodies and the valuable guidance materials published under the general component of the Programme

The Congress stressed that the TCP should continue to give priority to capacity building, through activities of training including attachments for forecasters of developing countries and the provision of guidance materials, with a view to upgrading further the capabilities of Members to provide better tropical cyclone, flood and storm surge forecasts and warnings, which is essential for a sustained augmentation of the tropical cyclone warning services provided by NMHSs, particularly in Small Island Developing States (SIDS) in the tropical cyclone basins and Least Developed Countries (LDCs) that are equally vulnerable to tropical cyclones. In this respect, the Congress placed a high value on continuation of the co-sponsorship by WMO for the annual RA IV Workshops on Hurricane Forecasting and Warning organized by NOAA at the RSMC Miami, the biennial Southern Hemisphere Training Courses on Tropical Cyclones by the Australian Bureau of Meteorology, and the biennial RA I Training Courses on Tropical Cyclones by Météo-France at the RSMC La Réunion, and training attachment of operational forecasters at TC RSMCs and TCWCs during the cyclone season, and storm-surge experts at the Indian Institute of Technology in India, noting the significant effectiveness in operational practice, and therefore requested the Secretary-General to enhance the coordination with those Centres to promote such activities.

The Congress noted with satisfaction that the TCP had strengthened cooperation with the Public Weather Services Programme (PWS) in implementing training workshops with a common aim to assist Members to improve their provision of support for safety of life and property, and stressed that those workshops should continue to be organized on modern techniques of tropical cyclone forecasting and warning and skills for interaction with the media, with special focus on operational forecaster responsibilities during tropical cyclone events. The Congress also strongly supported collaboration between the TCP and the Marine Meteorology and Oceanography Programme (MMoP), through JCOMM, in the series of Regional Workshop on Storm Surge and Wave Forecasting as an important initiative of WMO and IOC to enhance capabilities of Members in the field of natural disaster prevention and mitigation. The Congress was pleased to note that those workshop was effective in transferring operational wave and storm surge forecasting skills, as well as technology transfer in the form of freeware for storm surge and wave modelling and forecasting. The Congress agreed that those activities should be continued and further strengthened in the future and, in this context, noted with appreciation that consideration was being given to including elements of inundation modelling in these workshops, in collaboration with the hydrological community, through the Commission for Hydrology. The Congress noted with appreciation that the “First JCOMM Scientific and Technical Symposium on Storm Surges” wouldl be held in Seoul, Republic of Korea in October 2007 and encouraged the participation of tropical cyclone experts in this symposium.

The Congress noted the need for closer liaison and enhanced coordination among the six TC RSMCs and TCWCs concerned. To this end, the Congress agreed on the continuation of the series of technical coordination meetings among the six TC RSMCs and TCWCs concerned with regard to their role, function and responsibility, and to technical matters of common interest. The Congress approved the organization of the Sixth TC RSMCs/TCWCs Technical Coordination Meeting in 2009. In this connection, the Congress noted with appreciation that the Government of Indonesia has agreed to fund the establishment of Jakarta TCWC, which would start in early 2008.

Noting the requirements within the framework of the five regional tropical cyclone bodies for further strengthening of warning systems and measures to minimize disasters caused by tropical cyclones and associated storm surges, floods and landslides, the Congress emphasized the importance of developing collaborations through concrete initiatives in linking three major components of their activities, i.e. operational meteorology, hydrology, and disaster risk reduction from the viewpoint of a multi-hazard early warning system. To this effect, it agreed that there was an urgent need to encourage proactive participation of hydrologists and DRR experts in the regular sessions of the five tropical cyclone regional bodies to identify gaps and requirements that could be addressed through collaborations and partnerships to support enhanced coastal and marine risk management decision-processes.

The Congress stressed critical contributions of the TCP to the WMO Disaster Risk Reduction Programme (DRR) and noted with appreciation efforts underway for coordination of the TCP, the Hydrology and Water Resources Programme (HWR) and DRR activities in this regard. It encouraged the TC RSMCs to promote research on the impact of global warming on tropical cyclones. This may be of great significance to many nations, particularly to small islands and low-lying coastal countries.

The Congress requested TCP to strengthen its study on the categorization of tropical cyclone intensity toward the establishment of a universal categorization of tropical cyclones.

