UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS THIRTY-EIGHTH SESSION

Hanoi, Viet Nam
14-19 November 2005

I. ORGANIZATION OF THE SESSION

1. The Thirty-eighth Session of the ESCAP/WMO Typhoon Committee was held in the Thang Long Ball Hall of the Meliá Hanoi Hotel, Hanoi, Socialist Republic of Viet Nam, from 14 to 19 November 2005.

2. The Session was attended by 81 participants from 12 out of 14 Members of the Typhoon Committee, namely: China; Hong Kong, China; Japan; Lao People's Democratic Republic; Macao, China; Malaysia; Philippines; Republic of Korea; Singapore; Thailand; the Socialist Republic of Viet Nam; and the United States of America (USA).

3. The Session was also attended by 19 observers from Brunei Darussalam, Germany, Italy and Russian Federation and 5 partner organizations: UNDP, UN-ISDR, UNESCO-IOC, WMO/CAS, and ADRC and several interested agencies of Viet Nam. Representatives from the Economic and Social Commission for Asia and the Pacific (ESCAP), the World Meteorological Organization (WMO) and Typhoon Committee Secretariat (TCS) also attended the session. The list of participants is given in Appendix I.

Opening of the Session (agenda item 1)

4. The opening ceremony was declared open by H.E. Mr Nguyen Cong Thanh, Vice Minister of the Ministry of Natural Resources and Environment and the Permanent Representative of the Socialist Republic of Viet Nam with WMO, at 0900 hrs on Monday, 14 November 2005 in the Thang Long Ball Hall of the Meliá Hanoi Hotel.

5. The following statements were delivered at the opening ceremony:

- The welcome and opening address by H.E. Mr Nguyen Cong Thanh, Vice Minister of the Ministry of Natural Resources and Environment and the Permanent Representative of the Socialist Republic of Viet Nam with WMO;
- The message of Mr Kim Hak-Su, Under Secretary-General of the United Nations and Executive Secretary of UNESCAP, read by Mr Le-Huu Ti, the representative of UNESCAP Secretariat; and
- The address of Dr Tokiyoshi Toya, the representative of the WMO Secretariat on behalf of Mr Michel Jarraud, Secretary-General of WMO.

The above-mentioned statements are given in Appendices II.A, II.B and II.C.

6. After the opening statements, a ceremony was held where the 2005 ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award was presented by Dr Roman L. Kintanar, Interim Secretary of the Typhoon Committee Secretariat and Mr Angelo B. Palmones, representative of the Typhoon Committee Foundation Inc. to the National Hydrometeorological Service of Viet Nam in recognition of its valuable contribution to disaster reduction.

II. ELECTION OF OFFICERS (agenda item 2)

7. Dr Xu Xiaofeng, Chairman of the Committee for 2004-2005, reported main features of his activities during his tenure on behalf of the Committee. These included (1) participation in the World Conference on Disaster Reduction, held in Kobe, Japan in January 2005 (at that occasion, he also addressed a special session of annual assembly of the International Flood Network (IFNet) as a keynote speaker to promote cooperation between IFNet and the Committee, (2) participation in the annual workshop of the Working Group on Hydrology, held in Kuala Lumpur in September 2005, to represent the Committee at the opening ceremony and to deliver a keynote speech on "Challenges on Meteorology towards Reducing Typhoon-related Disasters", and (3) participation in the consultation meeting of regional organizations on disaster reduction, organized by the Asian Disaster Preparedness Center (ADPC) and UNESCAP under the framework of the Partnership for Disaster Reduction in South-East Asia in

October 2005 in Bangkok. He also informed the Committee of the invitation by ADPC and UNESCAP.for the Committee to participate in the next meeting to be held in February 2006 as a follow-up of the consultation meeting to discuss in detail specific priority areas for collaboration.

8. Dr Bui Van Duc, (Viet Nam) and Mr. R. Jeffrey LaDouce (USA) were elected Chairman and Vice-Chairman of the Typhoon Committee, respectively. Mr Chow Kok Kee (Malaysia) was elected Chairman of the Drafting Committee.

III. ADOPTION OF THE AGENDA (agenda item 3)

9. The Committee adopted the agenda as shown in Appendix III.

IV. WORKING SESSION OF METEOROLOGICAL, HYDROLOGICAL AND DISASTER PREVENTION AND PREPAREDNESS WORKING GROUPS (agenda item 4)

10. Prior to the plenary session for the Committee, three parallel sessions on meteorology, hydrology and disaster prevention and preparedness (DPP) were convened on the morning of 14 November 2005 in three separate meeting rooms to review progress of work during the past year, to identify priorities for cooperation and to recommend points to the Committee for consideration.

11. The major outcomes of the working sessions of the three Working Groups were reported to the plenary session as given below.

V. THE COMMITTEE'S ACTIVITIES DURING 2005 (agenda item 5)

12. The Committee was informed of activities carried out in 2005, including important achievements, key issues and future directions by each Member, TCS, WMO and ESCAP on meteorology, hydrology and disaster prevention and preparedness. The Committee was also informed of related activities by the representatives of UN-ISDR, UNESCO/IOC, WMO-CAS and ADRC.

(a) Meteorological Component (agenda item 5.1)

13. The session reviewed the activities of the Members during the past year, details of which are presented in Appendix IV. On the basis of these reports, the Committee identified the following highlights as priority areas for cooperation among the Members:

- GTS and communications update
- Tropical cyclone information processing system
- Satellite and Radar as well as AWS interpretation
- Operational typhoon models and its integration, including validation
- Ensemble prediction systems (EPS)
- Typhoon warning generation system, including warning signal system
- Typhoon TV-show system and mobile Web weather service.

14. The Committee took note of the report of the parallel session of the Working Group on Meteorology (WGM) which met on Monday, 14 November 2005 (Appendix **V**)

15. The Committee was informed by the representative of China that the FY-2C became operational in 2005. Since 1 January 2005, users in China and in other countries/regions have

already started to receive data from the extended-imagery broadcast by FY-2C, and from 1 June on, the data process center (DPC) provided 13 kinds of images and products.

16. The Committee was informed that the Severe Weather Information Centre (SWIC) hosted by Hong Kong, China became an operational component of the Public Weather Services Programme of WMO on 23 March 2005. The total page views of SWIC exceeded 7 million views in 2005 giving an annual growth of over 30%.

17. The Committee was informed by the representative of Japan that the Multi-functional Transport Satellite-IR (MTSAT-IR) was successfully launched on 26 February 2005. The MTSAT-IR took over the meteorological communication function from GMS-5 on 28 April 2005. The meteorological payload of the MTSAT-IR has been operational since 28 June 2005 and will fulfil its meteorological mission in the next five years. MTSAT-2, which will serve as an in-orbit backup satellite to MTSAT-IR, has already completed the manufacturing stage and is now under final testing phase. MTSAT-2 will be stationed above the equator at 135 or 145 degrees east.

18. Committee is informed that the RSMC Tokyo - Typhoon Center starts disseminating SAREP (SAtellite REPort) in BUFR format, or, Table Driven Code Forms (TDCFs), in November 2005, and that the Center will discontinue disseminating the SAREP report in the present Traditional Alphanumeric Codes (TACs) in November 2006. The Committee urged Members to prepare to receive the SAREP report in BUFR format with sufficient coordination with the Center before November 2006.

19. The Committee was pleased to note that a four-dimensional variational data assimilation (4D-Var) system has been operationally employed in JMA's Global Analysis since February 2005. As the 4D-Var analysis allows for adequate assimilation of observational data and produces more realistic analysis fields, the forecast score with 4D-Var showed much better performance than the former 3D-Var based system. The improvement of the analysis fields resulted in improvement of the typhoon track forecasts.

20. The Committee expressed its gratitude to JMA, and to Regional Specialized Meteorological Centre (RSMC) Tokyo - Typhoon Centre in particular, for the continuously providing the Members with tropical cyclone advisories, warnings and tropical cyclone information at its Numerical Typhoon Prediction Web Site. The activities of RSMC-Tokyo in 2005 and implementation plan for the period 2005 to 2009 are contained in Appendix VI.

21. The Committee was informed that eight (8) Members have already sent their observational data to RSMC Tokyo for inclusion in the Expanded Best Track Data (EBT) of 1996-2004. The Committee urged the six (6) Members who still have not done so, especially those frequently affected by tropical cyclones, to send the data to RSMC Tokyo.

22. The Committee was informed by the representative from Lao PDR on the assistance they received this year for the improvement of their meteorological and hydrological service from Japan and Viet Nam.

22b. The Committee took note of the presentation of a project by Prof. John Chan on 14 November 2005.

Conclusion:

23. On the basis of the information provided by the Members and findings of the Working Group Session on Meteorology, the following conclusions were reached:

- The Committee expressed its appreciation to the Chair and Vice Chair of WGM for their contribution during the past year;

- There is an urgent need to improve coordination of meteorological activities among the Members as well as with other international organizations;
- The Committee took note of important progress made in the implementation of the various RCPIP projects under meteorology and agreed to amend and incorporate the changes in the RCPIP as proposed, as shown in Appendix V; and
- It noted the importance of the Third International Conference on Early Warning (EWCIII) to be held in Bonn, Germany, in March 2006, as an opportunity to enhance visibility of the Committee and expressed its appreciation to UNESCAP, WMO and TCS in cooperation with UN/ISDR for the assistance aiming at mobilizing resources to enable TC Members to participate in EWCIII.

Decisions:

24. On the basis of the information provided by the Members and the findings of the pre-session on meteorology, the following decisions were reached:

- To re-establish the Working Group on Meteorology (WGM) to be responsible for the planning and promotion of cooperation among the TC Members in the implementation of the Meteorological Component of the RCPIP, and appoint Mr Wang Bangzhong, (China) and Ms. Duong Lien Chau (Viet Nam) as Chair and Vice Chair of WGM, respectively;
- To request the WGM to continue to address the following issues:
  (1) The level of advancement and capacity of various National Meteorological and Hydrological Services (NMHSs) as stipulated in the corresponding goals of RCPIP;
  (2) Sharing the experiences among the Members;
  (3) Linkages with requirements and activities of other TC Working Groups and training and research;
- To request the ESCAP, WMO, TCS, development partners and Members of TC to provide assistance to Cambodia; Lao, PDR and D.P.R, Korea to strengthen their NMHSs in particular in communication and human resource development;
- To authorize WGM to use TC Trust Fund to participated in the integrated workshop for the three components in 2006;
- To adopt the revision of RCPIP proposed by WGM as contained in Appendix XVI.
- To initiate the process of addressing the naming of tropical depressions;
- To organize a workshop, namely, “Inter-comparison of Typhoon Monitoring, Forecasting and Information Systems in the Typhoon Committee Region”, including discussion on Ensemble Prediction Systems (EPS) in 2007, with an aim to exchange good practice among Members and improve the Members’ typhoon forecaster platforms.
- Encourage participation of Committee Members at the ASIA/THORPEX (mainly on NWP and EPS issues).
- WMO to publish as soon as possible the 2006 edition of the Typhoon Committee Operation Manual (TOM) as submitted by the Rapporteur, Mr. Nobutaka Mannoji (Japan), with the amendments given in Appendix VII and request Japan to continue the services of Mr. Mannoji.
- WMO to upload the updated TOM in the TCP homepage and distribute the 2006 edition in CD ROM format to Members by March 2006.
- The names Pongsona, Maemi, Sudal, Rananim, Yanyan and Tingting were replaced by Noul, Mujigae, Mirinae, Fanapi, Dolphin and Lionrock respectively.
- The Committee decided to retire the names Matsa, Nabi and Longwang and requested the respective Members to propose replacement names. It requested TCS to inform the Members of procedures and timetable for submission of new names for consideration at the 39th session.

- It recognized the opportunity offered by the Third International Conference on Early Warning to be held in Germany in March 2006 and requested all the Working Groups in cooperation with UNESCAP, WMO and ISDR to make efforts to facilitate participation of interested TC experts in the Conference.
- WGM to submit a report to the 39th session.

