ESCAP/WMO
Typhoon Committee

REPORT ON DRR EXPERT MISSION 2011

CAMBODIA
LAO PDR
THAILAND

JANUARY 2012

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

WMO

TC/TD-No. 0003

REPORT ON
DRR EXPERT MISSION - 2011

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TC/TD-No 0003

ISBN 978-99965-817-2-4

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Published in January 2012

Printed in Macao, China by Unique Network Printing Fty, Ltd. - January, 2012.

TABLE OF CONTENTS

FOREWORD

Since a long time ago the Republic of Korea has been adopting a policy of international cooperation and support to less developed countries.

This attitude is reflected in its activities within the Typhoon Committee (TC), not only in the field of disaster risk reduction but also in the other two main components of the Committee, meteorology and hydrology. As regards meteorology, the Korea Meteorological Administration actively collaborates with TC in the transfer of know-how, namely through the offer of fellowships and hosting workshops. In terms of hydrology, Korea has also developed activities through the Ministry of Land, Transport and Maritime Affairs and the Korea Institute for Construction Technology, leading projects and supporting participants from the less developed Members in attending TC workshops. As for disaster risk reduction, a good example of this collaboration is the international project called Web GIS based Typhoon Committee Disaster Information System (WGTCDIS), under which members of the Working Group on Disaster Risk Reduction (WGDRR) have participated in several expert missions.

Despite being the most recent working group of the TC, only created in 2005, the WGDRR, initially called Working Group on Disaster Prevention and Preparedness (WGDPP), has been running a meritorious activity towards achieving the main objective of the Committee, to reduce the loss of lives and minimize the social, economic and environmental damages caused by typhoon-related disasters. An example of this activity is the realization of several expert missions to TC Members in order to implement the WGTCDIS, led by the National Institute for Disaster Prevention (NIDP) of Korea, recently designated National Disaster Management Institute (NDMI).

This report refers to the third expert mission under this project involving stakeholders related to disaster risk reduction in several TC Members, the first of which in 2008 to Lao PDR, Philippines, Thailand and Viet Nam. The second visited in 2009 three cities of Viet Nam and the third established contacts in Cambodia, Lao PDR and Thailand.

The latter main objectives were to introduce analytical methods included in the WGTCDIS, educate and train how the typhoon trajectory and the typhoon related damages can be estimated, and collect disaster related information. Taking advantage of this mission, it was also introduced the distributed rainfall runoff model developed by NIDP for developing GIS based hazard map to assess flood risk in low land or urban areas. The identification of needs and gaps on operating the WGTCDIS as early warning and disaster risk management systems was also a concern during this mission.

The WGTCDIS will be one more tool made available for the international community of the Asia and the Pacific region to reduce the consequences of the typhoon-related disasters and it can also be used as a platform to share information, knowledge, experience and good practices regarding the hazardous consequences of the typhoons. Finally, I would encourage the WGDRR, NDMI and TCS to continue their work with a view to implementing this important project.

Mr. CHO Seok Joon,
Administrator of
Korea Meteorological Administration
Chairman of Typhoon Committee

INTRODUCTION

The region Asia and the Pacific is the home for 60% of world population and one of the most susceptible and vulnerable area to various kinds of natural disasters in the world. The main reasons for the high vulnerability to natural disaster are that great number of countries are located in low land, and highly populated which over 60% of world population and over 70% of world poor are in Asia and the pacific region. In the recent decade 1999 and 2008, Asia experienced 38% of number of natural disasters and 39% of economic losses but more than 85% of total number of mortality and 85% of the affected population.

Asian cities in floodplains and coastal areas are becoming more susceptible and vulnerable to disasters due to the rapid paced urbanization and climate change and imprudent environmental degradation. Statistics and data clearly show that much of Asia region is very vulnerable to natural disasters including typhoon, and the damage is likely increasing in Asia (IPCC, 2007). Since East Asia region, especially, along the coast, has been rapidly developed and is crowded with population, higher damage rate and amount are recorded. For more developed countries, typhoon related impacts cause major social and economic disruptions through loss of lives and property. For developing countries, in addition to the tragic personal loss of life and property, natural disasters, especially typhoons, severely threaten and impact their sustainability, capacity building, debt repayments, and even the basic necessities of life such as clean drinking water, food, and shelter.

It is generally accepted that more frequent or intense occurrences of high-impact anomalous weather are likely as atmosphere attempts to counteract or adjust to the effects of climate changes. As such, sustainable disaster mitigation efforts against typhoon related impacts, including too much or lack of typhoon-induced rainfall, will need to address issues across the whole spectrum of climate and weather systems. Therefore, disaster risk reduction should be urgently implemented, which requires particular attention in the region. Early warning system and better infrastructure for information sharing and networking of sharing operational products are indispensible to save lives. Previous lessons and good practice cases should be shared. Credible information should be shared at regional/national/local levels because information sharing will accelerate building capacity and resilience (Silverman, 1986).

Working Group on Disaster Risk Reduction of Typhoon Committee

The Typhoon Committee (TC) is an inter-governmental body organized under the joint auspices of the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO) in 1968 in order to promote and coordinate the planning and implementation of measures required for minimizing the loss of life and material damage caused by typhoons in Asia and the Pacific. The TC, through its regional cooperation and collaboration has been working, for the past 43 years, to help the people of Asia and the Pacific region through the accomplishment of actions to reduce the loss of life and property due to typhoon-related effects. The TC has established the Working Group on Disaster Prevention and Preparedness (WGDPP) at the 38th Session held on November 2005, in Hanoi, Viet Nam, to advise and assist the TC in (i) identifying priority issues and areas of cooperation in the DPP component; (ii) promoting and facilitating the exchange of experiences and knowledge on technologies related to the above issues and areas; (iii) coordinating and implementing priority activities and programs of the TC aiming at strengthening capacity of the Members in DPP; (iv) mobilizing resources to carry out priority activities of the TC related to the DPP component; (v) reporting overall progress in the implementation of the DPP component; and (vi) recommending to the TC priority areas, programs and activities for cooperation in DPP component research by related experts of the Members. In order to enhance cooperation with the United Nations organizations specially World Meteorological Organization (WMO) and reduce confusion by using different name, the Working Group on Disaster Risk Reduction (WGDRR) was the new designation of Working Group on Disaster Prevention and Preparedness

(WGDPP), which was adopted at the 42nd Session of Typhoon Committee held on 25-29 January 2010 in Singapore. The WGDRR chair has hosted annual WGDRR workshops in Republic of Korea and conducted WGDRR meetings in the TC Integrate Workshops and TC Sessions to share technologies and information regarding early warning system and disaster risk management, decide current issues and discuss future projects.

WEB GIS based Typhoon Committee Disaster Information System

Starting with the common understanding that typhoons and related disasters such as floods, storm surges and landslides are not one nation's problem but international issues, the WGDRR initiated a prototype of Typhoon Committee Disaster Information System (TCDIS) since 2007. Main object of the WGDRR project is to support TC Members and to identify and implement high priority activities for typhoon risk mitigation and commissioning of technical assistance and studies to sustain these initiatives. The TCDIS was developed to share information regarding disaster risk management, TC organization and structures, key results areas, typhoon disasters reported by TC Members and establish guideline of Early Warning System (EWS) and Disaster Management System (DMS) of 14 TC Members in Asia and the Pacific area namely Cambodia; China; Hong Kong, China; Japan; Lao People's Democratic Republic; Macao, China; Malaysia; People's Democratic Republic of Korea; Philippines; Republic of Korea; Thailand; USA; Viet Nam. For both guideline of the EWS and the DMS, the National Institute for disaster Prevention (NIDP) whose Director of NIDP is chair of WGDRR collected both system reports from 12 TC Members excepting Cambodia and People's Democratic Republic of Korea and assessed them and then published a summary report (Yi et al., 2009; Yi et al., 2009).