In view of the great benefits of the International Workshop on Tropical Cyclones (IWTC), the Congress requested the Secretary-General to pursue, as appropriate, the recommendations from IWTC-VI and agreed to support the Seventh International Workshop on Tropical Cyclones (IWTC-VII). In this regard, the Congress noted that France offered to host the IWTC-VII in La Réunion in 2010.

The Congress urged the Secretary-General to ensure that the TCP Office of the Secretariat be appropriately resourced to ensure continued delivery to the essential work of the Programme and its key contribution to disaster prevention and mitigation.

The Congress endorsed continuation of the following TCP sub-projects for the period (2008-2011):

(a) TCP sub-project No. 23: Combined effects of storm surges/wind waves and river floods in low-lying areas;
(b) TCP sub-project No. 25: Study on the economic and societal impacts of tropical cyclones;
(c) TCP sub-project No. 26: Evaluation of tropical cyclone warning systems (their effectiveness and deficiencies).

In view of the Tropical Cyclone Programme that has much to contribute to reduction of risks of disasters caused by tropical cyclones and related hazards, and hence to the active involvement in activities of DRR and the ISDR and to helping Members achieve sustainable development, the Congress decided:

(1) That the WMO Tropical Cyclone Programme shall be further strengthened;
(2) That the activities of the Tropical Cyclone Programme shall comply with the WMO Strategic Plan (2008-2011) adopted under Resolution 6.2/1 (Cg-XV), with its major contributions focused on the following Expected Results:
I. Enhanced capabilities of Members to produce better weather forecasts and warnings;
III. Enhanced capabilities of Members to provide better hydrological forecasts and assessments;
VI. Enhanced capabilities of Members in multi-hazard early warning and disaster prevention and preparedness;
VIII. Broader use of weather, climate and water outputs for decision-making and implementation by Members and partner organizations;
IX. Enhanced capabilities of Members in developing countries, particularly Least Developed Countries, to fulfil their mandates;

In this connection, the Congress urged the WMO Members to ensure that their Meteorological, Hydrological and Disaster Risk Reduction Services take whatever steps are within their competence and coordinate with the appropriate authorities:

(a) To promote awareness of the risks associated with tropical cyclones and related hazards;

(b) To continue to strengthen their forecasting and warning capabilities and ensure wide dissemination, understanding and utilization of their products, particularly at the community and local level;

(c) To see that the measures necessary to save human lives and reduce damage are carried out at all levels, including the community level, as a consequence of tropical cyclone forecasts and warnings;

(d) To continue to work regionally through sharing of knowledge, skills, experience and resources to save human lives and reduce damaging impacts.

The Congress called for the continuation of the fruitful and close cooperation with other international organizations, especially the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), ISDR System partners, the International Civil Aviation Organization (ICAO), and regional disaster mitigation and preparedness agencies, and with other WMO Programmes and Technical Commissions, such as JCOMM, to promote a multidisciplinary approach towards the attainment of the humanitarian goals of the programme, and appealed to the Voluntary Cooperation Programme donor Members, the United Nations Development Programme (UNDP), Development Banks and other international organizations and funding agencies concerned with the goals of TCP to give the maximum possible support to those activities by contributing the resources essential for their expeditious implementation;

The Congress requested the Secretary-General:

(1) To bring this resolution to the attention of all concerned;

(2) To keep Members concerned fully informed of progress and of developments in the planning and implementation of the programme;

(3) To assist Members in their efforts to safeguard life and property from tropical cyclones and related hazards by supporting, to the maximum extent possible within the available budgetary resources, activities related to the programme and especially those directly linked with the provision of accurate and timely warnings and the organization of proper community response.

4.3 TCP Activities in 2007

Main activities under the general component continued to be directed towards the publication of manuals and reports, which provide information and guidance to Members to assist them in the increased application of scientific knowledge and technology for the improvement of warning and disaster prevention and preparedness systems. Under this component, attention was also given to the broader aspects of training under the TCP. Ppriority was given to capacity building to address the issue of sustainable development with emphases particularly on attachments of forecasters from developing countries at the different Regional Specialized Meteorological Centres (RSMCs) during the cyclone season and storm surge/wave experts at the Indian Institute of Technology in Kharagpur, India, a number of workshops and several joint training events in cooperation with the Public Weather Service Programme. These activities are in accordance with the Programme's objective to facilitate the transfer of knowledge and technology to improve the institutional efficiency of the NMHSs leading to the provision of better tropical cyclone track and intensity forecasts and associated flood and storm surge forecasts.