(b) Hydrological component (agenda item 5.2)

25. The session reviewed the activities of the Members during the past year, details of which are presented in Appendix IV. Priority activities within the hydrological component among the Members include the following:

- Activities that have been widely tackled: Most of Members have been tackling hard on several traditionally important activities, with which high priority needs to be attached continuously:

  - Improvement of real-time Meteorological/hydrological data collection networks and timely disaster warning dissemination
  - Extension of flood forecasting systems to more river basins
  - Improvement of flood forecasting model accuracy/performance

- Activities that have been taken by some of Members and will need to be taken by more Members:

  - Preparation of Flood Hazard Maps
  - Dissemination of more user-friendly warning system
  - Development of debris flow/landslide forecasting and warning system
  - Capacity building of hydrologists in TC members (through OJT Training, etc.)
  - Dissemination of outputs and raising visibility of TC through various means, such as publication of manuals/guidelines and attendance of international conferences

- Activities that few or no Members have been tackled, but that need to be widely tackled soon:

  - Development of methodology and application of socio-economic impact assessment of typhoon-related disasters
  - Preparation of debris flow/landslides hazard maps
  - Public awareness activities such as education/training of local people on typhoon-related disaster risks

26. The Committee noted with appreciation the active collaboration among the members of the hydrologic working group and DPP experts and meteorologists of the Committee during the past two years. It highlighted the importance of this interaction and encouraged the WGH to deepen the level of collaboration with two other WGs in order to enhance further impacts of the activities of WGH. The Committee also noted the importance of the following developments in its Members:

- Efforts to deal with multi-hazard information in a systematic manner within the context of establishing well-functioning institutional arrangement, one of the good ways to follow is to establish multi-hazard information delivery system in a systematic manner such as the establishment of the National Disaster Warning Center in Thailand and Multi-hazard warning system in Malaysia;
- In some Members, such as Republic of Korea and Japan, in order to make best use of limited resources, many multi-purpose dams have been historically

constructed that include flood control function. For those multi-purpose dams, it is necessary to (1) study the possibility of more efficient dam operation to meet various and new requirement from the users, and (2) standardize the results as "Guideline";

- Legal arrangement: Revision of laws/acts to meet the requirement of better managing disasters is necessary but often is a lengthy process. Examples include:

  - Revision of flood fighting act, in order to make preparation of FHM mandatory (Japan)
  - Revision of Sabo-law in order to make debris flow/landslide risk assessment mandatory, and restrict new development/construction within high-risk areas. (Japan)

- Recent experience of the Philippines in community involvement in the hydrological monitoring and dissemination process:

  - to supplement activities of the central/local governments for the rivers where their resources is limited
  - to make local people aware of the flood and typhoon-related hazards
  - to strengthen the coping capacity of local communities.

27. The Committee took note of the report of the parallel session of the Working Group on Hydrology (WGH) which met on Monday, 14 November 2005 (Appendix VIII).

28. The Committee was pleased to note the continuing increase in the number of participants from the TC Members in the Workshop this year, the participation of TC Hydrologists and DPP experts as well as invited meteorologists from TC Members. It took note of the fact that the use of about US$16,000 from the TC Trust Fund for the Workshop had generated more than US$80,000 in kind contribution from various parties, consisting of about US$32,000 from the Ministry of Land, Infrastructure and Transport (MLIT) of Japan and about US$23,000 from the Ministry of Construction and Transportation (MOCT) of Republic of Korea. It expressed its appreciation to the Governments of China, Japan, Malaysia, Philippines and Republic of Korea for their contribution in kind to the various activities of WGH and technical support provided by UNESCAP in the organization of this Workshop. It also expressed appreciation to Mr Katsuhito Miyake and Mr Liu Jin-ping, Chair and Vice Chair of the Working Group respectively for their dedication and effective leadership in guiding the work on hydrology during the past year.

29. The Committee took note of the progress made in the implementation of the various RCPIP projects, especially those related to flood hazard mapping, sediment disaster forecasting and warning, evaluation and improvement of operational flood forecasting system focusing on model performance, development of guidelines for reservoir operation in relation to flood forecasting, and extension of flood forecasting systems to selected river basins of WGH.

30. The Committee was pleased to note the emphasis adopted by WGH for the Workshop of 2005 with its focus on assessment of socio-economic impacts of flood-related disasters and efforts of UNESCAP in collaboration with UNDP and the Economic Commission for Latin America and the Caribbean (ECLAC) to assist Members in the region on the development of a common methodology for assessment. It encouraged WGH to continue the efforts towards standardization of methodologies to assess socio-economic impacts of typhoon-related disasters in the Committee Area.

31. It expressed its appreciation to the Government of Japan for the financial support extended to selected members of WGH to participate in WCDR and the MOCT of Republic of Korea for the financial support to selected members of WGH to participate in the international

conference of the International Association of Hydraulic Research (IAHR), held in Seoul in September 2005.

32. It also expressed sincere appreciation to the MLIT of Japan and MOCT of Republic of Korea for the intention to provide financial support to activities of WGH in 2006, including possible participation of selected TC Members in the Fourth World Water Forum to be held in Mexico City in March 2006.

Conclusions:

33. On the basis of the information provided by the Members and findings of the parallel session on hydrology, the following conclusions were reached:

- The format of the annual Workshop adopted since 2004 to include also practical field work had provided new directions for further improvement to the work of WGH. This included the International Symposium, Panel of Experts, a field training on hazard mapping and the active participation of interested members in the joint preparation of the detailed prepared roadmaps for further action of the ongoing projects.

- In order to maintain the momentum and interest of TC Members in these cooperative efforts, the Working Group recommended to the Committee to authorize the use of TC Trust Fund to hold a Workshop on Hydrology and DPP in 2006 and that linkage with other organizations and regions of the World, such as through the Fourth World Water Forum, be made to enhance systematic support from interested Members and organizations in these efforts. In this context, it recognized the importance of linking activities of the Typhoon Committee to the global efforts on disaster reduction, especially the Hyogo Framework for Action: 2005-2015 and the Beijing Action for Disaster Risk Reduction in Aisa. It therefore recommended to adopt the following theme for the planned workshop in 2006: "**Integrating activities of the hydrology, meteorology and DPP components of the Typhoon Committee into the related international frameworks for disaster risk management for better impacts and visibility**".

- The Committee recognized the important opportunity offered by the Fourth World Water Forum to enhance visibility of the Committee and acknowledged the intention of the Japan Water Forum, the Infrastructure Development Institute, Japan (IDI) and Korea Water Forum to support participation of TC experts in the Forum. It encouraged WGH in cooperation with the other WGs to collaborate seek support for participation of all interested TC experts in the Forum.

- The Committee expressed its appreciation to the Ministry of Water Resources of China for its intention to accept attachment of two TC hydrologists to participate in the annual flood forecasting operations at the Bureau of Hydrology and to the Department of Irrigation and Drainage of Malaysia for its generous offer to conduct a four-week on-the-job training to hydrologists of selected TC Members. Interested Members are invited to contact the focal points of China and Malaysia and requested TCS to issue invitation as may be communicated by the two respective Members.

Decisions:

34. On the basis of the information provided by the Members and deliberations, the Committee made the following decisions:

- To re-establish the Working Group on Hydrology (WGH) responsible for the planning and promotion of cooperation among the TC Members in the implementation of the Hydrological Component of the RCPIP and appoint Mr Katsuhito Miyake, Japan, Dr Hong Ilpyo, Republic of Korea as Chair and Vice Chair of WGH, respectively. In addition, it recognized the increasing work load faced by the WGH and appointed Dr Liu Zhi-yu, China as Secretary of WGH. It requested WGH to submit a report to the 39th session.

- To organize a workshop with the theme "Integrating activities of the hydrology, meteorology and DPP components of the Typhoon Committee into the related international frameworks on disaster risk management for better impacts and visibility" in 2006 with an allocation of a total of US$17,000 for TC Hydrologists and invite interested Members to host the Workshop.

- To allocate funds for members of the AWG and WGM to participate in a back-to-back meeting with the WGH Workshop to ensure effective integration of all related activities of the Committee into the related international frameworks for action on disaster risk management.

- To authorize WGH in cooperation with UNESCAP, WMO and TCS to mobilize resources to enable TC experts to participate in the Fourth World Water Forum in Mexico in March 2006 and invite Japan Water Forum, IDI, and Korea Water Forum to assist in the organization of a thematic session in typhoon-disaster risk management at the Forum.

(c) Disaster prevention and preparedness component (agenda item 5.3)

35. The session reviewed the activities of the Members during the past year, details of which are presented in Appendix IV**.** The main features of the presentations of the 12 members are summarized below.

- Information collection system using remote sensing technology, including satellite imagery, can be a powerful tool for disaster prevention and preparedness component.

- Hazard zoning and mapping is one of the key foundations for an effective disaster management system. Flood and landslide mapping are the ones to start with. Townwatch mapping would help understand the use of hazard map at community level.

- Disaster database system using systematic numbering such as GLIDE proposed by ADRC in previous years and adopted by the United Nations Office for Coordination of Humanitarian Affairs (OCHA) needs to be promoted for more efficient information sharing.

- Experiences regarding evacuation schemes and related legal systems need to be reviewed and shared at the regional level.

- Integration of disaster risk reduction concepts into actual policy in development planning and recovery process using legislative system is essential to mitigate and minimize the consequences of typhoon-related disasters.
- Modified Environmental Impact Assessment or Disaster Impact Assessment can be adopted in developing members to reduce reckless and uncontrollable development.

- It is important to conduct drills and exercises involving the public and to raise awareness of the community-based warning and response system.

- It needs to conduct capacity building trainings for trainers or volunteers who are responsible for disaster management at the local/community level. It is also desired to provide information on typhoon disasters to the education sector and encourage them to be integrated in school curriculum.

- Regional detection and monitoring systems used in tsunami detection and warning can be reviewed to take advantage of already-available technologies which may be mobilized for typhoon-related disasters, or vice versa. International sharing on the standard operational plan or manual for multi-hazard warning response is desired.

- Tools such as PDA, radio, TV, Cell Broadcasting Service, town speakers, handy loud speakers, and etc. need to be recognized and promulgated for early warning communication.

- Sharing of information and experience on the operation of early warning systems is highly desirable and should be promoted.

36. Based on this review, the Committee attached priority to the following items to be implemented as DPP projects starting next year.

- Develop and Implement a database on the DPP component focusing on the compilation and publication of an inventory of early warning systems operated by Members. The database can be expanded to include other information as the project progress.

- Link hazard mapping on flood and landslide with local actions and implementations to enable the local community to produce and use relevant hazard maps.

- Promote the importance of application of remote sensing technology, especially satellite technology, in DPP.

- Provide opportunities that DPP experts and media representatives work together on disaster communication.

- Offer an experience-sharing network on disaster impact assessment as a tool in disaster risk reduction.

- Other socio-economic issues still need to be discussed.

Conclusions:

37. On the basis of the information provided by the Members and findings of the parallel session on DPP, the following conclusions were reached:

- The Committee recognized the need to enhance coordination and interaction among all the working groups. In this connection, it encouraged WGDPP to advance progress expected from the key activities of WGDPP, especially those related to the inventory of early warning systems in the TC Members and the establishment of socio-economic database of typhoon-related disasters in the region. In this connection, it recognized the importance of close collaboration between WGDPP and ADRC in the development of the database.

- The Committee expressed its appreciation to Republic of Korea and Hong Kong, China for various initiatives to further enhance the important role of DPP in promoting visibility of the Committee and in facilitating mobilization of resources to support the operations of the Committee.

- The Committee expressed its appreciation to UN-ISDR for the support it provided to the Working Group on DPP during the past year and during the conduct of the 38th Session and invited UN-ISDR to continue this fruitful partnership, including the possible holding of a special session to be held at the Third International Conference on Early Warning in March 2006 in Germany.

- The Committee recognized the need to implement activities of the Disaster Prevention and Preparedness (DPP) component of RCPIP in close collaboration with WGM and WGH, and agreed to hold an integrated TC workshop in 2006 on the theme mentioned in para. 34.

- The Committee recognized the benefit of synergy in implementing DPP activities of the RCPIP projects in collaboration with ongoing DPP activities of ADPC/ESCAP projects, including those related to "early warning", "community-based disaster risk management" and "enhanced participation of the media in disaster reduction."

- The Committee noted with appreciation the proposed road map as contained in Appendix XXII, submitted by the WGDPP, and agreed to consider it in future sessions.

Decisions:

38. On the basis of the information provided by the Members and deliberations, the Committee made the following decisions:

- To re-establish a Working Group on Disaster Prevention and Preparedness (WGDPP) and appointed Dr Sam-Kew Roh, Republic of Korea and Dr Ming Chung Wong, Hong Kong, China as Chair and Vice-chair of WGDPP respectively. It also invited the Members to nominate their respective focal points to participate in the work of WGDPP.

- To encourage interested DPP experts to actively participate in the integrated Workshop to be organized by WGH in 2006 and invite interested Members to provide resources to enable DPP experts of the Committee to participate in the Workshop.

- In view of the importance of DPP priority activities, the Committee decided to allocate resources to enable key members of WGDPP to undertake their activities.

- To invite UN-ISDR, ADRC, ADPC and other interested organizations to provide support to WGDPP.