In 2008, TCDIS was enhanced as a Web GIS based, namely Web GIS Based Typhoon Committee Disaster Information System (WGTCDIS) to suit Members' local needs for effective mitigation of typhoon risks. The WGTCDIS was greatly improved in visual by the WMO web style and function to estimate similar typhoon trajectory and assess localized typhoon related damages was also upgraded with TC Members data. Now we collect disaster information from five TC Members namely Viet Nam; Hong Kong; Guam, USA; Japan and Republic of Korea and the WGTCDIS is continuously being developed for benefit of the Committee's Members. In order to assess the damage from a forecasted typhoon approaching the region of interest, it is essential to obtain information on hazard in terms of the strength of typhoon and the vulnerability of the region as well as meteorological factors such as wind and rainfall rate. The former can be obtained from various sources such as warning or special report from KMA (Korean Meteorological Administration) or RSMC (Regional Specialized Meteorological Center) stationed in Tokyo, Japan. Either source provides projected location and strength of the typhoon by using numerical and statistical modeling. On the other hand, the latter is site-specific information since wind speed and rainfall rate are significantly dependent on local topography and land use. Typhoon disaster information such as typhoon trajectory, central pressure, sea surface temperature, rainfall, and location, type, and amounts of damages was collected from 14 Typhoon Committee Members and standard DB system was established for integrated disaster information analyzing and information based disaster assessing used in the WGTCDIS.

Expert Mission of WGDRR

In order to establish the Members' own WGTCDIS and then educate the formulation of comprehensive disaster information system and train operation of the WGTCDIS, WGDRR performed the Expert Mission since 2008. Through the Expert Mission, NIDP-centered expert team introduced the main system developed by NIDP and surveyed data such as the GIS information and disaster related information which can assist establishment of the WGTCDIS. In the Expert Mission, required information such as GIS information, rainfall, wind speed, central pressure, the weather station, and typhoon related damages

information and data format were introduced to participants Members and were collected from TC Members. The Expert Mission has another main function as a great platform to identify needs and gaps on technologies and information regarding disaster risk management of participating Members and discuss about WGDRR's future out-reach projects in relation to the EWS and DMS.

The first Expert Mission was composed of five experts from Republic of Korea and Mr. Olavo Rasquinho from Typhoon Committee Secretariat (TCS) (Yi et al., 2008). The second Expert Mission was performed by three experts from Republic of Korea, who developed the WGTCDIS for Viet Nam and visited Hanoi, Da Nang and Ho Chi Minh cities in 2009. The expert mission in 2010 did not take place because none of the TC Members that were supposed to prepare their own disaster information necessary for the establishment of the WGTCDIS have accomplished this task.

In these Expert Missions, for the future work, it was discussed that Republic of Korea would make MOU with interested Members for regular meetings and instruction of public officers in charge of disaster management in the policy of disaster risk reduction. WGDRR representatives participated on the 6th WGDRR Workshop in Incheon, Republic of Korea, agreed the 3rd Expert Mission should visit three TC Members namely Thailand, Lao PDR and Cambodia during 7-13 August in 2011.

HISTORY OF THE EXPERT MISSION

First Expert Mission

The main object of the first Expert Mission was to introduce the WGTCDIS for collecting essential typhoon disaster related disaster information. The program of the first Expert Mission performed during 12-19 May, 2008 is shown in Table 1. Main outcomes were the education and training of the WGTCDIS and collecting of typhoon related disaster information and GIS information for building the WGTCDIS.

Table 1 Program of the first Expert Mission, in 2008.

Place	Date	Main Contents
Hanoi, Viet Nam	May 12 (Mon)	· Opening Ceremony · Brief on Expert Mission · Education of the WGTCDIS · Disaster Information Systems of Members · Practice and discussion
Vientiane, Lao PDR	May 13 (Tue) - 14 (Wed)	
Bangkok, Thailand	May 15 (Thu) - 16 (Fri)	
Manila, Philippines	May 19 (Mon)	

The first Expert Mission was led by the WGDRR Chair and Chair invited expert persons in various areas such as disaster management system, IT/database, Global Identification Number, and public-outreach, etc. to form the expert team. Five expert members from Korea and Olavo Rasquinho from TCS were joined for expert team. The name and roles of six expert members are listed in Table 2.

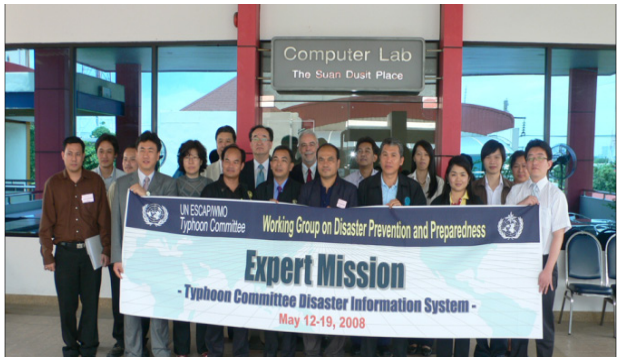
Table 2 Experts who participated in the first Expert Mission, in 2008.

Name	Role	Specialty
Waon-Ho Yi	General management	Chair of WGDRR
Sam-Kew Roh	Collect data related to EWS	Expert in EWS
Jitae Kim	Presentation of TCDIS	Hydrologist
Eun-Mi Chang	Presentation of WGTCDIS Survey disaster information for WGTCDIS	Expert in GIS and IT
Dong Hyun Lee	Collect data and report for EWS and DIS	Statistician
Olavo Rasquinho	Support for management and mission report	TCS

Participants from Lao PDR, Philippines, Thailand and Viet Nam, shown in Figure 1, joined the Expert Mission in 2008. Participating Members, management organizations and number of participants are listed in Table 3.

(a) Viet Nam

(b) Lao PDR



(c) Thailand

d) Philippines

Figure 1 Representative photo of participants from four Members in the first Expert Mission, in 2008.

Table 3 Recipient Members and organizations of the first Expert Mission in 2008.

Participating Members	Organizations	Participants
Lao PDR	Department of Meteorology and Hydrology	9
Viet Nam	Department of Floods and Storms Control	13
Thailand	Department of Disaster Prevention and Mitigation	16
Philippines	Disaster Control Division in Quezon City	10

The typhoon related disaster information were surveyed for building the WGTCDIS and standard disaster database to share information and integrated assessment of typhoon related damages.

Also future collaboration works for providing disaster information to calibrate estimation method in WGTCDIS and upgrade WGTCDIS and make a guideline for the disaster management system and early warning system were discussed.

Second Expert Mission

After the first Expert Mission, NIDP finished to collect disaster information from Viet Nam and then established the WGTCDIS of Viet Nam end of 2008. The second Expert Mission was conducted by three experts from Korea to build WGTCDIS of Viet Nam's own and educate and train the WGTCDIS to government officials in three regions of Viet Nam. The program of the second Expert Mission performed during 2-7 March, 2009 is shown in Table 4. Main outcomes were the education and training of the WGTCDIS and conclusion of cooperation works to modify the WGTCDIS by validation with new coming typhoons.

Table 4 Program of the second Expert Mission in 2009.

Place	Date	Main Contents
Hanoi, Viet Nam	March 2 (Mon)	· Opening Ceremony · Brief on Expert Mission · Education of the WGTCDIS · Disaster Information Systems of Viet Nam · Practice and discussion
Da Nang, Viet Nam	March 3 (Tue) - 4 (Wed)	
Ho Chi Minh, Viet Nam	March 5 (Thu) - 7 (Sat)	

The second Expert Mission was led by the WGDRR Chair and Chair invited three expert persons from Korea to form the expert team. The name and roles of three expert members are listed in Table 5.