TCP was engaged in the study on suitable conversion factors between the WMO 10-minute standard average wind and 1-minute, 2-minute and 3-minute "sustained" winds. This undertaking is on schedule to look into determining the conversion factors connecting the various wind averaging periods and its subsequent inclusion into the Global Guide to Tropical Cyclone Forecasting and the Operational Plans/Manual of the TC regional bodies. A draft report on the study was prepared by Systems Engineering Australia Pty Ltd (SEA).

Many activities were also carried out under the regional component with a view to minimizing tropical cyclone disasters through close regional cooperation and coordination. Major emphasis was placed on improvement in the accuracy of the forecasts, provision of timely early warnings and on the establishment of necessary disaster preparedness measures. Each of the tropical cyclone bodies has in place a formally adopted tropical cyclone operational plan or manual, aimed at ensuring the most effective tropical cyclone forecasting and warning system with existing facilities, through cooperative agreement on sharing of responsibilities and on coordinated activities within the respective region. Each of these bodies was giving attention to the implementation of their technical plan for future development of services to meet regional needs for upgrading forecasting and warning facilities and services for tropical cyclones and associated floods and storm surges, as well as for related disaster prevention and preparedness measures and supporting activities in training and research.

During 2007, the following events were organized or co-sponsored under TCP:

- Training on Operational Tropical Cyclone Forecasting (RSMC New Delhi, India; 29 January - 9 February);
- WMO/ESCAP Panel on Tropical Cyclones, thirty-fourth session (Male, Maldives, 25 February – 1 March);
- RA IV Hurricane Committee, twenty-ninth session (Curacao, Netherlands Antilles, 27 March – 3 April);
RA IV Workshop on Hurricane Forecasting and Warning (Miami, Florida, USA, 16-28 April);
- Typhoon Operational Forecasting Training at RSMC Tokyo-Typhoon Center (Tokyo, Japan, 18 to 27 July) - Attachment of Storm Surge Experts from Bangladesh and Pakistan to the Indian Institute of Technology (Kharagpur, India, 20 August to 2 September)
- Typhoon Committee Roving Seminar (Manila; 5-8 September);
Typhoon Committee Workshop on Social Economic Impacts of Extreme Typhoon-related Events (Bangkok, Thailand; 10-14 September);
- 7th Southern Hemisphere Training Course on Tropical Cyclones (Melbourne, Australia; 10-28 September);
- ESCAP/WMO Typhoon Committee, 40th session (Macao, China; 21-26 November);
- Training on Operational Tropical Cyclone Forecasting (RSMC Nadi, Fiji; 3 - 13 December);

In addition, staff of the TCP Division participated in the following activities:

- Training on Operational Tropical Cyclone Forecasting (RSMC New Delhi, India; 29 January - 9 February);
- WMO/ESCAP Panel on Tropical Cyclones, thirty-fourth session (Male, Maldives, 25 February – 1 March);
- RA IV Hurricane Committee, twenty-ninth session (Curacao, Netherlands Antilles, 27 March – 3 April);
- RA IV Workshop on Hurricane Forecasting and Warning (Miami, Florida, USA, 16-28 April);
- Typhoon Committee Workshop on Social Economic Impacts of Extreme Typhoon-related Events (Bangkok, Thailand; 10-14 September);
- 7th Southern Hemisphere Training Course on Tropical Cyclones (Melbourne, Australia; 10-28 September);
- ESCAP/WMO Typhoon Committee, Fortieth session (Macao, China, 21 to 26 November).

4.4 Activities of TCP Regional Bodies in Other Basins

The thirty-fourth session of the WMO/ESCAP Panel on Tropical Cyclones was held in Male, Maldives from 25 February to 1 March 2007. The session was attended by 27 participants from seven (out of eight) Members of the Panel, namely, Bangladesh, India, Maldives, Oman, Pakistan, Sri Lanka and Thailand. It was also attended by observers from China, Asian Disaster Reduction Center (ADRC), Indian Institute of Technology (IIT)-Kharagpur, International Civil Aviation Organization, (ICAO), International Federation of Red Cross and Red Crescent Societies (IFRC), United Nations Development Programme (UNDP) and representatives from WMO, UNESCAP and Technical Support Unit (TSU).