(d) Activities on training and research (agenda item 5.4)

39. The Committee took note of the report made by the Chairman of the Typhoon Research Coordination Group (TRCG) including the status and plan for the visiting lecturer programme, the Typhoon Committee Research fellowship scheme and the workshop on effective tropical

cyclone warning. Wide ranges of research activities have been carried out by Members during the intersession period, including topics associated with:

- 3d/4d-Var data assimilation and bogusing with satellite drift wind and AMSU radiance,
- conceptual models on formation probability, twin typhoon interaction, structural change at landfall, vertical wind shear and rain asymmetry, intensity measures with microwave channels,
- application of ensemble prediction system guidance; calibration and bias correction, downscaling to high winds,
- statistical models for intensity forecasting, continued improvement of STIPS and CLIPER,
- development of high resolution model for interaction with ocean, inner core structure, various verification studies,
- long-range forecasting to understand the influence of MJO on storm intensity

40. At the kind invitation of the China Meteorological Administration (CMA), the second regional workshop entitled “Effective tropical cyclone warning” was hosted at the Shanghai Meteorological Bureau (SMB) from 24 to 28 April 2005, and the SMB made excellent arrangements for the workshop. The workshop focused on the close collaboration among the three components. The workshop was supported from the Typhoon Committee Trust Fund (TCTF) of USD 27,400 for the invitation of five resource persons, two lecturers for EPS, and fourteen participants. WMO supported the expenses for the representative of WMO to provide a special lecture. The CMA kindly provided financial support for the two resource persons from USA and Australia respectively in addition to the expenses including the venue, facilities, and working arrangements. Hong Kong, China; Japan; Republic of Korea; and Macao, China supported the participation of their respective representative to the workshop. Major findings and recommendation of the workshop can be found in Appendix X.

41. Three research projects has been completed under the Typhoon Committee research fellowship scheme during the intersessional period:

- Effect of tropical cyclone bogusing on model analysis and forecasts by Ms. Wang Dongliang, Shanghai Typhoon Institute, CMA, hosted by Hong Kong Observatory, Hong Kong, China during 11 October – 10 December 2004;
- Evaluation of the model performance in typhoon prediction in the high-resolution global model (T426L40) by Ms Sugunyanee Yavinchan, Thai Meteorological Department , hosted by Typhoon Research Center, Kongju Nat’l University, Republic of Korea during 1 August – 30 October 2005; and
- Impact study of Moisture Data on TC Forecasting in South China Sea and Western North Pacific by Dr. Vicente B. Malano, PAGASA , hosted by Hong Kong Observatory, Hong Kong, China during 20 September – 19 November 2005.

42. The Committee noted that the research paper by Dr. Peng Taoyong (China) on TC track forecasting with use of superensemble, has been published in the International Journal of Systems and Cybernetics (2005). Dr Peng’s research study was funded by the Korea Meteorological Administration from 15 June to 15 November 2001.

43. Two roving seminars on the application of multi-model ensemble typhoon forecasts were held during the intersession period with the financial support of 10,000 USD from the Typhoon Committee Trust Fund (TCTF), and the kind arrangements of the local hosts:

- Beijing, China, 22-24 November 2004
- Petaling Jaya, Malaysia, 25-27 November 2004

44. More than 40 participants attended the two roving seminars. The roving seminars were well recognized, in which a host of knowledge on ensemble forecast theories and applications were lectured, experiences of TC numerical model developing and operational TC forecasting were fully exchanged. All the participants expressed their appreciation of the significance and helpfulness of the seminar. The participants expressed their thanks to the lecturers Dr. Chan and Dr. Mannoji for the high standards and providing excellent notes which had enhanced their knowledge on tropical cyclones and in the ensuing discussions during and after the lectures the participants learned a lot about the short comings, current status and progress made in tropical cyclone formation and prediction.

45. Regarding to the activities of TRCG for 2006, TRCG propose to hold a roving seminar as shown in Appendix XI. The TRCG also propose to continue the Typhoon Committee research fellowship scheme in 2006, in parallel with review on its progress and direction for the improvement.

46. The Committee was informed by the representative of the Republic of Korea that the Korea Meteorological Administration (KMA) will host two training courses in 2006, the Training Course on Weather Forecasting for Operational Meteorologists and the Partnership Building Program on Meteorological Technology and Policy for National Meteorological Services.

47. The Committee was pleased to note that Singapore welcomed requests for attachment of scientists from Members to the ASEAN Specialized Meteorological Centre (ASMC) and that the password protection of the ASMC Intranet has been removed.

48. The Committee was informed by the representative from USA that the International Pacific Desk Training Internship continued in 2005 with 6 students which included one from Malaysia.

Conclusions:

49. On the basis of the information provided by the Members of the TRCG and the report of the meeting of the TRCG (Appendix IX), the following conclusions were reached:

- The Committee expressed its appreciation to Dr Woo-Jin Lee, (Republic of Korea), Chairman of TRCG and all TRCG members for the report and their contributions;
- The Committee encouraged Members to participate in the roving seminars to be held in Viet Nam in 2006 and urged that the presentation material be distributed to all Members in the form of CD-ROM after the seminars; and
- The Committee encouraged Members to promote research under the TC research fellowship scheme with possible extension to hydrology and DPP components.
- The Committee encouraged Members to develop performance measures for workshops or seminars supported by the Committee.

Decisions:

50. On the basis of the information provided by the Members and deliberations, the Committee made the following decisions:

- To re-establish TRCG with the same Terms of Reference and appoint Dr Woo-Jin Lee, (Republic of Korea) and Mr Edwin Lai (Hong Kong, China) as Chair and Vice Chair of TRCG, respectively;
- To continue the Typhoon Committee research fellowship scheme in 2006, in parallel with the review on its progress and direction for its improvement and request TCS to make necessary arrangements to implement the scheme for 2006;

- To hold the next roving seminar in Viet Nam in 2006 with appropriate performance measures and support from TC Trust Fund; and
- To support the joint regional workshop every 1-2 years.

VI. REVIEW OF THE 2005 TYPHOON SEASON/PUBLICATIONS (agenda item 6)

51. The Committee noted that as of 14 November 2005, 22 named tropical cyclones formed in 2005. The total number almost equals the 30-year average frequency of cyclones occurring in the western north Pacific. Ten tropical cyclones with tropical storm intensity or higher hit China while ten tropical cyclones made landfall on the continent. It is worth noting that the number of tropical storms that made landfall on the continent has been relatively low in recent years. Thirteen of the cyclones attained typhoon intensity. The ratio of the number of TCs with typhoon intensity to that of the named TCs has been relatively high in recent years. Details of the 2005 typhoon season are contained in Appendix XII.

52. The Committee took note with appreciation the review of the 2005 typhoon season provided by the RSMC Tokyo-Typhoon Center as given in Appendix XIII.

Publications:

53. The Committee took note that the TCS published the 17th issue of the Typhoon Committee Newsletter in July 2005 and the 2004 Typhoon Committee Annual Review (TCAR) in October 2005 which were disseminated to the Members, ESCAP and WMO in electronic (CD-ROM) format. The Committee reappointed the Chief Editor.

54. The Committee noted with appreciation that the RSMC Tokyo – Typhoon Center published the "Annual Report on Activities of the RSMC Tokyo – Typhoon Center in 2004" in the form of CD-ROM with printed matters in October 2005. The report is also available on the Web page of JMA/RSMC Tokyo – Typhoon Center http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/annualreport.html.

VII. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item 7)

55. The Committee was informed by the representative of the WMO Secretariat that the:

(a) Fifth TC RSMC/TCWCs Technical Coordination Meeting will be held in Honolulu, Hawaii, USA from 5 to 8 December 2005.

(b) Fourth Workshop on Storm Surge and Wave Forecasting will be held in Manila in July 2006.

(c) Expert meeting on the formulation of TCP Sub-Project No. 26: Evaluation of tropical cyclone warning systems (their effectiveness and deficiencies) will be held in August 2006, and

(d) First RA I Workshop on Tropical Cyclone Research will be held in St. Denis, La Reunion in October 2006.

56. The Committee was informed that the research group of RA I TCC, which is organizing the First RA I Workshop on Tropical Cyclone Research had invited the participation of tropical cyclone researchers from the Committee.

57. The Committee noted with satisfaction that two woman forecasters from Macao, China and Singapore had successfully undertaken the fifth on-the-job training in typhoon operations at the RSMC Tokyo – Typhoon Center from 20 to 29 July 2005. It also noted with appreciation that JMA would organize the attachment of two woman forecasters (each from the Lao PDR and Viet Nam) to the RSMC Tokyo for 10 days in July 2006.

58. The Committee endorsed the following four targets of the TCP Expert Meeting on Effective Early Warnings of Tropical Cyclones which was held in Kobe, Japan from 17 to 18 January 2005 in conjunction with the World Conference on Disaster Reduction (Kobe, January 2005):

- All TC RSMC and TCWCs to strive to increase the accuracy of tract and intensity forecasts of tropical cyclones by 10 per cent by 2015. The Committee noted the difficult challenge of attaining the intensity goal based on current research;
- All TC RSMC, TCWCs and concerned Members of tropical cyclone regional bodies to issue probabilistic forecasts of tropical cyclones up to 5 days by 2015;
- Members of tropical cyclone regional bodies to educate stakeholders annually on proper interpretation of tropical cyclone forecasts, advisories, warnings and other meteorological and hydrological information; and
- Members of tropical cyclone regional bodies to ensure dependable and effective dissemination of tropical cyclone nowcasts, forecasts, advisories, watches and warnings in real time to decision-makers including emergency managers, media, general public and other stakeholders.

59. The Committee was informed by the representative of WMO Commission on Atmospheric Science (CAS) that the Sixth International Workshop on Tropical Cyclones will be held in San Jose, Costa Rica from 20 to 30 November 2006. Forecasters and researchers from the Members of the Committee were encouraged to actively participate at this International Workshop.

VIII. PROGRAMME FOR 2006 AND BEYOND (agenda item 8)

Advisory Working Group

60. The Committee took note of the report of the Advisory Working Group on the Selection of the Typhoon Committee Secretariat and expressed its appreciation to Mr Chow Kok-Kee and Mr James Weyman, the Chairman and Vice Chairman of AWG for their efforts and devotion to this important matter of the Committee. The Committee adopted the recommendations of AWG and conducted the selection procedures as recommended by AWG.

61. The Committee expressed its sincere appreciation to the Government of the Philippines and the Macao, China for their detailed offers and presentations during the session.

62. As recommended by the AWG, a secret ballot was conducted. Macao, China was selected to host the Typhoon Committee Secretariat.

63. At this occasion, the Committee expressed its sincere appreciation to the Government of the Philippines for the hosting of its Secretariat during the last 34 years. It also expressed its deep gratitude to Dr Roman L. Kintanar for his devotion and dedication to the cause of the Typhoon Committee.

64. The Committee decided to request AWG to continue its efforts to translate the RCPIP into a strategic plan and annual work plan and requested AWG to submit the strategic plan and annual work plan to the Committee for its consideration at the 39th session. In this connection, it also endorsed the proposal of AWG to introduce cross-cutting goal for the work of the Committee. For the RCPIP to be implemented in 2006, it endorsed the following priority areas:

- The conduct of a survey on existing early warning systems operated by the Members and to develop a database. These activities will be led by the WGDPP;
- The assessment of GTS and communication to be led by the WGM;
- The study on standardization of methodology to assess socio-economic impacts of typhoon-related disasters to be led by the WGH; and
- The formulation of a strategy for integrated typhoon research programme.
- It recognized the need to further improve TC Web Site with the objectives to have a world-class web site to serve as a portal for tropical cyclones, to provide facilities to share opinion/experience, to boost the image of the TC as a result-oriented body, which has many accomplishments. In this connection, it expressed appreciation to Hong Kong, China for the assistance in registering the domain names for the Committee.

65. In view of the above conclusions, the Committee made the following decisions:

- To re-establish the Advisory Working Group and appointed Dr Xu Xiaofeng and Mr James Weyman as the Chair and Vice Chair of AWG.
- To invite the Government of Macao, China to nominate candidate(s) for the Secretary of the Committee for confirmation by the 39th Session.
- To establish the Working Group on Resource Mobilization with Terms of Reference shown in Appendix XIV and appoint Dr Koji Kuroiwa, Japan as Chair and invited Singapore to nominate Vice Chair of the Group.
- To request TCS and AWG in consultation with all Members to develop an annual work plan aiming at providing detailed, specific actions/measures to meet Goals and Objectives in RCPIP and to circulate it 3 months before next Session for Members to review.
- To request Members to appoint specific person for each of the Working Groups on Meteorology, Hydrology, Disaster Prevention and Preparedness (DPP) and one for Research/Training (TRCG) and Resource Mobilization Group and to establish a monitoring mechanism to ensure active participation in TC activities.
- To undertake efforts and allocate resources to further improve TC Web Site and request TCS to follow up on the registration of domain names.
- To implement the budgetary process proposed in Appendix XV to provide a greater role for TC Chairperson and TC Interim Secretary and AWG to improve the effectiveness and efficiency of its operations.
- To adopt the updated RCPIP as shown in Appendix XVI.
- To request that missions funded by TCTF are required to submit the brief mission report to provide findings and recommendations on follow-up actions through TCS to the Members, ESCAP and WMO.