Table 5 Expert members participated in the second Expert Mission in 2009.

Name	Role	Specialty
Waon-Ho Yi	General management	Chair of WGDRR
Tae Sung Cheong	Presentation of Decision Making System for DRR	Hydraulic Engineer
Eun-Mi Chang	Presentation of WGTCDIS	Expert in GIS and IT

Three organizations in Viet Nam shown in Figure 2 were joined in the second Expert Mission. Participating Member, management organizations and number of participants are listed in Table 6.

(a) Hanoi, Viet Nam

(b) Da Nang, Viet Nam

(c) Ho Chi Minh, Viet Nam

Figure 2 Representative photos in Viet Nam in the second Expert Mission, in 2009.

Table 6 Recipient Member and organizations of the second Expert Mission, in 2009.

Participating Member	Organizations	Participants
Viet Nam (Hanoi)	National Center for Hydro-Meteorological Forecasting	9
Viet Nam (Da Nang)	Department of Dyke and Flood, Storm Control	10
Viet Nam (Ho Chi Minh)	Department of Dyke and Flood, Storm Control	12

The typhoon related disaster information was surveyed for upgrading the WGTCDIS of Viet Nam and standard disaster database to share information and integrated assessment of typhoon related damages. Also future collaboration was agreed for providing disaster information to calibrate estimation method in WGTCDIS of Viet Nam. The WGTCDIS of Viet Nam developed on 2008 was calibrated with recent typhoons hit to Viet Nam on 2009. Calibration results show that estimated typhoon trajectory results good fit to the measured typhoon trajectory and the WGTCDIS estimates the typhoon related damages reasonably. It is expected that the WGTCDIS of Viet Nam will be used for early warning system and disaster management system for typhoon related disaster risk reduction. WGTCDIS for Hong Kong, China was also developed in 2009. However, WGTCDIS of Hong Kong needs to be calibrated carefully before its application to early warning and disaster management systems.

WEB GIS BASED TYPHOON COMMITTEE DISASTER INFORMATION SYSTEM

The WGTCDIS contributes to typhoon related disaster risk reduction in Asia and the Pacific region though timely and efficient way of information sharing via its website (www.tcdis.org). The WGTCDIS can also be used as a platform to share disaster information, knowledge and experiences, good practices, and other information regarding typhoon-related disaster risk reduction. The WGTCDIS is composed of two main systems, namely the information sharing system and the disaster information system. The information sharing system is to share general information such as early warning systems and disaster management systems of Members, publications, news and photos regarding on TC and activities and projects of WGDRR. The disaster information system gives information of typhoon trajectories determined by nearest neighbour method (NNM) to minimize correlation errors regarding typhoon trajectory and central pressure and to estimate damages from rainfall and wind speed which is determined by certain typhoon trajectories.

GeoLinking Services (GLS) for Displaying the Typhoon Related Disaster Information

In order to display the typhoon related disaster information, GeoLinking approaches were employed as shown in Figure 3. The log-in page shown as ① of Figure 3 will appear when the disaster information system menu is clicked. When you type ID and Password and click the log in button, the map of TC Member will be shown as ② of Figure 3. To get the account for ID and password, you visit the upper center corner of the main page and click the Recommend button. If the button is clicked, you can write a letter to ask for an account to web master with the information such as name, affiliate, and the reason of the account opening. After checking the purposes, the web master will send the ID and Password to you by e-mail given in your request letter. The Typhoon Information menu has all the information of the typhoons from 1951 to 2010, which are stored in database including GIS. Similar typhoon can be checked out by the computer program and the algorithm in background mode. When the observation data are inserted, the predicted track and the estimation of loss can be simulated. When you select the Typhoon list menu tab, all the typhoon names from 1951 to 2010 are listed below the Typhoon list menu shown in ③ of Figure 3. You either click a name of typhoon or you can insert specific period from one date to another date, then the information on the typhoon will be shown. If a typhoon name is clicked, the icon of typhoon eye, its pressure and track will be displayed. If the character “I” icon is clicked, detailed information will be shown in table which includes latitude, longitude and central pressure and be shown. When you select the Similar Typhoon search tab, a box will be displayed to insert the date, longitude and latitude, and central pressure can be inserted as shown in ③ of Figure 3. To facilitate the input process, the text file can be imported. The detailed track information can be saved and exported as a text file format. Disaster Information shows all the damage related information based on the data obtained from the Members.

Web GIS based system enables user to choose region or province of interest, the enhance view of which is shown to allow user to select any particular data displayed in the map. Another way of display the disaster information is to select a particular typhoon and then, related disaster data and information are shown in the Web GIS based system. The Regional Risk Analysis menu shows the historical data of damage, the expected precipitation and wind velocity. Assuming that the regional conditions such as terrain has not changed much, the estimation can be made based on the trend in the past. The damages can be inferred from the historical data for each region. Regional estimated data can be compared. The result can be listed in the middle of window, and total loss and public facility damages can be estimated by region, when the name of region is clicked. In the WGTCDIS, two ways of risk assessment have been established for the members during typhoon. One of the representative tools for risk assessment is HAZUS-MH developed by FEMA of USA, which is based on the physical and statistical technology to evaluate the strength of hazard and predict damage considering the assets in the region of interest. Scientific and logical method used in HAZUS-MH allows users to estimate gross amount of damage in the event of hurricanes; however, the depth and the level of analysis are somewhat unrealistic when the data cannot be collected in such a level, which is the case for WGTCDIS. Instead, a statistical approach employed by Geoscience of

Australia is more appropriate for risk assessment in regional or national level employed in WGTCDIS. Natural Hazard Mapping produced by Geoscience of Australia is online system which provides disaster information for flood, earthquake and landslide using web-GIS system. The WGTCDIS incorporates such an approach to enable users to access disaster information. The Web GIS based system enables the user to choose the region or province of interest, the enhance view of which is shown to allow the user to select any particular data displayed in the map (④ of Figure 3). When the user clicks the menu of Image located in the bottom of the Tool Bar, the image icons are displaced as the local area had experienced damages shown in ⑤ of Figure 3. When the user clicks any interesting image icon displayed in the GIS map, the photo images and information such as media, report and portal information will be presented shown in ⑥ of Figure 3.

Typhoon Trajectories Estimation

Three important data for the warning and management of typhoon related disasters are i) meteorological information of past typhoons such as path, central pressure, maximum wind speed; ii) meteorological records of wind speed and rainfall rate at each weather station during typhoons; iii) damage records during typhoons. The meteorological information of past typhoons is statistically processed using NNM (Nearest Neighbour Method) to match a past typhoon which is the most similar to the present typhoon forecasted by meteorological agencies in the world. The technique uses NNM, a pattern analysis for random phenomenon, to classify past typhoons similar to the typhoon of interest (Silverman, 1986). NNM estimates and classifies the nearest neighbour density function for target data (projected path and