Under the Panel, attachment of three forecasters from Bangladesh, Myanmar and Sri Lanka was arranged by WMO and the RSMC New Delhi from 12 to 23 February 2007 for the on-the-job training at the RSMC on operational analysis and forecasting of tropical cyclone. Panel News No.22 was published in March 2006, No. 23 in February 2007, and No.24 in October 2007, by TSU and distributed to the Members and others concerned. The Panel's Annual Review for the year 2006 which was consolidated and finalized by the Chief Editor, Mr A. K. Bhatnagar (India) with contributions from the National Editors was submitted to WMO in March 2007 for publication.

The twenty-ninth annual session of the Hurricane Committee was held in Curacao, Netherlands Antilles, 27 March – 3 April 2007. The meeting was represented by almost all the Members of WMO Regional Association IV (RA IV), as well as several other participants from Spain, Caribbean Institute for Meteorology and Hydrology (CIMH), International Federation of Red Cross (IFRC), International Strategy for Disaster Reduction (ISDR) and Caribbean Meteorological Organization (CMO). The Government of the USA hosted an RA IV Workshop on Hurricane Forecasting and Warning, and Public Weather Services in Miami, 16 - 28 April 2007. It was organized by the NWS/NOAA Tropical Prediction Center/National Hurricane Center in cooperation with WMO (TCP Division and PWS Unit). The workshop was conducted in English, and attended from eleven Members of RA IV.

The Latin America-Caribbean Hurricane Awareness Tour (LACHAT) took place from 16 to 22 April 2007. The U.S. Air Force C-130 (J-model) Hurricane Hunter plane visited Campeche and Cozumel, Mexico; Grand Cayman Island; Santo Domingo, Dominican Republic; St Croix, US Virgin Islands; and San Juan, Puerto Rico. As in past years, the CHAT successfully conveyed the importance of the team effort involved in the hurricane preparedness programme and the need for advance planning in high-risk communities. The CHAT enhanced the visibility of the participating country's weather forecasting and emergency management offices. Slightly over 12,000 persons toured the plane.

Eleven WMO/RA IV Members attended the American Meteorological Society (AMS) Annual Meeting in San Antonio, Texas from 13 -19 January 2007. The eleven RA IV members joined colleagues from NMHSs from around the world to participate in the AMS International Sessions on Global Challenges Facing National Hydro-Meteorological Services (NMHSs) and Capacity-Building Workshop on Numerical Weather Prediction (NWP).

For the members of RA I and RA V Tropical Cyclone Committees, the seventh Southern Hemisphere Training Course on Tropical Cyclones and Workshop on Public Weather Services was held, Melbourne, Australia, from 10 21 September 2007. Thirteenth participants from ten countries participated in these two events, building their capacity in modern techniques of tropical cyclone forecasting and warning, and skills for delivering those products through the national Public Weather Service programmes and activities. Also, the Training Course in Marine Meteorology for the Pacific Small Island Developing States (SIDS) National Meteorological Services (NMS) was organized in Tahiti, French Polynesia, from 8 to 12 October 2007.

The 2006 and 2007 Pacific International Desk Training Programme were conducted in Honolulu, Hawaii Islands, USA. About ten participants from about seven countries participated in this programme during the 2006-2007 period.

4.5 Cooperation with Other Organizations

In accordance with the wishes of the WMO Congress, close cooperation with other international and regional organizations has strengthened. Thus, there has been close cooperation and collaboration with the Economic and Social Commission for Asia and the Pacific (ESCAP), the International Strategy for Disaster Reduction (ISDR) Secretariat, the Asian Disaster Reduction Center (ADRC), the International Federation of Red Cross and Red Crescent Societies (IFRC), the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and other organizations, on a variety of matters of common concern. The main items include ESCAP's co-sponsorship of the Typhoon Committee and the Panel on Tropical Cyclones, as well as the ISDR Secretariat and the ADRC's involvement in the disaster prevention and preparedness component of the TCP, in particular in the context of the ISDR.