IX. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (agenda item 9)

(a). Arrangements for the Typhoon Committee Secretariat (TCS)

66. The Committee expressed its gratitude to the Government of the Philippines for hosting the TCS and for providing a full-time meteorologist, a part time hydrologist as well as office space with office facilities and supplies. The Committee also expressed its gratefulness for the dedication and continuous services extended by Dr. Roman L. Kintanar in his capacity as the

Interim Secretary of the Committee and appointed him as the Interim Secretary for the intersession between the 38th and 39th sessions.

67. Macao, China shall assume the functions of the TCS for at least four years from the 39th session. The Committee requested Macao, China to coordinate with the current TCS staff to ensure a smooth transfer of operations and for Macao, China and the current TCS to submit quarterly reports to the TC Chairman on the progress of the transition. Transition will include a visit of TCS staff to Macau supported by TCTF.

68. The Committee decided to allocate resources to support the Typhoon Committee Secretariat during the transition period as in the previous year.

(b) Technical Cooperation

69. The Committee was informed of the technical cooperation activities of WMO and ESCAP as well as UN-ISDR and UNESCO-IOC in support of the programmes of the Typhoon Committee and expressed its appreciation to ESCAP, WMO and collaborating partners for providing assistance to Members of the TC.

70. The Committee was also informed of the progress of the development of the Resource Mobilization Database by the Working Group on Resource Mobilization (WGRM) chaired by Mr. Koji Kuroiwa. Mr. Kuroiwa stated that the database will be composed of two sub-databases, a donors data and the past successful records of the TC Members. The first prototype of the Resource Mobilization Database will be presented to the Committee at its 39th session in 2006. Emphasizing that the unique advantage of the database is sharing of knowledge and experiences among the TC Members, the Committee urged Members to actively participate in the survey on resource mobilization to be conducted in 2006.

71. The Committee welcomed the participation of the Director of the Development Cooperation Office of the Embassy of Italy as an observer to the session and his expression of interest in possible collaboration with the Committee and in the project proposal "Improvement of Forecasting and Early Warning for the least-developed Members of the Typhoon Committee".

72. In noting the interest of collaboration with Italy, the Committee requested the Government of Italy to consider possibilities to extend its assistance to the Committee either through WMO or contribution to the TC Trust Fund. The Committee requested the Interim-Secretary to hold consultations with the Government of Italy and report to the Chairman of the Committee and the AWG for further consideration/action.

(c) Typhoon Committee Trust Fund (TCTF)

73. The Committee reviewed the interim statement of account of TCTF submitted by WMO which covered the period from 01 January 2004 to 31October 2005 as shown in Appendix XXI.

74. The Committee urged its Members and collaborating partners to continue to enhance their contributions to the Trust Fund.

75. The Committee, after careful consideration, agreed to the use of the TCTF for the following specific purposes from I January to 31 December 2006.

(i) Operating costs of TCS, including the support for the TCS Secretary (approx. US$ 25,000);

(ii) Publishing the Typhoon Committee Newsletter No. 18 (approx. US$ 500);

(iii) Printing and distribution costs of the publication of the 2005 Typhoon Committee Annual Review (TCAR) (CDs) (US$ 500);

(iv) Transition costs for TCS (US$ 4,500);

(v) Printing and distribution costs of documents for the thirty-ninth session of the Committee (US$ 500);

(vi) Support for attachment of two (2) women forecasters to RSMC Tokyo – Typhoon Center (Tokyo, July 2006) (US$ 4,000);

(vii) Support for the Fourth Storm Surge and Wave Forecasting Workshop (Manila, July 2006) (US$ 5,000);

(viii) Support for the attendance of typhoon experts at the Sixth International Workshop on Tropical Cyclones (San Jose, 21 to 30 November 2006) (US$ 15,000);

(ix) Support for a Workshop on Implementation of the Hydrological Component of RCPIP (2006) (US$ 17,000);

(x) Roving seminar in Viet Nam (US$ 14,000);

(xi) WGM to attend workshops (US$ 8,000);

(xii) AWG meeting and activities (US$ 15,000);

(xiii) DPP meeting (US$ 5,000).

(Total: US$ 114,000)

Any other emergency expenditure that can be justified for the use of the TCTF requires the concurrence of the Interim Secretary of the TC and the Typhoon Committee Chairman. In this regard, emergency expenditure can only be executed if savings are realized elsewhere within the limit of US$117,000.

The Committee also requested AWG Chair and Vice Chair to advise TC Chair and the Interim Secretary of TC on the selection of expert(s) to represent the Committee to attend international meetings as outlined above. This implies that the seeking of endorsement of Chair and Vice Chair of AWG is mandatory prior to the use of TCTF for any official representation of TC at international meetings.

76. The Committee decided that total actual expenditure for the year 2006 is not to exceed US$ 114,000, noting that the support cost to be charged by WMO has not been included in the above budget.

77. In noting the exceptional circumstances of urgent activities required for its efforts to restructure its operations for better efficiency of work, the Committee recalled its previous decision to limit the total planned budget, including the support cost, within the limit of US$100,000 and decided to limit total planned budgets for the 2007 onwards to US$100,000.

X. DATE AND PLACE OF THE THIRTY-NINTH SESSION (agenda item 10)

78. The Committee welcomed the offer of the delegation of the Philippines to host the thirty-ninth session in November 2006, subject to the approval of its Government. The exact date of the 39th session will be communicated to UNESCAP, WMO, TCS as well as the Chairman of

TC by January 2006. The meetings of TC Working Groups on meteorology, hydrology and DPP would be arranged by the WMO, UNESCAP and TCS in consultation with the Chairman and the host Member as an integral part of the Session.

79. The Committee expressed its appreciation for the invitation for a joint session to be hosted by Oman. Circumstances at this time make the Committee unable to accept this invitation. However, it would consider other possibilities in the future for a joint session with the Panel on Tropical Cyclones. The Committee requested the TCS to inform Oman of this situation and also to investigate the possibility of a future joint session. The delegate of Thailand indicated that they would also consider the possibility to host such a joint meeting.

XI. SCIENTIFIC LECTURES (agenda item 11)

80. The following scientific lectures were presented:

81. The Committee expressed its appreciation to all the lecturers and requested the current TCS to disseminate all the lecture papers and to include them in the Typhoon Committee Annual Review for 2005.

XII. ADOPTION OF THE REPORT (agenda item 12)

82. The Committee adopted the report of the session at 1615 hours, 19 November 2005.

XIII. CLOSURE OF THE SESSION

83. The delegates from the Members of the Typhoon Committee, observers, and representatives of UNESCAP, WMO and TCS expressed their thanks and appreciation to the Government of Viet Nam, the National Hydrometeorological Service of Viet Nam for the successful hosting of the 38th session of the Typhoon Committee. They also expressed gratitude to Dr Bui Van Duc, Director General of the National Hydrometeorological Service of Viet Nam, and his staff for the warm hospitality and excellent arrangements made and also for organizing the excursion trip to the beautiful sites of the Ha Long Bay.

84. The Session was closed by the Chairman at 1715 hours, 19 November 2005.

APPENDIX I

UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (UNESCAP)
and
WORLD METEOROLOGICAL ORGANIZATION (WMO)

Typhoon Committee
Thirty-eighth Session
14-19 November 2005
Ha Noi, Viet Nam

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Appendix II.A

Opening speech
by H.E Mr. Nguyen Cong Thanh,
Vice Minister of Natural Resources and Environment of Viet Nam
at the Opening Ceremony
of the 38th Session of the UNESCAP/WMO Typhoon Committee
Hanoi, 14 November 2005

Distinguished guests,
Delegates,
Ladies and Gentlemen,

First of all, on behalf of the Leaders of the Ministry of Natural Resources and Environment, I would like to extend our warmest welcome and best wishes to all participants to the 38th annual session of the UNESCAP/WMO Typhoon Committee, one of the most important events in the fields of meteorology and hydrology management and disaster prevention and mitigation.

Distinguished guests,
Ladies and Gentlemen,

We are living in the area of significant influence of disasters. It is already recognized that 90 per cent of the natural disasters are weather-, climate- and hydrology-related including typhoons. The year 2005, though it has not ended yet, could be marked by many hydro-meteorology-related natural disasters, especially typhoons. Such destructive typhoons as Katrina, Rita, Damrey, Kai-Tak, etc. have led to severe flooding in several parts of the world and have caused great loss of lives and properties.

Locating in the South-east Asia, Vietnam understands how severe the influence typhoons may cause. In the typhoon season of 2005, Viet Nam has been affected by 8 typhoons, which caused flash floods and high floods in the north and central parts of Viet Nam resulting in loss of lives and left enormous damages to the country.

The loss and damages induced by typhoons and floods, however, can be reduced if more effective and appropriate response measures, especially accurate and timely forecasts and warnings are in place.

The persistent efforts to address natural disasters and mitigate the casualties and losses caused by typhoon is one of the most important tasks facing various governments and is also the mission of the Typhoon Committee.

Being a member of the Typhoon Committee since 1979, Viet Nam highly appreciates the roles and valuable contributions of the Committee in typhoon disaster prevention and mitigation. The activities aiming at strengthening regional cooperation and exchange of typhoon information and forecasts, and cooperation in research and training are proved to be effective and useful for all parties concerned.

It is our hope that the Typhoon Committee will continue giving high priority to the implementation of the Regional Cooperation Programme Implementation Plan (RCPIP), strengthening the members' capacity and assistance to developing countries to enhance their typhoon and flood forecasting and warning capabilities through training and provision of guidance materials.

Since natural disasters, especially typhoons, do not recognize political boundaries, the members of the Typhoon Committee should strengthen the cooperation to deal with the problems. This allows us to reach our goal of protecting of human lives and properties, conserving the environment and the achieving the goal of sustainable development in each member country/territory, in particular, and in our region, in general.

The Government of Viet Nam has been paying great attention to disaster prevention and preparedness. In recent years, the capability of meteorological and hydrological monitoring and forecasting has been gradually strengthened. This makes positive contribution to the disaster prevention and preparedness, in general and flood and typhoon control, in particular. Viet Nam, within its capacity, will actively participate in various activities of the Typhoon Committee and will do its best to enhance the effectiveness of the Committee.

Bearing this in mind, I would like to wish all the delegates good health and enjoyable stay in Viet Nam.

I wish the Session every success.

Thank you!

APPENDIX II.B

UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
and
WORLD METEOROLOGICAL ORGANIZATION

Typhoon Committee
Thirty-eighth session
14 – 19 November 2005
Hanoi, Viet Nam

MESSAGE FROM MR. KIM HAK-SU, EXECUTIVE SECRETARY, UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

It gives me great pleasure to address this message to the participants attending the thirty-eighth session of the Typhoon Committee.

At the outset, I should like to express our sincere appreciation to the Government of Viet Nam for hosting this session. I am pleased to note that Viet Nam has, in recent years, increased its participation in various activities of the Typhoon Committee aimed at achieving the common objectives of cooperation, particularly in promoting and coordinating the planning and implementation of measures and capacity-building to minimize the loss of life and damage caused by typhoons.

These regional efforts are necessary to mitigate the impact of natural disasters, which have profoundly affected many countries in Asia and the Pacific in terms of the quality of life through their destruction of food crops and livestock, shelter and other aspects of the built environment, and the forced dislocation of households and communities. This is particularly true with the increasing impact of natural disasters in the region in recent years, including the tragic impact of the December-2004 Tsunami, which affected several countries of the Typhoon Committee. A UNESCAP study this year found that natural disasters have had much greater socio-economic impact in the region: (1) the number deaths increased from 85 per cent of the world's total number of deaths due to natural disasters (for the period 1900 to 1987) to 91 per cent (for the period 1900 to 2005) and (2) economic losses increased from 25 per cent of the total world economic loss for the period 1900-1987 to 54 per cent for the period 1900-2005. The total number of people killed by natural disasters during the past five decades, from 1950 to 2005, amounted to more than 5.5 million, of which cyclones and floods accounted for 54 per cent, drought for 27 per cent and earthquakes for 10 per cent. The total economic losses during the same period were estimated at over US$588 billion, of which cyclones and floods accounted for 57 per cent, earthquakes for 33 per cent and drought for 5 per cent.

Let me take this opportunity to share with you two important recent developments.