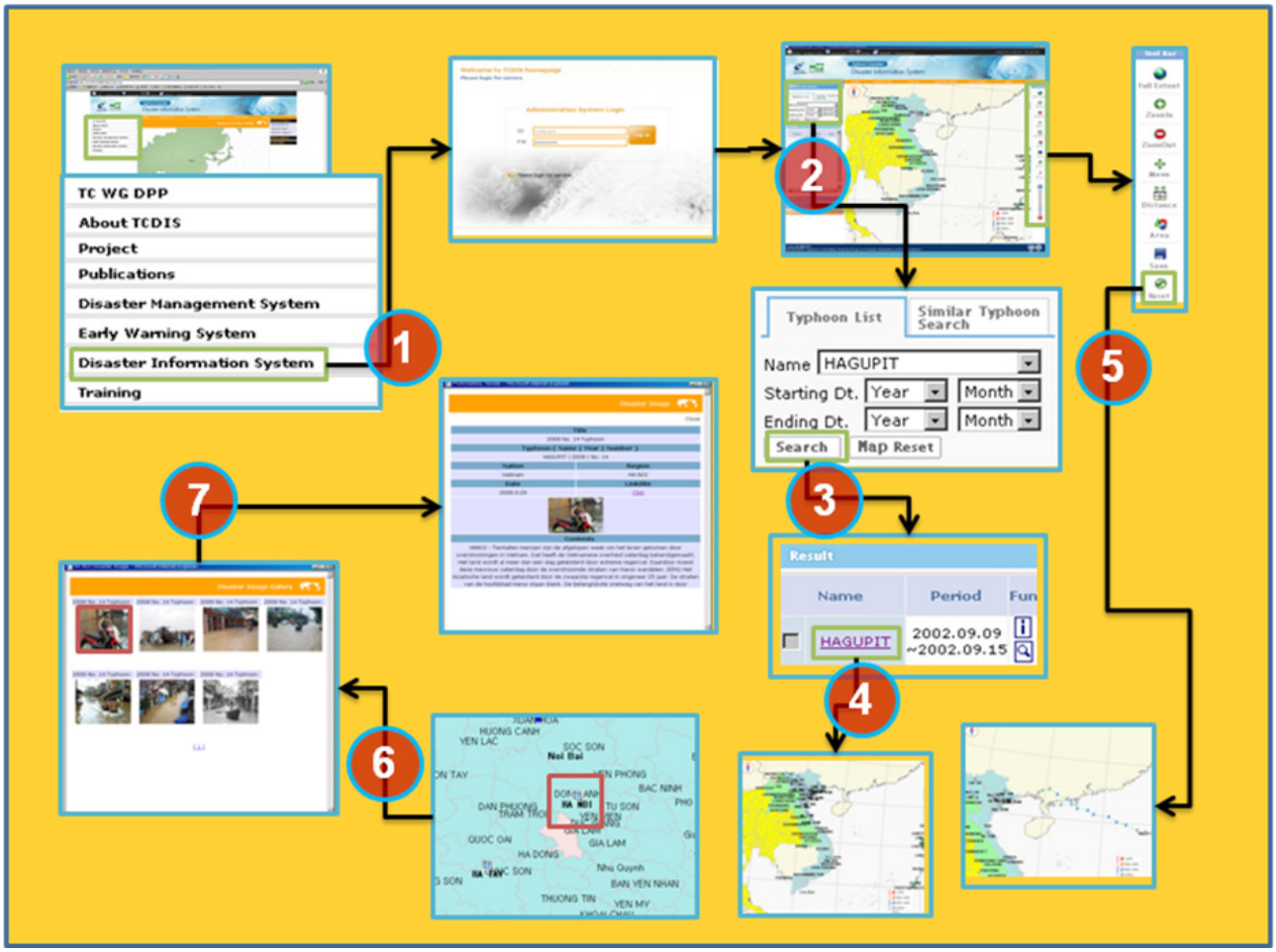


Figure 3 Example of GeoLinking services to display the typhoon related disaster information

pressure of the typhoon of interest) and reference data (past typhoons) to select a past typhoon which is the most similar to the typhoon of interest.

Determination of weights for each factor in multi-dimensional NNM is very essential because it decides relative importance. In general statistics, the aggregated weights can be obtained from sensitivity test for its factor; however, the general mean value theorem cannot be applied to the meteorological information of the typhoons because of its non-stationary characteristics. Hence, the relative magnitude of each factor affecting wind speed is used to determine the weights. However, it was found that the relative weights often produced prejudiced information generating similar typhoons with large margin of error in trajectory as well as central pressure. Also, this method considers only the similarity of path and the magnitude of pressure not the similarity of spatial ranges covered by the typhoon, which is essentially a function of path and strength of the typhoon. As a result, the damage induced by the typhoons does not match the general acceptance.

In the WGTCDIS, the similarity analysis is upgraded to use spatial correlation as a measure of similarity. As an example, Figure 4 shows the scattered plots for maximum wind speeds and central pressures recorded for 1547 typhoons from 1951 to 2007 in RSMC best tracks. It clearly shows a high correlation of 91%. Using the improved method, the similarity analysis for typhoon MAEMI (2003) was retried to find that typhoon SARAH (1959) has about 89% of similarity and much improved compared to the previous results as shown Figure 5.

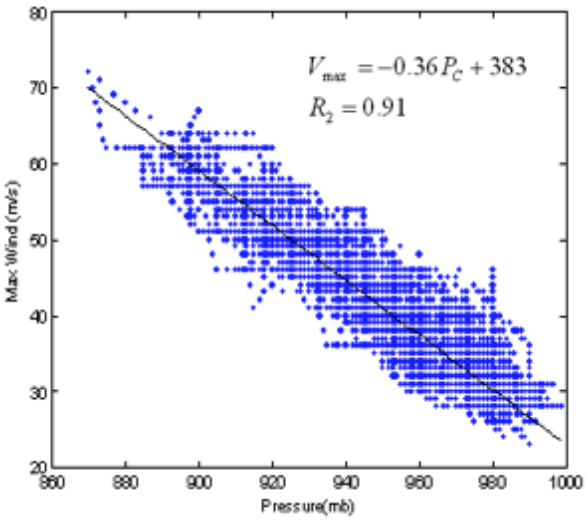
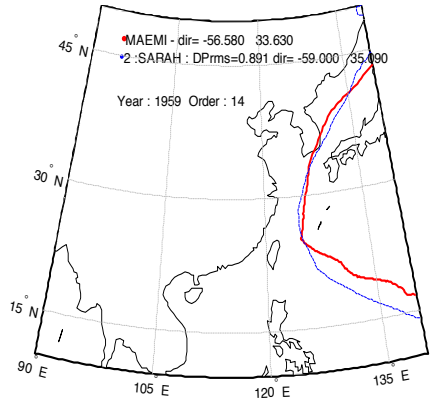
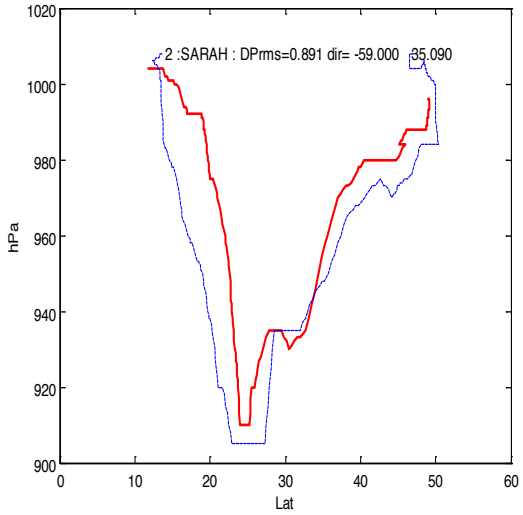


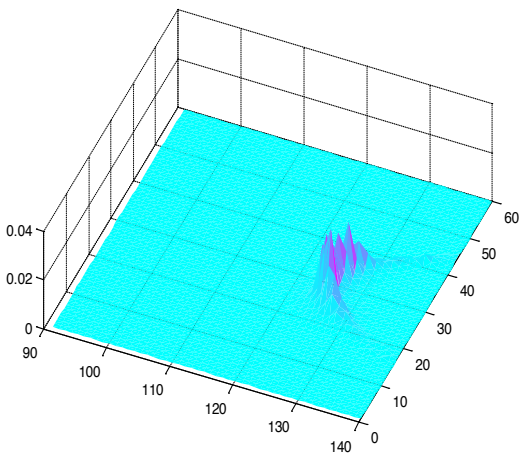
Figure 4 Correlation of maximum wind speeds and central pressures recorded for 1547 typhoons from 1951 to 2007 in RSMC best tracks. In which $\mathbf{V}_{max}$ is the mum velocity and $\mathbf{P}_c$ is the central pressure