As part of the long-established close working relationship between WMO and the International Civil Aviation Organization (ICAO), a number of the TC RSMCs and Tropical Cyclone Warning Centres have also been designated as ICAO Tropical Cyclone Advisory Centres (TCAC) by ICAO Regional Air Navigation Agreements. The centres, listed below, provide specialized tropical cyclone warning services for the aviation community:

RSMC/TCWC	**Area of responsibility**
Darwin (Australia)	South-eastern Indian Ocean, South-western Pacific Ocean
Honolulu (USA)	Central North Pacific
La Réunion (France)	South-western Indian Ocean
Miami (USA)	North Atlantic, Caribbean, Eastern North Pacific
Nadi (Fiji)	Southern Pacific
New Delhi (India)	Bay of Bengal and the Arabian Sea, i.e. N: Coastal line; S: 5N/10N; E:100E; W: 45E
Tokyo (Japan)	Western North Pacific, including the South China Sea

On a regional basis, WMO, through its Tropical Cyclone Programme, has fostered and maintained close collaboration and fruitful coordination with regional bodies concerned with disaster preparedness, prevention and mitigation issues, in particular with the Asian Disaster Preparedness Center (ADPC), the Asian Disaster Reduction Center (ADRC), the Caribbean Disaster Emergency Response Agency (CDERA), and the South Pacific Regional Environment Programme (SPREP), and UN-ISDR Africa and Central America.

4. 6 TCP planned activities for 2008

TCP covers a wide range of activities which are of a continuing and long-term nature. Preceding sections of this report contain an overview of several of the ongoing activities and, in some instances, indications have been given of the plans for the period ahead. The main parts of the 2008 programme are set out below in summary form:

General component

(a) Follow-up activities on the WMO Strategic Plan;

(b) Updating of the TCP home page within the WMO Web site, and developing the Tropical Cyclone

Forecaster web site (TCP Sub-project No. 24) which will serve as a source for tropical cyclone forecasters to obtain forecasting and analytical tools for tropical cyclone development, motion, intensification, and wind distribution;

(c) Attachment of forecasters to all six TC RSMCs during the cyclone season;

(d) Continue to implement the following TCP sub-projects, endorsed by Congress XV (Geneva, 2007)

- Sub-project No. 23 - "Combined Effects of Storm Surges and River Floods in Low Lying Areas";
- Sub-project No. 25 - "Study on the economic and societal impacts of tropical cyclones";
- Sub-project No. 26: "Evaluation of tropical *cyclone warning systems (their effectiveness and deficiencies)".*

Outreach to media and general public by posting tropical cyclone information to the WMO news website, and responding by email to inquiries related to tropical cyclones around the globe.

Regional component

Under the regional component, the programme will be mainly concerned with the activities undertaken by the five regional tropical cyclone bodies and the implementation of the decisions they make. A provisional schedule of meetings and training events for 2008 within or related to the TCP, is given below:

- WMO/ESCAP Panel on Tropical Cyclones, 35th session (Manama, Bahrain, 5 – 10 May 2008);
- RA IV Workshop on Hurricane Forecasting and Warning, and Public Weather Services (Miami, USA, 7-19 April 2008);
- RA IV Hurricane Committee, 30th session (Orland, USA, 23-29 April 2008);
- RA I Workshop on Tropical Cyclone Research (La Reunion, 23-26 May 2008
- Typhoon Operational Forecasting Training (RSMC Tokyo, Japan; 23 July – 1 August 2008);
- Training on Storm Surge Forecasting at Indian Institute of Technology (IIT) (Delhi, India; planned in November 2008);
- RA V Tropical Cyclone Committee 12th Session (Alofi, Niue; 11 – 17 July 2008);
- RA I Tropical Cyclone Committee 18th Session, Co joint with DRR Project Planning Meeting for Early Warning System (Lilongwe, Malawi; 6 – 10 October 2008).