First, on 9 September 2005, a ceremony was held at UNESCAP Headquarters to mark the US$1 million contribution of the Government of the Republic of Korea to UNESCAP in support of technical cooperation in tsunami-affected countries. UNESCAP will use this contribution to implement regional projects as part of the UN's response to the Indian Ocean tsunami, focusing on improving the coordination and effectiveness of regional practices and policies, and integrating regional disaster preparedness and management into public policy and national systems in the Asia-Pacific region. The contribution shall also be used to facilitate the exchange of experiences and good practices within the region on education and awareness programmes, as well as mitigation strategies and pilot programmes for populations affected by the tsunami.

Second, the Government of Thailand has made a US$ 10 million contribution to a regional trust fund to support tsunami early warning arrangements in the Indian Ocean and South-East Asia. This contribution was made in follow-up to a pledge announced by the Prime Minister of Thailand, H.E. Dr. Thaksin Shinawatra, at the Ministerial Meeting on Tsunami Early Warning Arrangements, held earlier this year in Phuket, Thailand. The fund was launched on 26 September 2005 at a ceremony held at the Ministry of Foreign Affairs of Thailand. At the ceremony, H.E. Dr. Kantathi Suphamongkhon, the Minister of Foreign Affairs of Thailand, and I signed the trust fund agreement. The trust fund will be managed by UNESCAP. It is expected to contribute to the broader United

Nations response to the tsunami by supporting the development of a regional early warning system that would take the form of a network of national and regional centres. The fund would assist these centres in building capacity in terms of technologies, organizational arrangements and expertise. Thailand is cooperating with the Asian Disaster Preparedness Centre (ADPC), an international entity located in Thailand, in establishing one such regional centre.

With the important developments that I have just outlined, we have every reason to be hopeful that national and regional synergies may be fostered in collective efforts to build the resilience of the region's communities and nations to natural disasters. Other donors may also wish to contribute to the regional trust, to support our common endeavour to ensure a safer world for all in the twenty-first century.

In this connection, I wish to particularly commend the Committee for its continuing sincere efforts and eagerness to implement the Regional Cooperation Programme Implementation Plan (RCPIP) and would like to reiterate my warm support to the Committee in its efforts to reform its structure and operations. I am pleased to note the continuous increase in support of the Ministry of Land, Infrastructure and Transport of Japan, and of the Ministry of Construction and Transportation of the Republic of Korea in the implementation of the RCPIP, also warmly welcome the intention of several other Typhoon Committee Members, such as China; Macao, China; Malaysia; and the Philippines, to support these common endeavours. I wish to particularly appreciate the substantive support of the Regional Specialized Meteorological Centre of Tokyo, Japan, and the Hong Kong Observatory of Hong Kong, China, in the operations of the Committee and the continuous support of the Government of the Philippines in providing secretariat services for the Typhoon Committee during the past several decades.

UNESCAP is committed to supporting your efforts to enhance subregional cooperation in cyclone-related disaster mitigation and water resources management within the framework of our own programme of work and available resources.

With your active participation, I am confident that the deliberations of the Session will be fruitful and that the distinguished representatives will be able to provide useful guidance on the future activities of the Committee.

I wish the Session every success.

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Appendix II.C

WMO Address at the Opening of
the Thirty-eighth session of the ESCAP/WMO Typhoon Committee
(Hanoi, Viet Nam, 14 November 2005)

Your Excellency, Mr Nguyen Cong Thanh, Vice Minister of the Ministry of Natural Resources and Environment, and the Permanent Representative of the Socialist Republic of Viet Nam with WMO,

Dr Xu Xiaofeng, Chairman of the Typhoon Committee

Mr Le Huu Ti, Representative of UN ESCAP

Dr Roman L. Kintanar, Interim Secretary of the Typhoon Committee Secretariat

Distinguished Delegates and Guests,

Ladies and Gentlemen,

It is indeed an honour and a privilege for me, on behalf of Mr Michel Jarraud, Secretary-General of WMO, to address the opening of the thirty-eighth session of the ESCAP/WMO Typhoon Committee. I would like to welcome all the participants. I wish to take this opportunity of thanking Your Excellency Mr Thanh, and through you, the Government of Viet Nam, for hosting this year's session in Hanoi. Your presence among us demonstrates your own interest, and that of your Government, in the programmes and activities of WMO and in regional and international cooperation.

I also wish to express my deep appreciation, and that of the World Meteorological Organization, to Dr Bui Van Duc, Director-General of the National Hydrometeorological Service of Viet Nam, and his staff, for the warm welcome and for the excellent arrangements made to ensure the success of the session.

We also wish to thank Dr Xu Xiaofeng, the Chairman of the Typhoon Committee and all those who contributed to the work of the Committee. We express our appreciation to the Government of the Philippines for hosting the Committee's Secretariat and for providing the services of the Interim Secretary, a meteorologist and a part-time hydrologist. WMO's appreciation is also extended to the Government of Japan for the continued contribution of specialized tropical cyclone weather forecasting services of the Regional Specialized Meteorological Centre in Tokyo. I wish to assure you of WMO's continued support to the programmes and activities of the Committee and continuance of the excellent coordination with the UN ESCAP.

This session is convened after the recent passage of Typhoon Kai-tak which caused flash floods and significant damage to some parts of Viet Nam and Typhoon Damrey which caused the worst floods in 40 years in Viet Nam's Yen Bai province and claimed at least 32 lives. I wish to reiterate WMO's sincere condolences and sympathy to your Government and to the Vietnamese people who were adversely affected by these typhoons.

We are well aware in this region that the impact of tropical cyclones is illustrative of the damages that could be caused by hydrometeorological disasters. There have been a number of occurrences when the loss of life due to a single tropical cyclone was over 100,000 people, and in one case where the death toll was about 300,000. The economic damage caused by the most destructive tropical cyclone was estimated at about US $30 billion. It need not be emphasized that developing countries are more vulnerable to these problems, compared to their developed counterparts.

The subject of tropical cyclones is of particular interest to the World Meteorological Organization and in more recent years, WMO has been intensifying its efforts in the mitigation of tropical cyclone disasters, within the framework of its involvement in the International Strategy for Disaster Reduction (ISDR) and in the context of Sustainable Development for Small Island Developing States (SIDS).

Distinguished Delegates and Guests,

Global efforts, especially within the context of the Tropical Cyclone Programme, have resulted in a noticeable improvement in the warning systems in many parts of the world. It is evident that, where adequate warning and preparedness systems are instituted, many lives can be saved. These forecasts and warnings are undoubtedly becoming of greater value and it has been estimated that up to 40 per cent of the property damage could have been averted.

In this connection, it is crucial to underscore the importance of further socio-economic studies to demonstrate more clearly the cost-benefit from investments in natural disaster prevention, particularly in early warning systems. It is worth noting that WMO's Tropical Cyclone Programme is currently undertaking a study on the economic and social impacts of the tropical cyclones with emphasis on the assessment by end-users of relevant weather services in all the tropical cyclone affected areas in the world.

You may recall that, in this region alone, disaster-relief costs last year for weather-related disasters amounted to more than US $110 million.

In this context, WMO is working with its partners at the international, regional and national levels to improve early warning capabilities further and ensure that these systems are available to all countries, particularly those with the least resources. *We should learn the lesson from recent disasters, including the 26 December 2004 tsunami, that there is a heavy price to pay if early warning systems are not in place.* In this connection, WMO is prepared to share its experience and competence.

Ladies and Gentlemen,

One of the major strengths of the Typhoon Committee over the years has been the fact that the main funding for its developmental programmes has come from the contributions of the Member countries themselves. However, there is a need for development partners to provide the assistance needed to effectively implement items in the Programme, which cannot be funded nationally. It is also important that other sources of extra-budgetary funding be tapped, such as bilateral and multi-lateral arrangements. WMO will continue to assist the Directors of National Meteorological and Hydrological Services (NMHSs) in seeking funds for projects in the region from other sources, such as from regional financial institutions. However, it should be noted that the primary responsibility for initiating resource mobilization and taking follow-up action rests with the National Services themselves.

Ladies and Gentlemen,

I am sure that this session will offer a valuable opportunity for the exchange of views on the successes and problems experienced by the Committee since its last session, and that it developed appropriate strategies for coordinated actions to upgrade tropical cyclone forecasts and warning services, including the RSMC operations, and enhanced public awareness. It is our hope that the session would come up with priority activities and related strategies to strengthen the existing systems and infrastructure and in the further *development of a culture of prevention* in the region.

Dear colleagues,

These matters will no doubt engage your attention for the coming days at the session. I can assure you that WMO will continue to support the Typhoon Committee, to the fullest extent possible.

On behalf of the Secretary-General of WMO, I would, before closing, like to once again thank our host and wish you every success in your deliberations during the days to come.

Thank you all for your kind attention.

APPENDIX III

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC and WORLD METEOROLOGICAL ORGANIZATION

Typhoon Committee
Thirty-eighth Session
14-19 November 2005
Ha Noi, Viet Nam

PROVISIONAL AGENDA

1. Opening of the Session

2. Election of officers

3. Adoption of the agenda

4. The Committee's activities during 2005:

    4.1 Meteorological component;
    4.2 Hydrological component;
    4.3 Disaster Prevention and Preparedness component;
    4.4 Other activities related to training and research

5. Review of the 2005 typhoon season/annual publications

6. Coordination with other activities of the WMO Tropical Cyclone Programme

7. Programme for 2006 and beyond

8. Support required for the Committee's programme

9. Date and place of the Thirty-ninth session

10. Scientific lectures

11. Adoption of the report

APPENDIX IV

REVIEW OF THE COMMITTEE'S ACTIVITIES DURING 2005

In **China**,

I. Overview of Meteorological and Hydrological Conditions in 2005

1. Meteorological Assessment

From October 2004 to October 10 2005, altogether 27 tropical cyclones (including tropical storms, severe tropical storms and typhoons) were formed over the Northwest Pacific and the South China Sea. The total number was basically equivalent to the average (27.49) in 1951-2004. Out of 27, 16 TCs were developed into typhoons, which accounts for 59.26% of the total. In other words, the total typhoon number was slightly less than normal average (17.19 accounting for 62.53%). During the same period, 2 TCs were developed over the waters around the Hainan Province, which were 4.92 less than the multiple-year average.

2. Hydrological Assessment

During the flood season in 2005, China experienced several severe river floods and flash floods. Devastating deluges plagued in the whole Pearl River Basin - one of 7 major river basins in China in the last 10 days of June. A catastrophic flood that usually happens once every100 years occurred along the middle-lower reaches of the Xijiang River, leading to the highest water levels ever recorded in history on its main streams and tributaries.

During the first 10-day period of July, two tributaries of the Yangtze River, namely Fujiang River and Qujiang River, saw excessive or major floods with the water levels either breaking the historical records or exceeding the safety stage.

During the middle 10 days of July, the upper stream of the Huaihe River experienced major floods. In the same period, affected by Typhoon Haitang (0505), the Minjiang River in Fujian province witnessed a major flood that usually happens once every 20-30 years.

In the second 10-day period of August, under the effect of Typhoon Matsa (0509), heavy floods occurred in the two tributaries of the Liaohe River, namely Qinghe River and Caihe River, and the Hunhe River as well as Taizi River.

In the first 10-day period of September, due to Typhoon Tailm (0513), a flood that usually happens once every 5-10 years occurred in the middle-lower stream of the Huaihe River.

In relation to the accumulated stream water volume by 1 September for the major rivers in China, the Huaihe River and the Songhuajiang River met more stream runoff than usual, i.e. the Huaihe River had 20-40% more than usual and the Songhuajiang River had 40-50% more than usual. Nevertheless, the accumulated stream water volume for the other major rivers was decreased or close to that in normal years, among which the Haihe River Basin had 90% more runoff than usual.

The scope of hydrologic services was further expanded. Hydrologic forecasts produced significant benefits in hazard reduction during the local rainstorm floods in the Xijiang, Huaihe and Minjiang river basins. Hydrologic monitoring played an important role in water resources management in the Yellow River Basin, in water transfer from the Yangtze River to the Taihu Lake and in the water diversion in the Heihe river basin.

Statistics showed that the Bureau of Hydrology of Ministry of Water Resources, China has collected more than 1 million pieces of hydrological information, released 127 issues of *Hydrological Information* and 41 issues of Hydrological Forecasts and Predictions from 1 January to 30 September. When the floods took place in the Xijiang River, the State Bureau of Hydrology in collaboration with two provincial bureaus of hydrology issued about 400 station/time of flood forecasts, over 90% of which reached the excellent criteria, and it issued the accurate flood forecast 1 day ahead of time anticipating that flood peak level would reach 26.80m at the Wuzhou Station (the actual water level was 26.75m.).

During the Huaihe River Flood period, the hydrological departments made a forecast 3 days ahead of time that the possible flood peak level could reach 29.10m at the Wangjiaba Station (the true flood level was 29.14m.). In the period of Minjiang Flood, the Fujian Provincial hydrological department organized 3 expert groups to make hourly flood forecasts by applying a flood early warning system, and they prepared a number of schemes for flood management, which provided basis for flood control and disaster prevention.