(a) Comparison of typhoon trajectories



(b) Comparison of central pressure distribution



(c) Correlation coefficient = 91%

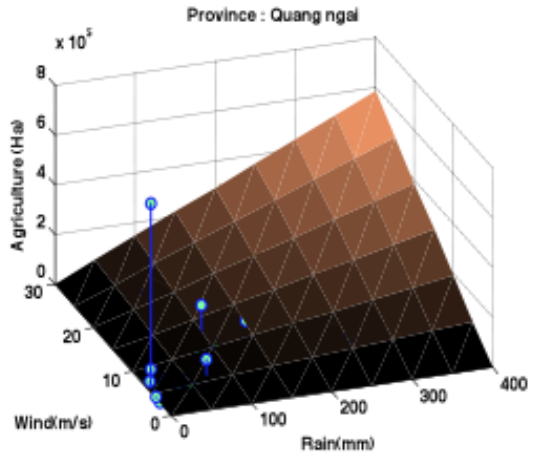
Figure 5 Similarity Analysis for Typhoon MAEMI using Improved Meth. In which ——— trajectory of Typhoon Maemi (2003) and ..... trajectory of Typhoon Sarah (1959).

Localized Damage Estimation

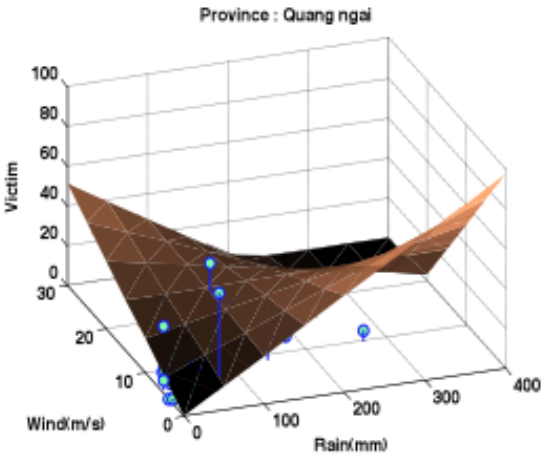
Once the most similar typhoon of past is statistically found, the damage of the typhoon can be rough estimation of projected damage. Another way of predicting typhoon damage uses local meteorological damage and weather reports during past typhoons. For each typhoon event, wind speed and rainfall rate have been recorded at each weather station, in which the accumulated rainfall rate and the maximum wind speed can be representative factors of hazard in the regional area. After each typhoon event, most of regional authorities in TC Members investigate and record physical and economical damages. Using both data, the amount of damage can be correlated with the corresponding regional weather information, which presents the functional trend of damages as dependent variable and weather information as independent variables.

Two risk assessment methods were established for the TC members in the WGTCDIS. One of the representative tools for risk assessment is HAZUS-MH, developed by FEMA in USA, which is based on the physical and statistical technology for evaluating the strength of the hazard and for predicting the damage that a typhoon may cause considering the assets in the region of interest. The scientific and logical method used in HAZUS-MH allows the users to estimate the gross amount of damage in the event of a typhoon, but the depth and level of analysis are somewhat unrealistic when the data cannot be collected on such a level. The other risk assessment method, a statistical approach employed by Geoscience of Australia, is more appropriate for risk assessment on the regional or national level, for which purpose it is employed by the WGTCDIS. Natural Disaster Hazard Mapping, produced by Geoscience of Australia, is an online system that provides disaster information on floods, earthquakes, and landslides using a Web GIS based system. The WGTCDIS incorporates such an approach to enable its users to share typhoon disaster information and typhoon-related disaster risk assessment results.

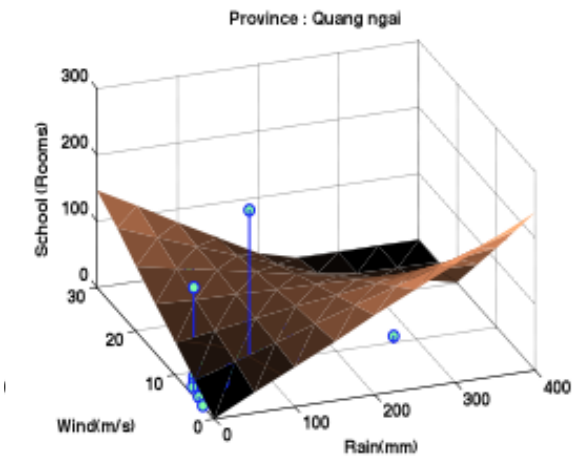
The Kernel density function (KDF) is used to estimate the typhoon-related damages considering the localized vulnerability of the region of interest. The localized KDFs of typhoon-related damages can be established by using historical rainfall and maximum wind speed data, as shown in Fig. 6. Fig. 6 shows a local area that incurred various typhoon-related damages due to various factors.



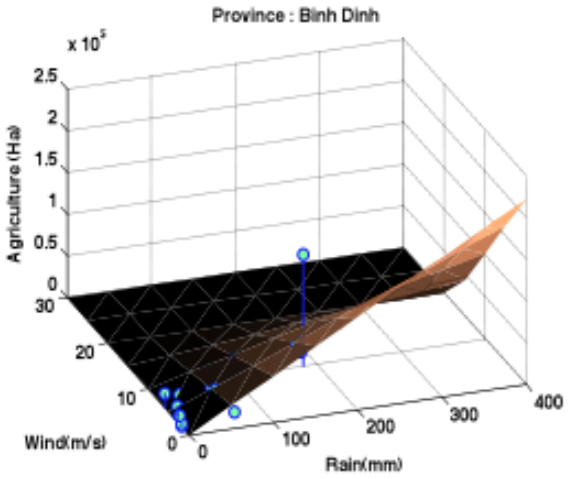
(a) Agricultural



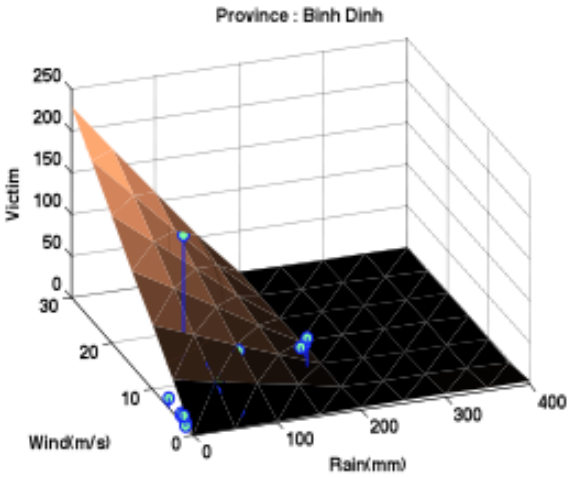
(b) Human life



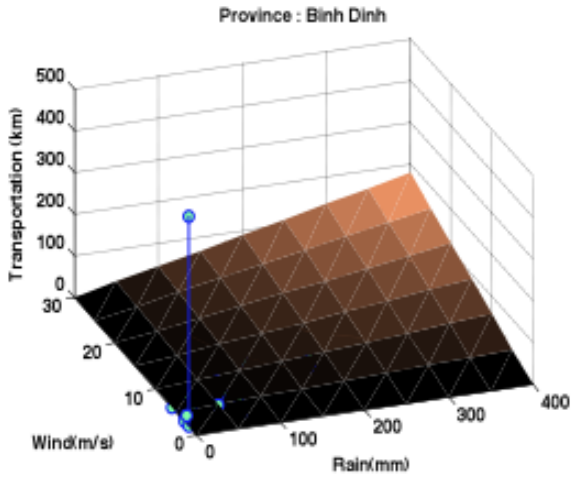
(c) School



(d) Agricultural



(e) Human life



(f) Transportation

Figure 6 Estimated results of typhoon-related damages.