Important activities in the year projected will include:

- As appropriate, preparation, editing, publication and distribution of new editions or supplements to the Tropical Cyclone Operational Plans for the Bay of Bengal and Arabian Sea (English only), the South-West Indian Ocean (English and French), the South Pacific and the South-East Indian Ocean (English and French), the Hurricane Committee Region (English and Spanish) and the Operational Manual for the Typhoon Committee Area (English only);
- Distribution of updated technical plans for further development of the Regional Cooperation Programmes of the five regional tropical cyclone bodies;
- Preparation and publication of Panel on Tropical Cyclones Annual Review for 2007and Panel News.

and, in more general terms:

- Activities for the implementation of the Tropical Cyclone Programme section of the WMO Strategic Plan;
- Implementation of activities within the framework of the International Strategy for Disaster Reduction (ISDR);
- Follow-up activities aimed at implementation of decision of the UN World Conference of Small Island Developing States (SIDS) (Mauritius, January 2005) and the World Conference on Disaster Reduction (Kobe, Japan, January 2005);
- Continued activities for the implementation of the Regional Cooperation Programmes, Technical Plans and other work programmes of the regional tropical cyclone bodies;
- Work of study groups, sub-groups and rapporteurs established by the regional tropical cyclone bodies, e.g. training and research activities in the meteorological component of the Typhoon Committee's programme under the leadership of the Secretary, typhoon Training and Research Coordinating Group (TRCG), and the rapporteur on updating of the Typhoon Committee Operational Manual, the Working Group on the Panel on Tropical Cyclones Coordinated Technical Plan, the implementation of satellite based telecommunications regional networks, and on regional activities on storm surges
- Action on further proposals made by the Fifteenth WMO Congress, the Executive Council, the Regional Associations concerned and the regional tropical cyclone bodies.

Appendix I

TCP REGIONAL BODIES

ESCAP/WMO TYPHOON COMMITTEE	**WMO/ESCAP PANEL ON TROPICAL CYCLONES**	**RA I TROPICAL CYCLONE COMMITTEE FOR THE S.W. INDIAN OCEAN**	**RA IV HURRICANE COMMITTEE**	**RA V TROPICAL CYCLONE COMMITTEE FOR THE S. PACIFIC AND S.E. INDIAN OCEAN**
(14 Members)	**(8 Members)**	**(15 Members)**	**(26 Members)**	**(17 Members)**
CAMBODIA	BANGLADESH	BOTSWANA	ANTIGUA & BARBUDA	AUSTRALIA
CHINA	INDIA@	COMOROS	BAHAMAS	COOK ISLANDS
DEM. PEOPLE'S REP. OF KOREA	MALDIVES	FRANCE@	BARBADOS	FIJI@
HONG KONG, CHINA*	MYANMAR	KENYA	BELIZE	FRENCH POLYNESIA*
JAPAN@	OMAN	LESOTHO	BRITISH CARIBBEAN TERRITORIES*	INDONESIA
LAO PDR	PAKISTAN	MADAGASCAR	CANADA	KIRIBATI
MACAO, CHINA*	SRI LANKA	MALAWI	COLOMBIA	MICRONESIA
MALAYSIA	THAILAND	MAURITIUS	COSTA RICA	NEW CALEDONIA*
PHILIPPINES		MOZAMBIQUE	CUBA	NEW ZEALAND
REPUBLIC OF KOREA		NAMIBIA	DOMINICA	NIUE
SINGAPORE		REP. OF SOUTH AFRICA	DOMINICAN REPUBLIC	PAPUA NEW GUINEA
THAILAND		SEYCHELLES	EL SALVADOR	SAMOA
USA		SWAZILAND	FRANCE	SOLOMON ISLANDS
VIET NAM, SOCIALIST REPUBLIC OF		UNITED REPUBLIC OF TANZANIA	GUATEMALA	TONGA
		ZIMBABWE	HAITI	UNITED KINGDOM
			HONDURAS	USA#
			JAMAICA	VANUATU
			MEXICO	
			NETH. ANTILLES AND ARUBA*	
			NICARAGUA	**Non-Members of WMO (6):**
			PANAMA	- EAST TIMOR
			ST. LUCIA	- MARSHALL ISLANDS
			TRINIDAD AND TOBAGO	- NAURU
			UK	- PALAU
			USA@	- TOKELAU
			VENEZUELA	- TUVALU
@RSMC Tokyo - Typhoon Center	@RSMC-Tropical Cyclones-New Delhi	@RSMC La Réunion - Tropical Cyclone Centre	@ RSMC Miami - Hurricane Centre	@RSMC Nadi - Tropical Cyclone Centre # RSMC Honolulu - Hurricane Centre