3. **Socio-economic Assessment**

The landfall typhoons and tropical storms in China brought abundant precipitation, and abated the agricultural drought and hot day in the southern Yangtze River and South China, and the water storage of reservoir increased. However, the violent wind, heavy rain and associated astronomical tides also brought about severe losses in the coastal areas during this year, especially in Zhejiang Province. According to the preliminary statistics, more than 94 million people and 63000 km^2 farmland were affected by tropical cyclones, and 360 were killed, and 70 missing and 287 thousands houses collapsed and 830 thousands houses were destroyed. The direct economic losses were about 81.5 billion RMB Yuan.

Comparing the disaster losses with those of the last 10 years, the economic losses caused by typhoon and tropical storm in China during January to September in 2005 were more severe. But the total casualties markedly decreased as the result of precise forecast and early warning provided by the Meteorological Services as well as correctly arrangements made and actively measurements taken by each level of government departments.

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

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

◆ **FY-2C Geo-stationary Meteorological Satellite**

The FY-2C, China's first operational geo-stationary meteorological satellite, was launched successfully on 19 October 2004. China has so far established operations of both polar-orbiting and geo-stationary meteorological satellites.

● ***The FY-2C application system became operational in 2005***

Since 1 January 2005, users in China and in other countries/regions have already started to receive data from the extended-imagery broadcast by FY-2C, and from 1 June on, the data process center (DPC) provided 13 kinds of images and products.

In order to satisfy the needs for weather, climate and the disasters' monitoring and forecasting, starting from June 27, the National Satellite Meteorological Centre (NSMC) initiated the flood season observation mode of FY-2C, which can catch and deliver 48 relevant images to all over China every day, i.e. in addition to normal 28 full disc images per day (in not-flood season only), 20 additional imagery covering the north hemisphere were made available.

● ***FY-2C satellite data applications have scaled a new stage in remote sensing***

With the capability enhancement in satellite development and data receiving, a system for monitoring weather, environment and disasters with multiple satellites has been created at NSMC, and it is in a better position to monitor various disastrous weather and environmental changes frequently and comprehensively. As for weather systems, not only large scale weather events such as frontal cyclone, typhoon and wind shear cloud, but also local convective cloud and other meso- to small-scale weather systems like short-time thunder storm, gale and hailstone can be captured. Furthermore, the newly added FY-2C detecting channel can provide more comprehensive information for operational use in disaster and environment monitoring. The products based on FY-2C data, such as heavy fog, dust storm, snow, soil moisture, fire and water situations, have improved the timely availability of disaster and environment monitoring information from the satellite. These coverage of these monitoring has been expanded to a wider range including whole Asia and Australia, and abundant information for prediction, forecast and analysis of weather, climate and environment have been made available.

● ***FY-2C Data and Products***

Up to September 20, 2005, NSMC has monitored and analyzed 16 Tropical Cyclones (TCs) with the meteorological satellite data, including TC center positioning, strength estimating, track monitoring, and structure and distribution analysis of the strong wind and the heaviest rainfall zones, etc. NSMC released the real-time results of the analysis of the TCs, such as the location of the TC, its strength, track and synthetically result with the multiple data through its website (http://dear.cma.gov.cn).

In 2005, the first operational stationary satellite FY-2C was put into operational use. When making TC analysis,, NSMC mainly used the data and products from FY-2C, including:

✧ Position and estimated intensity of TCs by using both visible and infrared imagery from FY-2C. The positioning accuracy was so precise that it could locate a TC centre within a half pixel range. Also the detective bands of FY-2C had added up to 5 channels, thus the structure and thermodynamic characteristics of TCs had higher resolutions. Therefore the TC intensity estimation was improved.

✧ FY-2C satellite derived wind data for analyzing the occurrence, development and motion trend. These products could reveal the distribution of the air-stream fields in the mid and upper levels of troposphere. With them, we could better understand the upper divergence of TCs and their surrounding environment. Thus we could predict TC development.

✧ FY-2C TBB data and Cloud classification data for analyzing the distribution pattern and development of the strong TC convective zones. By utilizing the quantitative processing of the multi-channel data from FY-2C, NSMC could identify the convective clouds within TCs and could understand the possible impacts of TC associated severe weather.

✧ Precipitation Estimates product for analyzing the precipitation induced by TCs over the sea. By using these products from FY-2C, which could address data scarcity issue over open sea, NSMC could know the rainfall distribution pattern of TCs.

✧ Water vapour imagery and possible precipitation product for analyzing the TC water vapor environment. FY-2C water vapour channel could reveal the moisture transport at mid and upper levels, combining with the possible precipitation product, NSMC could understand the moisture fields within a TC environment.

● ***FY-2C Tropical Cyclone Analysis System***

In order to cooperate with the utility of FY-2C in TCs, NSMC has improved the operational work in analyzing the TCs by satellite data. Based on the method delivered by Devorak, NSMC has proposed a new method to locate the TC center and estimate the TC strength, which is adapt to regular operational work. With the help the new method, NSMC has designed the TC analyzing system, which provide many ways to locate center and estimate strength. Besides that, NSMC created the data base of TCs.

◆ **Multiple Satellite Data Comprehensive Application System**

In 2005, NSMC continued to synthetically analyze TCs by using multiple satellite data. The satellites in use include: FY-1D、NOAA-16(17、18)、EOS（AQUA、TERRA） Polar-orbiting satellites. With AMSU-B microwave data and product, NSMC tried to analyze TC structures. QUIKSCAT sea surface wind vector and AMSU microwave data were used to analyze the distribution of strong wind and the maximum rainfall zones.

◆ **The Global Model for Typhoon Track Prediction (GMTTP)**

GMTTP, coupled with global medium-range spectral model T213L31, was developed at National Meteorological Center/CMA and it was put into quasi-operation in the 2004 and 2005 typhoon seasons. Unlike the previous Regional Model for Typhoon Track Prediction (RMTTP), GMTTP could produce tropical cyclone (TC) track prediction four times a day (00, 06, 12, 18UTC) for up to three target TCs at the same time covering the Northwest Pacific and South China Sea.

● ***TC Vortex formation techniques***

The initialization of GMTTP model still adopted bogus vortex scheme used in the RMTTP model, but some modifications, such as, the calculation of the top of the troposphere based on the global model atmosphere conditions instead of an original fixed value and the way to form background fields of typhoon vortex, was modified. The specific steps are as follows:

✧ To remove ill-defined and weak vortex from the large-scale background fields in order to get smooth environmental field.
✧ To construct a symmetric typhoon vortex based on based on a few parameters manually analyzed by forecasters: the TC central position (latitude, longitude), the central pressure and the maximum wind speed radius. The major features are the following:

- ➢ Calculate sea-level pressure profile with Fujita's(1952) formula.
- ➢ Axial-symmetrical vortex with a warmer core structure.
- ➢ Convergent circulation at the lower levels.
- ➢ Divergent circulation at the upper levels.

✧ To merge the synthetic typhoon vortex into the smooth environmental field by a blending method with a linear weighting function.

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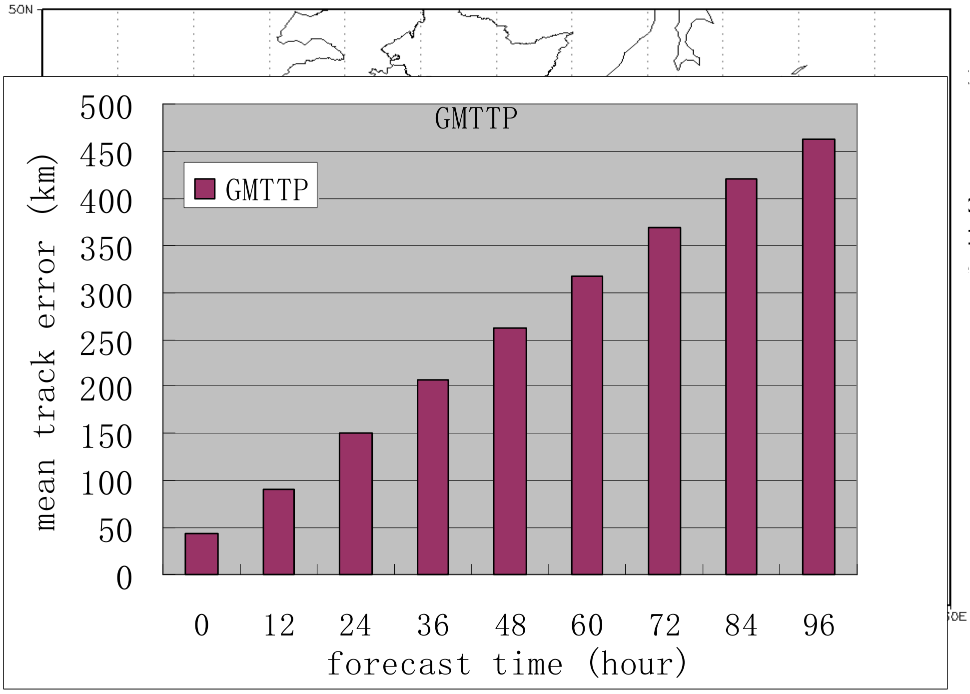
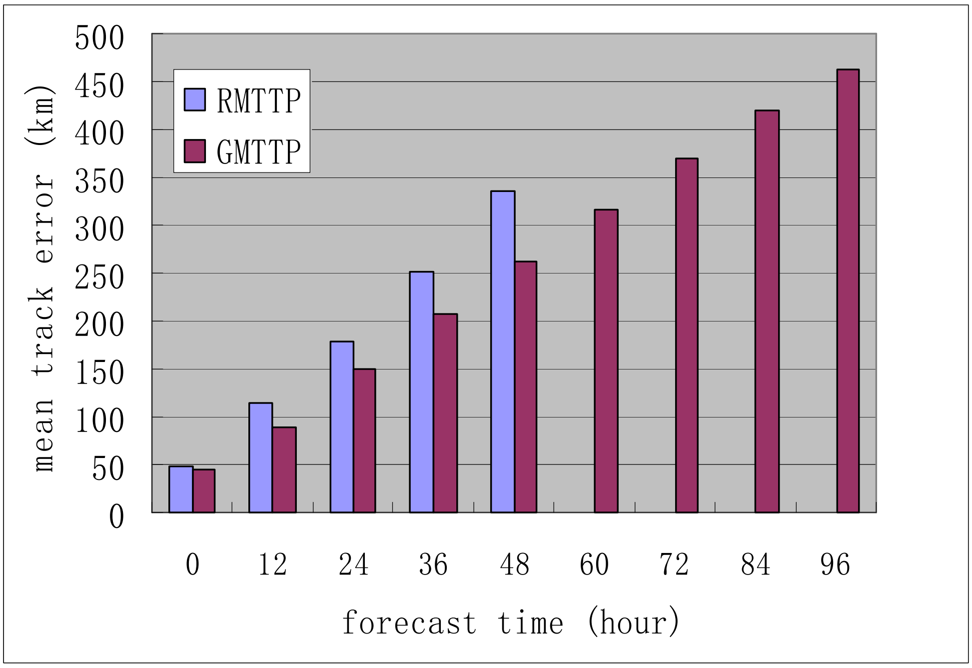


Fig. 2.2 Mean Track Errors for GMTTP (unit: km)

Compared with the RMTTP model, the GMTTP model makes good improvement in track forecast errors during the 2004 typhoon season. The detailed results are shown in the Fig. 2.3.

Fig.



2.3

Comparison of mean track error between GMTTP and RMTTP in 2004

Fig. 2.3 indicates a decrease in the global mean track errors for the 48-hour forecasts. The improvements shows that, to some extent, the new GMTTP model gives a better performance than the RMTTP model at least in 2004 typhoon season.

b. Implications to Operational Progress

- **Satellite Data DVB-S Broadcasting System**

The NSMC's Satellite Data DVB-S Broadcasting System (SDVBS) has run stably for more than a year, 78 receiving stations have set up across all China, and user terminal's receiving, processing and application software have been configured. Users in China have then convenience obtained data of multi polar orbit, stationary satellites and their products by SDVBS. SDVBS will further promote the applications of satellite remote sensing data and the process in establishing China's remote sensing operational systems and networks nationwide.

- **The Environmental Satellite Data Archiving and Retrieval System**

  NSMC has continued to provide all-around satellite data services free of charge to users via meteorological special line, internet and satellite broadcasts, etc., sharing the environmental satellite data from the networks among meteorological offices in China. The satellite data archiving and serving system serves as powerful platform through which the meteorological satellite data can be shared.