COLLECTING THE DISASTER INFORMATION FOR WGTCDIS

General information regarding early warning systems, disaster management systems, activities of TC and WGDRR were easily collected and these can be updated continuously. On the other hand, disaster information to develop the disaster information system of the WGTCDIS such as (i) meteorological information, (ii) GIS information and (iii) damage information were collected from only five Members namely Japan; Lao PDR; Hong Kong, China; Viet Nam; and Korea were collected. NIDP are developing Member's own WGTCDIS as an ongoing project of WGDRR and trying to extend WGTCDIS to Members. WGDRR will support Members every year to collect disaster information and NIDP will support to develop Member's WGTCDIS. For collecting the disaster information, NIDP prepared guideline.

Guideline for Collecting Disaster Information

For the meteorological information, it is relatively easy to collect weather stations information and weather information shown in Table 7-8 by surveying the database established by WMO. But if there are districts or provinces which name were changed recently, please provide them as shown in Table 9 because exact location of weather station is important to collect accurate weather information.

Table 7 Example of weather station established in Korea

Serial Number	Starting	Ending	Name*	Latitude	Longitude
:	:	:	:	:	:
66	1998.12.22.17:00	~	Cheolwon	38.1451	127.3063
:	:	:	:	:	:
95	2000.08.02. 12:00	2000.12.31.18:00	Munsan	37.8844	126.7625
:	:	:	:	:	:

*Name is the station name, which is usually the name of the district or province. If you do not have special name of station, please use the district or province name in the NAME column.

Table 8 Example of weather information collected from Korea

Serial Number	DATE (year month day)	Rainfall (mm)	Average Wind Velocity (m/s)	Wind Direction	Maximum Wind Velocity (m/s)
66	19910101	50	23	N	26.5
66	19910102	49	14.5	NE	25.4
133	19990413	212	12.5	NW	7.1
:	:	:	:	:	:

Table 9 Example of changed districts names of Korea

Date (year month day)	Old District Name	New District Name
19950101	Ulsan-Si	Nam-gu
19950101	Ulsan-si	Buk-gu
:	:	:

For typhoon related disaster information shown in Table 10, localized damages information has been collected from Vietnam; Lao PDR; Hong Kong, China; Japan and Korea. GIS information such as nation boundary, provincial boundary, large river, main road, etc. shown in Table 11 have been collected from Vietnam; Lao PDR; Thailand; Philippines; Hong Kong, China and Korea. The data including pictures, related news articles as well as provincial information of occurrence were also collected from all TC Members.

More information for Table 10 is following as:

- Start and End depends on the event unit, for example, a typhoon is affecting the area or reported to start the event and end the event.
- Type can be categorized into typhoon included or not, if there is a name of typhoon for the event, please write in the next column.
- Province and Country are vary from country to country, so write your own unit name in hierarchically, two steps such as province and county.
- Human Damage can be taken down into death (including missing) and victims (evacuated from the home or loss of property).
- Inundated Area is the area under the water during the event at the unit of kilometer square.
- Damage Amount can be recorded in US dollar, if the currency rate is not fixed and remarkably changeable, then write your own monetary unit (dong in case of Viet Nam).
- Damage Types depend on your unit, but explain the unit for each damage type.
  - House : building unit or household unit for collective housing,
  - Ship : number of broken ship to be repaired,
  - Public Facilities : US dollar or your own monetary unit,
  - River : the length of river flooded,
  - Transportation : damages can be expressed in length of road which needed to be repair after the event,
  - Other Public : loss can be written as money loss in the unit of US dollars or your own currency, and
  - Private Damage : damages can be written as money loss in the unit of US dollars or your own currency.

Table 10 Example of damage information obtained from Korea

Disaster						Human Damage		Inundated Area (km^2)	Damage Amounts (US $)	DAMAGE TYPES							
Start	End	Type	Name	Province	Country	Death	Victim			House	Ship	Farm Land	Public Facilities	River	Transpor-tation	Other Public	Private Damages
19910728	19910730	Typhoon	Caitlin	Kyunggi	Angjin	0	2	0	54,042	0	0	0	27021	0	17,053	9,968	0
19910802	19910805	Typhoon	Caitlin	Kyunggi	Paju	0	0	0	13,500	0	0	0	500	0	1,000	2,000	0
19910802	19910805	Typhoon	Caitlin	Kangwon	Wonju	2	15	20.5	20,646	2,424	3000	2,000	0	0	0	9,968	3,254
19910802	19910805	Typhoon	Caitlin	Kyungbuk	Pohang	0	0	0	127,910	0	0	0	0	0	0	0	127,910
19910829	19910903	Flood	-	Kyunggi	Angjin	0	3	35	6,537,919	285,583	2,870,143	1,523,522	797,529	549,092	278,049	20,012	213,989
19910829	19910903	Flood	-	Kangwon	Wonju	0	0	32.85	43,278	353	352	4,272	16,254	4,000	8,632	8893	522
19910829	19910903	Flood	-	Kyungbuk	Pohang	0	0	42.5	8,933	450	523	4272	205	165	2,368	150	800

Table 11 Example of GIS information obtained from Viet Nam Scale :1:25,000

Items	Archive Types	Yes/ No	Type of Format
Urban-Area	Selected Area	Yes	Dxf
Rural-Area	Selected Area	Yes	Dxf
Digital Elevation Data	Selected Area	Yes	Dxf
Land-use	Selected Area	Yes	Dxf
National Boundary	Whole Phil. Soc.	Yes	Shp
Admin Boundary	Whole Phil. Soc.	Yes	Shp
Main Highway	Whole Phil. Soc.	Yes	Shp
Street Map	Selected Area	Yes	Shp
National Boundary	Whole Phil. Soc.	Yes	Shp
Admin Boundary	Whole Phil. Soc.	Yes	Shp
Main Highway	Whole Phil. Soc.	Yes	Shp
Street Map	Selected Area	Yes	Shp

Contact person are also requested as follows: (i) institute or agency, (ii) department, (iii) name, (iv) fax number including national code, (v) phone number including national code and (vi) email address. The last information is for constraints that it is possible for you to bring the data out of territories in lower scale of a certain value, for example, more than detailed maps in 1: 50000 and be distributed out of Korea with some exception of special permission for public concerns.

In the WGTCDIS, DB structures are redesigned and constructed for each member and the disaster data tables are inter-related to typhoon information. In addition, the WGTCDIS allows users to search disaster data related to the typhoon which is generated from similarity analysis. Once a similar typhoon is found using the improved engine, the user does not need to search additional disaster information related to that typhoon because the system automatically provide that information. In the WGTCDIS, typhoon disaster information can be searched in various ways. Disaster data including damage and meteorological information are archived in national level, provincial level as well as each disaster event in the DB, so that users can pull out the data in any way.

Whenever a new typhoon is formed and developing, meteorological agencies of TC Members announce related information using web system. Since one cannot monitor the issue of typhoon warning 24 hours day, utility software was developed to help the user to collect the information of a newly developed typhoon. In the WGTCDIS, typhoon disaster information can be searched in various ways. Disaster data including damage and meteorological information are one more setback found in the previous method for similarity analysis for typhoon was the computational speed. In this phase, the optimization for data structures and the search algorithm was carried out to reduce the computational time by 87.5%.