* Member Territorie

List of Names for Tropical Cyclones Adopted by the Typhoon Committee for the Western North Pacific Ocean and the South China Sea

Contributed by	I Name	II Name	III Name	IV Name	V Name
Cambodia	Damrey	Kong-rey	Nakri	Krovanh	Sarika
China	**Haikui**	Yutu	Fengshen	Dujuan	Haima
DPR Korea	Kirogi	Toraji	Kalmaegi	Mujigae	Meari
Hong Kong, China	Kai-tak	Man-yi	Fung-wong	Choi-wan	Ma-on
Japan	Tembin	Usagi	Kammuri	Koppu	Tokage
Lao PDR	Bolaven	Pabuk	Phanfone	Ketsana	Nock-ten
Macau	Chanchu	Wutip	Vongfong	Parma	Muifa
Malaysia	Jelawat	Sepat	Nuri	Melor	Merbok
Micronesia	Ewiniar	Fitow	Sinlaku	Nepartak	Nanmadol
Philippines	Bilis	Danas	Hagupit	Lupit	Talas
Rep. of Korea	Kaemi	Nari	Changmi	Mirinae	Noru
Thailand	Prapiroon	Wipha	Mekkhala	Nida	Kulap
U.S.A.	Maria	Francisco	Higos	Omais	Roke
Viet Nam	Saomai	Lekima	Bavi	Conson	Sonca
Cambodia	Bopha	Krosa	Maysak	Chanthu	Nesat
China	Wukong	Haiyan	Haishen	Dianmu	Haitang
DPR Korea	Sonamu	Podul	Noul	Mindulle	Nalgae
Hong Kong, China	Shanshan	Lingling	Dolphin	Lionrock	Banyan
Japan	Yagi	Kajiki	Kujira	Kompasu	Washi
Lao PDR	Xangsane	Faxai	Chan-hom	Namtheun	**Pakhar**
Macau	Bebinca	Peipah	Linfa	Malou	Sanvu
Malaysia	Rumbia	Tapah	Nangka	Meranti	Mawar
Micronesia	Soulik	Mitag	Soudelor	Fanapi	Guchol
Philippines	Cimaron	Hagibis	Molave	Malakas	Talim
Rep. of Korea	Chebi	Noguri	Koni	Megi	**Doksuri**
Thailand	Durian	Rammasun	Morakot	Chaba	Khanun
U.S.A.	Utor	Matmo	Etau	Aere	Vicente
Viet Nam	Trami	Halong	Vamco	Songda	Saola

CHAIRMEN OF THE TYPHOON COMMITTEE

SESSION	PLACE	DATE	CHAIRMAN	VICE-CHAIRMAN
1st	Bangkok	17-20 Dec 1968	Vice Adm Sanit Vesa-Rajananda Thailand	Dr. Roman L. Kintanar Philippines
2nd	Manila	2-8 Dec 1969	Dr. Roman L. Kintanar Philippines	Mr. Tatsuo Kawagoe Japan
3rd	Bangkok	18-24 Nov 1970	Dr. Charoen Charoen-Rajapark Thailand	Dr. Roman L. Kintanar Philippines
4th	Tokyo	4-11 Oct 1971	Dr. Shigenobu Sakano Japan	Mr. Gordon J. Bell Hong Kong
5th	Bangkok	15-21 Nov 1972	Dr. Charoen Charoen-Rajapark Thailand	Dr. In Ki Yang Republic of Korea
6th	Bangkok	18-26 Nov 1973	Mr. Gordon J. Bell Hong Kong	Mr. Khamtanh Kanhalikham Laos
7th	Manila	8-14 Oct 1974	Mr. Khamtanh Kanhalikham Laos	Col. Ramon Macabuhay Philippines
8th	Bangkok	11-17 Nov 1975	Dr. Roman L. Kintanar Philippines	Dr. Charoen Charoen-Rajapark Thailand
9th	Manila	23-29 Nov 1976	Dr. Roman L. Kintanar Philippines	Dr. In Ki Yang Republic of Korea
10th	Tokyo	25-31 Oct 1977	Mr. Kazuto Nakazawa Japan	Mr. Ho Tong Yuen Malaysia
11th	Bangkok	3-9 Oct 1978	Mr. Gordon J. Bell Hong Kong	Mr. P Markandam Malaysia
12th	Bangkok	13-19 Nov 1979	Mr. Patrick Sham Hong Kong	Mr. Twee Montrivade Thailand
13th	Bangkok	10-21 Mar 1980	Dr. Roman L. Kintanar Philippines	Mr. Itsuro Shimizu Japan
14th	Manila	10-16 Nov 1981	Dr. Roman L. Kintanar Philippines	Mr. Twee Montrivade Thailand
15th	Bangkok	9-15 Nov 1982	Mr. Patrick Sham Hong Kong	Dr. Lim Joo Tick Malaysia
16th	Tokyo	6-12 Dec 1983	Dr. Ryuichi Iida Japan	Mr. Ho Tong Yuen Malaysia
17th	Manila	4-10 Dec 1984	Dr. Roman L. Kintanar Philippines	Mr. Luo Jibin China
18th	Beijing	8-14 Oct 1985	Mr. Luo Jibin China	Mr. Ho Tong Yuen Malaysia
19th	Bangkok	28 Oct - 3 Nov 1986	Mr. Patrick Sham Hong Kong	Mr. Catalino Arafiles Philippines