- **IBM High Performance System**

  CMA decided to buy IBM High Performance System(IBM HPCS) in June, 2004. All the equipments arrived in November, 2004. IBM HPCS was put in real-time operation on June 1, 2005. IBM HPCS is a new generation high performance parallel computing system, and provides a fundamental computational & storage platform for real-time operations and scientific researches in atmospheric sciences fields like weather, climate. It consists of 376 computing nodes, 3152 CPUs, and has a capacity of about 21 TFLOPS in total. Up to now, IBM HPCS is the most powerful computer system in China, ranking 18th on the Top500 list of June 24, 2005. IBM HPCS makes up an important part of CMA's infrastructure and considerably enhances computing capability of China's meteorological operation systems.

- **National Meteorological Data Storage System (MDSS)**

National Meteorological Data Storage System is the national level data center system of CMA, with responsibility for storage, archiving the meteorological data and providing data services. NMIC (National Meteorological Information Center) takes on the construction of MDSS.

MDSS is composed of RDB (Real-time Database system), IDB (Integrated Database system) and SDB (Sharable Database), which provide metrological data management and services respectively for national real-time operational system users, the internal professional users and the public society users.MDSS use RDBMS management integrated with the external file system, that RDBMS is ORACLE 9i.

At the present time, theβ1.0 version of RDB and SDB have been already put under test-running successively. Theβ2.0 version of RDB would begin its test-running in Oct. The construction of MDSS would be finished within Jun 2006.

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

In 2005, CMA's VSAT based domestic telecommunication network is running stable. There were 10 new PCVSAT receive-only stations installed, including the station installed in Myanmar in August, 2005. Currently, the PCVSAT system totally has 2450 remote stations, and its average daily broadcasting data volume is over 2.5Gbytes.

At RTH Beijing, the GTS links to Ulan Bator and Moscow were upgraded in February and March, 2005 respectively. The Beijing- Ulan Bator circuit has been upgraded from 75 Bauds to 14.4Kbps. The Beijing-Moscow link, which used to operate at 9600bps leased circuit, has been replaced and upgraded by a FR link with a symmetric CIR of 8/8kbps. And, the WMO FTP procedure is being used on the two links.
The CMA's new GTS system became operational in May, 2005. It supports the protocols of TCP/IP, X.25

and ASYNC, and has the capabilities of collecting and sharing data via Internet E-mail and Web services.

d. Progress in Training

◆ **Training Course for Meteorological Satellite Data Application**

From December of 2004 to January of 2005, CMATC held 2 Training Course for Meteorological Satellite Data Application and 144 trainees attended it. The training activities mainly covered the basic principles of satellite meteorology and analysis on the cloud imagery, production of weather forecasts based on satellite data, the production and application of sea surface temperature (SST) and TOVS data, locating a TC center and estimating TC intensity by using satellite image, the interaction between typhoon and the mid latitude weather systems, precipitation estimation by satellite data as well as analysis and application of water vapor imagery, etc.

◆ **Study Group of How to Apply Mathematics in Meteorology**

From May 16 to 27, 2005, CMATC held a Workshop on Application of Mathematics to Meteorology. 21 trainees attended it. The training focused on the vector calculation methods used for satellite data retrieval and heavy precipitation forecasts, etc.

◆ **Training Seminar on Increasing Meteorological Knowledge for the Directors of Local Meteorological Bureaus**

From Jan. 24 to 30, 2005, CMATC held the training seminar and 54 local directors attended it. The training included the application of radar and satellite data to weather forecast, and application of the new NWP technology, etc.

◆ **Improving the Training Materials**

- ***Multimedia Courseware for Application of Meteorological Satellite Data***

  In 2004, in order to meet the increasing demands for the training programs, CMATC prepared the web-version multimedia courseware entitled *Satellite Imagery-based Weather Identification and Analysis*, introducing the features of cloud patterns of the significant weather systems, analysis of tropical weather systems, mesosacale cellular convection (MCC) cases developed through merging of a typhoon with cold air mass, etc.

- ***Satellite Data Application-oriented Training Materials***

  Also in 2004, CMATC compiled such training materials as *Vector Machine-based Methodology and its Application to Meteorology* and the *User's Guide on Vector Machine-based Forecasting Platform: CMSVM*, instructing on application of vector computers to the satellite data retrieval, forecast of heavy precipitation, etc.

e. Research Progress

◆ **Objective Tropical Cyclone Positioning System**

Based on GIS technology, an objective TC center positioning system was developed to integrate different data and algorithms. All kinds of vector and raster layer data, including QuikSCAT ocean surface wind, weather station observations, numerical model outputs, and satellite imagery, could be analyzed and super positioned simultaneously by this system, which was useful in showing TC features from different points of view. Several TC center positioning methods, such as cloud-structure analyzing method, TBB extremum method, ocean surface vorticity extremum method and so on, were incoporated to make the positioning process more objective, precise and automatic. The system had been tested for 121 cases in 2003 and 2004 with average error within 21km, comparable to the operational positioning error, showing that the system was useful for operational applications.

◆ **Tropical Cyclone Formation**

The background circulation in the process of TC formation over the Northwest Pacific was classified into 5 categories according to the synoptic analyses and satellite observations. Results showed that, from 1995 to 2002, there were 183 TCs (71.2%) that were originated in the ITCZ, 17 (6.6%) under the easterly waves, 29 TCs (11.3%) were formed under TUTT, 18 TCs (7%) were associated with baroclinic disturbances, and another 10 TCs were related to trans-ITCZ tropical cyclone.

◆ **Climatology of Tropical Cyclones**

Correlations of TC frequency with some possible factors, including 500hPa height, sea level pressure, 200hPa wind speed, SST, were calculated. Stronger signals for seasonal TC predictions were detected. The TC frequency forecast for 2005 was made by using these signals. The predicted outlook indicated that the TC number would be slightly less than normal.

◆ **Tropical Cyclone Intensity Variations**

Using equivalent black body temperature (TBB) data retrievaled from GMS-5, the correlations between TBB factors and all Northwest Pacific（120ºE-155ºE、0ºN -50ºN）TC samples, excluding those landed and off-shore TCs, together with their 0-48 hour intensities from 1996 to 2002 were analyzed. It was found that some TBB factors such as total TBB located at about south-eastern eye-walls, the average symmetrical TBB (Symtbb) and asymmetrical TBB components within 0.8 and 1.7 degrees from TC center have significant anti-correlation with TC intensity, especially, Symtbb and asymmetrical TBB intensities have the best correlations with 24h and 48h TC intensities respectively. It was also found that the pixel counts were colder than -45℃ within 2 degree from TC center and the maximum of total TBB between 1.1 and 1.5 degree from TC center had good correlations with TC intensity respectively. Multiple regression schemes to forecast TC intensity in NWP based on samples from 1996 to 2002 were developed and verified in the context of climatological persistence, synoptic and TBB factors. It showed that the results from the scheme including 3 categories of factors to forecast the 12h and 24h TS intensity, 48h TS or STS intensity were more close to observations than that from the other schemes without TBB factors in regression equation. This scheme improved the 12-h TC intensity forecasts at intensity of above 15m/s, 24-h TC forecasts with almost unchanged intensity, and 48-h TC forecasts with an increasing intensity above 10m/s.

f. Other Cooperative/RCPIP Progress

◆ **37th Session of Typhoon Committee**

The 37th Session of Typhoon Committee was held in November 16th, 2004. Over 100 participants and representatives from the United Nations, WMO and more than 10 countries and regions along the Pacific Rim were present at the conference. Academician Qin Dahe, Administrator of the China Meteorological Administration (CMA) and Mr. Hu Yanzhao, Vice Mayor of the Shanghai Municipality attended the Opening Ceremony and addressed the meeting.

◆ **Regional Workshop on Tropical Cyclone Warning of Typhoon Committee**

The Regional Workshop on Tropical Cyclone Warning of Typhoon Committee was held in Shanghai from April 24th to 28th, 2005. 40 experts in the fields of meteorology, hydrology and disaster prevention/mitigation from 15 countries and regions including Republic of Korea, USA, Malaysia, China Hong Kong and China Macao took part in the workshop, discussing the accuracy and reliability of typhoon forecast, the amount of precipitation likely to be caused by typhoon as well as the forecast of typhoon radius. Dr. Xu Xiaofeng, Chairman of the Typhoon Committee, Deputy Administrator of CMA attended the Opening Ceremony and addressed the workshop. He emphasized that through international exchanges and cooperation, the ability in TC monitoring and early warning would be improved, and it could contribute to reduction of the weather-induced disasters and to the safety of people's lives and properties.

◆ **2004 WMO Typhoon Committee Roving Seminar**

2004 WMO Typhoon Committee Roving Seminar was held in CMA from November 22nd to 23rd, 2004. Nearly 30 people from Democratic People's Republic of Korea, China Hong Kong and some provincial meteorological bureaus attended the seminar. Mr. Nobutaka from the Japan Meteorological Agency and Professor Johnny Chan from City University of Hong Kong were invited to give lectures at the seminar respectively on typhoons in 2004, disasters induced by typhoons, multi-model typhoon ensemble forecast techniques, intergovernmental cooperation and forecasting theories on formation mechanism of tropical cyclones, etc.

Meteorological experts from the Central Meteorological Research Institute of the Democratic People's Republic of Korea, Hong Kong Observatory, Guangdong Provincial Meteorological Bureau, Zhejiang

Provincial Meteorological Bureau, Fujian Provincial Meteorological Bureau and the National Meteorological Center also conducted academic exchanges with other participants on such subjects as operational TC forecasts, NWP, meteorological service, improvement of operational forecast systems, etc.

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

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

◆ **Doppler Radars Network**

According to the Weather Radar Development Plan (2001-2015), 158 new-generation Doppler radars (CINRAD) will be deployed across China establishing a nationwide network. So far, 84 CINRAD radars have already been installed for operational use in China, capable to detect hail, rainstorm and typhoons. They have made positive contributions to the weather-related disaster prevention and mitigation efforts in the country.

CINRAD radars installed along the southeast coast of China, more specifically at Zhoushan, Changle and Xiamen have provided timely and useful information for TC monitoring and for preparing more accurate forecasts and they are playing an important role in mitigating TC-induced disasters.

The new-generation Doppler weather radars proved to be effective in monitoring precipitation and wind, which provided useful information for decision-makers in forest fire control and flood relief efforts in the Sichuan Province.

By the end of 2005, altogether about 93 CINRAD radars will have been installed in the mainland, and another 29 CINRAD radars will be installed in 2006.

◆ **Surface Observation**

125 Automatic Weather Stations (AWSs), which were established under the Automatic Atmosphere Monitoring System project, became operational as from January 1, 2005. Thus, about 1800 AWSes operated by CMA has been installed by 2005.

◆ **Other Non-conventional Observations**

In addition, some new observing systems were installed across China in 2005. The following observations and products are available at NMC.

- ✧ Soil moisture (from 60 automatic soil moisture observing stations)
- ✧ Lighting detections (from 80 lighting detection stations)
- ✧ Acid rain observations (from 89 acid rain observing stations)

All these data have been utilized by NMC's operational forecast systems and NWP systems. And the Doppler radar products proved to be the most important data for analyzing and forecasting the typhoons Matsa and Haitang at the Central Meteorological Observatory, CMA.

b. Implications to Operational Progress

◆ In order to fulfill the responsibilities in TC forecasting and related services, NMC has begun to make hourly positioning for the tropical cyclones, which enter the 24-hour warning zone since January 1, 2005, following to the recommendation of the 5th National Typhoon and Marine Meteorological Panel. The TC positioning information was issued through GTS and internet within 15 minutes after the hour.

◆ Based on the new-generation NWP system - GRAPES, a typhoon model named GRAPES_TCM was developed in 2004 and it was put into quasi-operational tests in 2005. By the end of August, it made 24- and 48-hour forecasts for 92 and 73 times respectively targeted on 15 TCs, and the mean 24-h forecast error was 158.1km, and 48-h error was 214.5km.

◆ The upgraded TC model developed by the Shanghai Typhoon Institute (STI_TCM) based on BDA (Bogus Data Assimilation) initialization technique was put into operation in 2005. Till the end of August, it produced 114 24-h forecasts and 88 48-h forecasts targeting on 15 TCs, with the 24-h mean error of 135.2 km and the 48-h error of 224.9km.

◆ The first operational sea wave numerical forecast system of CMA was established by Shanghai Typhoon Institute based on a hybrid wave model and a meso-scale atmospheric model. Statistics showed higher accuracy and more skillful for wind and wave forecasting. This system has been used in Shanghai Weather Center for more than two years and it began to be applied to other meteorological bureaus or weather offices in the coastal provinces from early 2005.