THE THIRD EXPERT MISSION

The Working Group on Disaster Risk Reduction (WGDRR) commenced the implementation of its first project, the Typhoon Committee Disaster Information System in 2005. WGTCDIS is a platform for information exchange among the TC Members. It has been noted that hitherto not all members have submitted the required information for implementation of the WGTCDIS. In this respect, the TC decided that an expert mission would be conducted in 2011 to promote the WGTCDIS and to assist members in data collection and entry to the WGTCDIS.

Typhoon Committee Secretary (TCS) announced the launch of the third WGDRR Expert Mission through circular letter to Members. Members interested in receiving the Expert Mission (Thailand, Lao People's Democratic Republic and Cambodia) notified TCS of their intention to participate. TCS, together with Chair of WGDRR selected 3 candidates as recipient Members and notified them. Each recipient Member nominated a focal point to liaise with TCS and relevant local stake-holders and as well as make suitable logistical arrangements for the Expert Mission. A mission plan was prepared and agreed upon by the recipient Members and TCS. The expert team, as well as the focal points of recipient Members had a coordination meeting during the sixth workshop of WGDRR, to fine-tune the mission plan for each recipient Member.

Objectives

The main objectives of the third Expert Mission are to (i) introduce analytical methods included in the WGTCDIS, (ii) educate and train how can estimate the typhoon trajectory and the typhoon related damages, (iii) introduce the distributed rainfall runoff model developed by NIDP for developing GIS based hazard map to assess flood risk in low land area or urban area, (iv) collect disaster related information regarding on the WGTCDIS, (v) identify needs and gaps on operating the WGTCDIS as early warning system and disaster risk management and (vi) discuss public out-reach projects regarding on disaster risk management.

Programs

For educating and training the WGTCDIS and identifying the gaps and needs on operation of WGTCDIS from the respective recipient members, expert mission was planned. The program of the third Expert Mission performed during 7-13 August, 2011 was shown in Table 12. Main program of the Expert Mission was for training WGTCDIS and collecting disaster information. Main outcomes were the education and training of the WGTCDIS and conclusion of cooperation works to modify the WGTCDIS by validation with new coming typhoons.

Table 12 Program of the third Expert Mission in 2011.

Members	Date	Contents
Thailand	8.8.	· 09:00-10:00 Opening and Expert Mission Briefing · 10:00-11:00 Presentation of the WEB-GIS based TCDIS (WGTCDIS) · 11:00-12:00 Presentation of Numerical Model for establishing Hazard Map · 13:30-14:30 Disaster Management System of the Thailand · 15:00-17:30 Training and Practice · 17:30-18:00 Discussion for Future Projects
Lao PDR	8.9.	· 15:00-16:00 Opening and Expert Mission Briefing · 16:00-17:00 Presentation of the WEB-GIS based TCDIS (WGTCDIS) · 17:00-18:00 Presentation of Numerical Model for establishing Hazard Map
Lao PDR	8.10.	· 09:00-10:00 Disaster Management System of the Lao PDR · 10:00-12:30 Training and Practice · 12:30-13:00 Discussion for future projects
Cambodia	8.11.	· 09:00-10:00 Opening and Expert Mission Briefing · 10:00-11:00 Presentation of the WEB-GIS based TCDIS (WGTCDIS) · 11:00-12:00 Presentation of Numerical Model for establishing Hazard Map · 14:00-18:00 Training and Practice
Cambodia	8.12.	· 09:00-10:00 Disaster Management System of the Cambodia · 10:00-11:00 Discussion for future projects · 14:00-18:00 Make a Expert Mission Report

The third mission was led by the WGDRR Chair and two invited experts to form the expert team as determined by the requirements indicated by the recipient Members. An expert team was organized which two experts are joined from Republic of Korea and Olavo Rasquinho from TCS to promote usages of the WGTCDIS and identify needs and gaps of recipient Members in relation to the implementation of the WGTCDIS, explore whether there is a need for public out-reach projects in relation to the Early Warning System, the Disaster Risk Management System, and any disaster risk reduction measures in the recipient Members. The name and roles of three expert are listed in Table 13.

Table 13 Experts who participated in the third Expert Mission in 2011.

Name	Role	Specialty
Sangman Jeong	- Expert Mission Leader - Brief on Expert Mission	Chair of WGDRR
Olavo Rasquinho	- Support for Expert Mission - Mission Report	TCS
Tae Sung Cheong	- Presentation of WGTCDIS - Presentation of Rainfall-Runoff Model	Secretary of WGDRR

The three TC Members Thailand, Lao PDR and Cambodia joined the Expert Mission in 2011 whose organizations and number of participants are listed in Table 14.

Table 14 Recipient Members and organizations of the third Expert Mission in 2011.

Recipient Members	Organizations	Participants
Thailand	Department of Disaster Prevention and Mitigation	11
Lao PDR	Department of Meteorology and Hydrology	14
Cambodia	Department of Meteorology	16

Expert Mission in Thailand

The brief of mission such as objectives, programs, activities of WGDRR and role of expert members was introduced in the Expert Mission in Thailand. The detailed analytical methods were presented to educate basic theories and algorithms estimating similar typhoon trajectory and localized typhoon related damages. Also participants had been trained on learning methods to estimate the similar typhoon trajectory and the typhoon related damages based on determined typhoon trajectories and to promote usage of the WGTCDIS.

For the flood disaster risk management, the distributed rainfall runoff model developed by NIDP was also introduced to Thailand Members. This model can be used for developing GIS based hazard map to assess flood risk in low land area or urban area when rainfall is forecasted. The hazard map overlapped GIS information can support useful information for decision making such as locations of shelters, utilities, dangerous area, hospital, etc, escape route from risk area and damages calculated from house and land use information.

The typhoon related disaster information was surveyed for building the Thailand's own WGTCDIS and standard disaster database to share information and integrated assessment of typhoon related damages. Also future collaboration works for providing disaster information to calibrate estimation method in the WGTCDIS and upgrade the WGTCDIS and the disaster management system and early warning system operated in Thailand were discussed to find gaps and needs. Figure 7 shows the representative photos collected from the Expert Mission in Thailand.

(a) Commemorative photograph with Thailand participants

(b) Brief on the Expert Mission

Figure 7 Representative photos of Expert Mission in Thailand in 2011.

In the expert mission, disaster management system shown in Figure 8(b) operated in Thailand was introduced and discussed to identify needs and gaps on operating the WGTCDIS as early warning system and disaster risk management in Thailand. The database structure for universal standard, effective methods for information sharing and technology transferring were discussed. Cooperation projects were also discussed to promote the WGTCDIS and to assist members in data collection and entry to

the WGTCDIS. For calibration and validation of WGTCDIS, cooperation works to provide disaster information, compare of estimated results with measured real typhoon and damages information and upgrade or enhance the WGTCDIS are very important. The main results from the Expert Mission in Thailand were following as (i) the abilities of public prevention between nations in the typhoon area were reinforced and (ii) through the expert mission, the way for organizing the international disaster management community has been paved.

(a) Presentation of the WGTCDIS and Rainfall Runoff Model

(b) Disaster Control Center of Thailand

Figure 8 Representative photos of Expert Mission in Thailand in 2011.

The future work plan for developing Thailand's own WGTCDIS was agreed in the Expert Mission. Thailand members will provide the disaster information for the WGTCDIS by end of 2011. Then NIDP will prepare report to submit UNESCAP in which annual assessment report and disaster information collected from Thailand, expert mission report and Thailand's own WGTCDIS established by NIDP will be included.