20th	Bangkok	20-26 Oct 1987	Mr. Luo Jibin China	Mr. Crisostomo C. Reyes Philippines
21st	Manila	22-28 Nov 1988	Dr. Roman L. Kintanar Philippines	Mr. Patrick Sham Hong Kong
22nd	Tokyo	30 Oct-6 Nov 1989	Mr. Patrick Sham Hong Kong	Mr. Luo Jibin China
23rd	Seoul	13-19 Nov 1990	Mr. Yong-Dai Park Republic of Korea	Mr. Luo Jibin China
1st JS	Pattaya	18-27 Feb 1992	Mr. FM Qasim Malik Pakistan	Dr. Patipat Patvivatsiri Thailand
25th	Zhuhai	8-14 Dec 1992	Mr. Yan Hong China	Mr. P. Markandam Malaysia
26th	Manila	2-8 Nov 1993	Mr. Fortunato M. Dejoras Philippines	Dr. Patipat Patvivatsiri Thailand
27th	Macau	6-12 Dec 1994	Mr. Antonio Costa Malheiro Macau	Mr. Toshiyuki Ono Japan
28th	Kuala Lumpur	5-11 Dec 1995	Mr. Cheang Boon Khean Malaysia	Dr. Patipat Patvivatsiri Thailand
2nd JS	Phuket	20-28 Feb 1997	Mr. Smith Tumsaroch Thailand	Mr. Yan Hong China
30th	Hong Kong, China	25 Nov - 1 Dec 1997	Dr. Hung Kwan Lam Hong Kong	Dr. Lim Joo Tick Malaysia
31st	Manila	1-7 Dec 1998	Dr. Leoncio A. Amadore Philippines	Dr. Sung-Euii Moon Republic of Korea
32nd	Seoul	23-29 Nov 1999	Dr. Sung-Euii Moon Republic of Korea	Dr. Hung Kwan Lam Hong Kong Dr. Lim Joo Tick Malaysia
33rd	Macao	28 Nov-4 Dec 2000	Mr. Fong Soi Kun Macao	Mr. Richard Hagemeyer USA
34th	Honolulu	28 Nov-4 Dec 2001	Mr. James C. Weyman USA	Dr. Chow Kok Kee Malaysia
35th	Chiang Mai	19-25 Nov 2002	Dr. Prapansak Buranaprapa Thailand	Dr. Hung Kwan Lam Hong Kong
36th	Petaling Jaya	15-20 Dec 2003	Dr. Chow Kok Kee Malaysia	Mr. R. Jeffrey LaDouce U S A
37th	Shanghai	16-20 Nov 2004	Dr. Xu Xiaofeng China	Mr. R. Jeffrey LaDouce U S A
38th	Viet Nam	16-20 Nov 2005	Dr. Bui Van Duc Viet Nam	Mr. R. Jeffrey LaDouce U S A
39th	Manila	4-9 Dec 2006	Dr. Prisco D. Nilo Philippines	Dr. Yap Kok Seng Malaysia
40TH	Macao	21-26 Nov 2007	Dr. Fong Soi Kun Macao	Mr. Suparerk Transriratanawong Thailand Dr. MC Wong Hong Kong