Expert Mission in Lao PDR

The brief of mission such as objectives, programs, activities of WGDRR and role of expert members were introduced in the Expert Mission in Lao PDR. The detailed analytical methods were presented to educate basic theories and algorithms estimating similar typhoon trajectory and localized typhoon related damages. Also participants had been trained on learning methods to estimate the similar typhoon trajectory and the typhoon related damages based on determined typhoon trajectories and to promote usage of the WGTCDIS.

For the flood disaster risk management, the distributed rainfall runoff model developed by NIDP was also introduced. This model can be used for developing GIS based hazard map to assess flood risk in low land area or urban area when rainfall is forecasted. The hazard map overlapped GIS information can support useful information for decision making such as locations of shelters, utilities, dangerous area, hospital, etc, escape route from risk area and damages calculated from house and land use information.

The typhoon related disaster information were surveyed for building the Lao PDR's own WGTCDIS and standard disaster database to share information and integrated assessment of typhoon related damages. Also future collaboration works for providing disaster information to calibrate estimation method in the WGTCDIS and upgrade the WGTCDIS and the disaster management system and early warning system operated in Lao PDR were discussed to find gaps and needs. Figure 9-10 show the representative photos collected from the Expert Mission in Lao PDR.

(a) Commemorative photograph with Lao PDR participants

(b) Brief on the Expert Mission

Figure 9 Representative photos of Expert Mission in Lao PDR in 2011.

In the expert mission, disaster management system shown in Lao PDR was introduced and discussed to identify needs and gaps on operating the WGTCDIS as early warning system and disaster risk management in Lao PDR. The database structure for universal standard, effective methods for information sharing and technology transferring were discussed. Cooperation projects were also discussed to promote the WGTCDIS and to assist members in data collection and entry to the WGTCDIS. For calibration and validation of WGTCDIS, cooperation works to provide disaster information, compare of estimated results with measured real typhoon and damages information and upgrade or enhance the WGTCDIS are very important. The main results from the Expert Mission in Lao PDR were following as (i) the disaster information for five years from 2005 to 2009 were collected to establish the Lao PDR's own WGTCDIS, (ii) the abilities of public prevention between nations in the typhoon area were reinforced and (iii) through the expert mission, the way for organizing the international disaster management community has been paved.

(a) Presentation of the Lao PDR's Disaster Management System

(b) Expert Mission Team with Administrator

Figure 10 Representative photos of Expert Mission in Lao PDR in 2011.

The future work plan for developing Lao PDR's own WGTCDIS was agreed in the Expert Mission. NIDP will establish Lao PDR's own WGTCDIS and prepare report to submit UNESCAP by end of October in which annual assessment report and disaster information collected from Lao PDR, expert mission report and their own WGTCDIS established by NIDP will be included.

Expert Mission in Cambodia

The brief of mission such as objectives, programs, activities of WGDRR and role of expert members were introduced in the Expert Mission in Cambodia. The detailed analytical methods were presented to educate basic theories and algorithms estimating similar typhoon trajectory and localized typhoon related damages. Also participants had been trained on learning methods to estimate the similar typhoon trajectory and the typhoon related damages based on determined typhoon trajectories and to promote usage of the WGTCDIS.

For the flood disaster risk management, the distributed rainfall runoff model developed by NIDP was also introduced. This model can be used for developing GIS based hazard map to assess flood risk in low land area or urban area when rainfall is forecasted. The hazard map overlapped GIS information can support useful information for decision making such as locations of shelters, utilities, dangerous area, hospital, etc, escape route from risk area and damages calculated from house and land use information.

The typhoon related disaster information was surveyed for building the Cambodia's own WGTCDIS and standard disaster database to share information and integrated assessment of typhoon related damages. Also future collaboration works for providing disaster information to calibrate estimation method in the WGTCDIS and upgrade the WGTCDIS and the disaster management and early warning systems operated in Cambodia were discussed to find gaps and needs. Figure 11-12 show the representative photos collected from the Expert Mission in Cambodia.

(a) Commemorative photograph with Cambodia participants

(b) Brief on the Expert Mission

Figure 11 Representative photos of Expert Mission in Cambodia in 2011.

In the expert mission, disaster management system shown in Cambodia was introduced and discussed to identify needs and gaps on operating the WGTCDIS as early warning system and disaster risk management in Cambodia. The database structure for universal standard, effective methods for information sharing and technology transferring were discussed. Cooperation projects were also discussed to promote the WGTCDIS and to assist members in data collection and entry to the WGTCDIS. For calibration and validation of WGTCDIS, cooperation works to provide disaster information, compare of estimated results with measured real typhoon and damages information and upgrade or enhance the WGTCDIS are very important. The main results from the Expert Mission in Cambodia were following as (i) the abilities of public prevention between nations in the typhoon

area were reinforced and (ii) through the expert mission, the way for organizing the international disaster management community has been paved.

(a) Presentation of the Cambodia's Disaster Management System

(b) Training of WGTCDIS

Figure 12 Representative photos of Expert Mission in Thailand in 2011.

The future work plan for developing Cambodia's own WGTCDIS was agreed in the Expert Mission. NIDP will prepare report to submit UNESCAP by end of 2011 in which annual assessment report and disaster information collected from Cambodia, expert mission report and Cambodia's own WGTCDIS established by NIDP will be included.

Support from the Typhoon Committee Trust Fund

The Secretary of Typhoon Committee emphasized during the third Expert Mission that the National Emergency Management Agency of Republic of Korea (NEMA) was selected by the Committee for receiving the Dr. Roman L. Kintanar Award 2010 for Typhoon-related Disaster Mitigation due to the WGTCDIS. He reminded the visited Members that the Typhoon Committee Trust Fund (TCTF) has funds allocated to help to support the expenditures related with the collection of data on the damage caused by typhoons. He also stressed that the project's success depends largely on the commitment of Members.

SUMMARY

The WGTCDIS developed by NIDP contributes to typhoon related disaster risk reduction in Asia and the Pacific region though timely and efficient way of information sharing via its website (www.tcdis.org). The WGTCDIS can also be used as a TC platform to share typhoon related disaster information, knowledge and experiences, good practices, and other information related to typhoon related disaster risk reduction. Since 2008, WGDRR performed the Expert Mission to establish the Members' own WGTCDIS and then educate the formulation of comprehensive disaster information system and train operation of the WGTCDIS. Through the Expert Mission, NIDP-centered expert team introduced the main system developed by NIDP and surveyed data such as the GIS information and disaster related information which can assist establishment of the WGTCDIS.

The third Expert Mission was led by the WGDRR Chair and two invited experts from Republic of Korea and Olavo Rasquinho from TCS to introduce WGTCDIS and distributed rainfall runoff model, educate and train them, collect disaster related information regarding the WGTCDIS, identify needs and gaps on operating the WGTCDIS and discuss public out-reach projects. In the Expert Mission, the detailed analytical methods were presented to educate basic theories and algorithms estimating similar typhoon trajectory and localized typhoon related damage. Participants were also trained on learning methods to estimate the similar typhoon trajectory and the typhoon related damage based on determined typhoon trajectories and to promote usage of the WGTCDIS. For the flood disaster risk management, the distributed rainfall runoff model developed by NIDP was also introduced.

Through the Expert Mission, NIDP collected Lao PDR's disaster information for five years from 2005 to 2009 to establish WGTCDIS. The future work plan for developing Member's own WGTCDIS was agreed in the Expert Mission. This Report was prepared by NIDP and will be submitted to UNESCAP by the end of 2011. Also future collaboration works for providing disaster information to calibrate the estimation method and upgrade the WGTCDIS, the disaster management and the early warning systems operated by Members were discussed to find gaps and needs.

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Printed in Macao, China January 2012

ISBN 978-99965-817-2-4

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ISBN 978-99965-817-2-4

ESCAP/WMO TC/TD-No. 0003