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

The CMA's domestic broadband network entered at the implementation phase. Currently, the broadband connections from NMIC to 25 provincial forecast centers, including with Tianjin, Fujian and Guangdong, have been implemented. All 25 links have been put into operation, and they are used to disseminate Doppler radar products. Each link has a bandwidth of 2Mbps. On average, there are about 4.5GBytes radar data transmitted from provincial centers to NMIC over the broadband network per day.

◆ National Weather Forecast Video Conference System is an operational system based on VSAT communication, wide-band terrestrial network and international standard audio/video encoding technology. The main system has one hub station, which is located at CMA headquarter in Beijing, and 31 two-way terminals at provincial meteorological centers. It can support distanced face-to-face meeting and discussion on point-to-point, point-to-multipoint manner. At present it is used for daily weather discussion on agro-meteorological weather, technological training and emergent weather events like TC landing, etc. The live program of daily weather discussion generated by this system is also broadcasted to over 2000 meteorological establishments under CMA framework through on-way VSAT broadcast system and Internet simultaneously. Its program is also recorded into multimedia programs and can be accessed and downloaded through Web.

d. Progress in Training

◆ **The New-Generation Doppler Radar Application Training Course**

From October of 2004 to September of 2005, China Meteorological Administration Training Centre (CMATC) held 6 training courses on the New-Generation Doppler Radar Application, and about 300 trainees in total attended the courses. The training mainly covered the principles of the new-generation weather Doppler Radar, TC center-locating, intensity or wind-speed estimation with Radar data, the analysis on radar echo characteristics and cases study on convective weather, typhoon-induced rainfall estimation and early warning techniques used for forecasting severe convective weather related to typhoon.

◆ **Seminar on New NWP Technology**

From March 23rd to April 5th, 2005, CMATC had a Seminar on New NWP Technology, and 55 people participated in it. The training contents focused on ensemble forecast, GRAPES system introduction, statistical interpretation of NWP products - Vector Machine, as well as research efforts on meso-scale NWP modeling, etc.

◆ **The Seminar on GRAPES Meso-scale Regional NWP Model**

The training course on GRAPES Meso-Scale Regional NWP Model was held at CMATC from April 7 to 21, 2005. 63 people attended the course. The contents mainly concentrated on the application of the new generation numerical forecast system—GRAPES, ensemble forecast, statistical interpretation of NWP products, and meso-scale NWP models, etc.

◆ **Advanced Training Class for Chief Weather Forecasters**

From September to December of 2004, CMATC organized the Advanced Training Class for Chief Weather Forecasters and 24 forecasters were trained. The training covered locating the typhoon center and estimating the intensity or wind speed of typhoon by making use of radar echo and satellite image, analyzing satellite image, estimating typhoon precipitation, interaction between typhoon and mid latitude weather systems, heavy rain forecast and severe convective weather prediction, TC forecast, small system of torrential rain and severe convective forecasts, the analysis on radar echo characteristics and case study on convective weather, etc.

◆ **Training Materials and Courseware for Application of New-Generation Doppler Weather Radars**

According to the "Specification of the New Generation Weather Radar System" of CMA and the characteristics of the disaster weather events in China, beginning from the year of 2004, teaching materials for the New-generation Doppler Weather Radar was revised. The new edition was about 600,000 words and specially focused on cultivating the students' ideas and skills on using the radar echo images, and understanding of the echo characteristics in terms of severe convective systems. And it was planned to add some special cases of typhoons in it in 2005.

e. Progress in Research

The tropical cyclone research carried out in 2004 mainly focused on TC structure, TC intensity change, TC track forecasting techniques, mechanism and estimation of TC rainfall, numerical simulation and modeling techniques etc.

◆ **Tropical Cyclone Structure**

Various observational data were applied to reveal TC structure and structural change in 2004. For example, with intensive surface observational data, Doppler Radar data and satellite cloud imageries, the structure and structure variation of the eye of typhoon Utor and its adjacent area were analyzed. It was found that there existed straight-line type of echoes with maximum length of 150 km, in which strong convective cells were embedded, in the typhoon eye and its adjacent area. It was considered that the straight-line type of echoes was related to deformation of the vortex structure in the inner region of the typhoon. Besides, the data from NOAA-16 Advanced Microwave Sounding Unit（AMSU）were employed to analyze the thermal structure of 12 tropical cyclones occurred over the north Western Pacific. Results showed that the AMSU observation might be able to reveal the main thermal characteristics differences of typhoons

The evolution and structure of two organized meso-α-scale convective systems (MCS) developed sequentially in the depression system of the landing typhoon Herb during 3-5 Aug. 1996 was simulated successfully using MM5. Based on model output，the structure and characteristics of MCS were investigated in details, and the air trajectories around MCSs were calculated. Finally, a conceptual model for MCS in landing typhoon was proposed. With Doppler radar echoes and disturbance of physical parameters from the simulated output, the structure and propagation of typhoon meso-scale spiral rain band and the corresponding embedded deep convective belt were studied. Based on the differences of characteristic scale of physical parameters in various regions, the imbalanced phenomenon of super gradient flow in lower typhoon eye wall region was analyzed.

Tropical Rainfall Measuring Mission data [TRMM Microwave Imager/Precipitation Radar/Visible and Infrared Scanner (TMI/PR/VIRS)] and a numerical model are used to investigate the structure and rainfall features of Tropical Cyclone (TC) Rammasun (2002). Based on the analysis of TRMM data, which are diagnosed together with NCEP/AVN [Aviation (global model)] analysis data, some typical features of TC structure and rainfall are preliminary discovered. Since the limitations of TRMM data are considered for their time resolution and coverage, the world observed by TRMM at several moments cannot be taken as the representation of the whole period of the TC lifecycle; therefore the picture should be reproduced by a numerical model of high quality. To better understand the structure and rainfall features of TC Rammasun, a numerical simulation is carried out with meso-scale model MM5 in which the validations have been made with the data of TRMM and NCEP/AVN analysis.

◆ **Tropical Cyclone Intensity Change**

The mechanism of TC intensification over offshore region and TC attenuation after landfalling was a priority area of focus in research. The strengthening process of typhoon Lily (2001) over Taiwan Strait was analyzed using satellite images and conventional observation data. Results showed that the overlapping of upper layer divergent stream, the increase of temperature and humidity over the south ocean of Taiwan Strait and existence of suitable cold air in the north of TC periphery were responsible for the re-intensification of typhoon Lily.

Numerical simulations were implemented to study TC intensification over offshore and TC dissipation process after landfall. Results of several sensitivity experiments indicated that topographical factors (terrain height, roughness length, sea-land distribution) in the western part of South China had an important impact on TC intensity change at landfall. Numerical studies on typhoon Utor (0104) also indicated that the decay of landfalling typhoon was mainly due to the decrease of water vapor supply from the surface following the surface frictions. The precipitation distribution was considerably affected by the topography in South China. So topography might have some effects on the asymmetric structure of typhoon Utor.

A set of analyses data at the resolution of 1°×1° is used to diagnose the large scale conditions favorable for the abrupt intensity change of Typhoon Rananim (2004) with special attention being paid to the interaction between an upper level cold vortex and the tropical cyclone. It is found that the existence of a warm core ring, sufficient vapor transportation, low vertical wind shear and upper level cold vortex work together in providing Typhoon Rananim a favorable environment for a sudden pre-landfall intensification. The upper level cold vortex plays an important role by increasing downward motion surrounding the tropical cyclone and the environmental instability.

◆ **Tropical Cyclone Track Prediction**

TC Track Prediction and analysis were carried out based on mesoscale model MM5, satellite infrared images and observational data. Results showed that Typhoon Sinlaku (0216) and tropical depression, which occurred in eastern part of Sinlaku, were rotated each other, and resulted in that the Sinlaku was moved southwestward. The orography in Taiwan, coastal trough and subtropical high east to the cyclone were the main factors resulting in the northwestward movement of Sinlaku.

A non-divergent barotropic model with no flows was employed to simulate interaction of binary typhoons in northwest - southeast orientation in order to understand how asymmetric theory influenced on interaction of the two typhoons. Results showed that asymmetricity could explain the motion feature of twin typhoons. The movement of each typhoon was governed by the ventilation flow that passed its center. On the other hand, the motion can react to their asymmetric structures. A quasi-geostropic three-layer model was developed to investigate the motion under various basic flows and diabatic heating. Results indicated that tropical cyclone was mainly steered by basic flow. However, the asymmetric disturbance interfered the motion of tropical cyclone. Besides, diabatic heating affected tropical cyclone remarkably, which tended to move towards the center of heating field.

Several numerical experiments with different domain size, horizontal resolution or cumulus parameterization schemes were performed using MM5V3 to investigate the abnormal track of typhoon Aere (2004). Results showed that the unusual track of Aere could be simulated quite well with MM5V3 and the abnormity might be caused by sudden changes in the environmental flow. The asymmetric structure of Aere itself was not a key factor. Changes in the mid-latitude circulation caused the first westward turning of Aere, while typhoon Chaba that existed more than 15 degrees lat/lon away to its east showed no direct impact upon Aere’s track. With the same horizontal resolution, the westward turning of Aere could be simulated better using Betts-Miller cumulus parameterization scheme in the outer domain than using GRELL scheme.

◆ **Tropical Cyclone Precipitation**

Many researches were carried out to investigate precipitation mechanism and quantitative precipitation estimation of tropical cyclones in the past year. Numerical experiments on rainfall associated to typhoon Sinlaku (0216) were conducted using MM5 model. Results showed that the cold air invaded in the periphery of tropical cyclone can increase rainfall quantity in the areas of TC periphery and inverse trough. However, when invading into the vicinity of typhoon center, the cold air would weaken the TC intensity dramatically and result in remarkable decrease of rainfall near TC center, while the rainfall occurred in the TC periphery and inverse trough areas would still be increased. The topography had some impacts on the distribution of rainfall with more asymmetric features.

Both typhoon Chebi (0102) and Toraji (0108) had similar tracks, while the intensity and distribution of rainfall induced were significantly different. Comparative analyses found that the prior environmental circulation, interaction and collocation between tropical westerly trough and the subtropical high were three main factors responsible for the difference of precipitation.
The quality of quasi-global, near-real-time, TRMM-based data of precipitation estimate related to TC was tested with rainfall records of automatic weather station network in Guangdong province. Results showed that they had good relationship and TRMM product could reveal the feature of 3-hour temporal variation of TC precipitation. Besides, the radial distribution of TC rain bands was variable during its landfalling process. The quality of rainfall data observed by the Global Positioning System (GPS) was also investigated for typhoon Ranasun（2002）in coastal area of East China. It was found that the precipitation estimation based on GPS was consistent with the intensive observation.

◆ **Numerical Assimilation**

Numerical assimilation products of various data were applied to investigate typhoon structure and precipitation. The cloud derived winds (CDW) data were assimilated by Global/Regional Assimilation and Prediction System of CMA with 3-D variation method. Analysis indicated that CDW data from different channels and levels had different standard deviation in numerical simulations. However, the assimilation of cloud-derived winds can improve the quality of TC wind and pressure field leading to the improvement of prediction in typhoon track and rainfall.

AMSU microwave data were also assimilated with three-dimensional variation method in order to explore the TC structure over the Northwest Pacific. It was found that the TC 3-D structure was revealed in a more reasonable way with data assimilation. For example, warm core structure of severe typhoon was strengthened, cyclonic circulations in the middle and lower layers of typhoon were more obvious and the strong anti-cyclonic circulation occurred in upper layer etc.

With severe tropical storm "Vongfong" as the target typhoon, nudging them into 4-D data assimilation process in meso-scale model MM5v3 assimilated the wind-profiler data. The influence of different intervals was detected in nudging-assimilation and nudging factor in the simulation. The results demonstrated that the assimilated initial fields were improved, and the rainfall simulation was improved compared with that with direct objective analysis field. With nudging factor $4.0\times10^{-4}s^{-1}$, the simulated result was more realistic.

The impacts of the assimilated bogus vortex on numerical simulation using MM5 four-dimensional variational data assimilation system were studied. The results showed that assimilation of typhoon vortex variables was more effective than the conventional bogussing method that implants a synthetic vortex into background. Simultaneous assimilation of bogus wind, pressure, temperature and specific humidity together was less effective than that of bogus pressure or any one of other variables. It was found that an initial field with clearer structure and more consistent with environmental flow would be obtained by assimilating pressure and specific humidity together.

The NRL (US Naval Research Laboratory) rainfall assimilation was implemented with the idea of adjusting diabatic heating to improve the initial conditions of Tropical Cyclone Chris, which made landfall near Port Headland, Western Australia during 3-6th, Feb. 2002. The NRL rainfall data, classified as three types (i.e. stratiform, convective and composite rainfall), is used to define the vertical profiles of diabatic heating. During the period of initialization (assimilation), the diabatic heating from the cumulus scheme is replaced by the heating profile given by Johnson (1984). The BMRC (Bureau of Meteorology Research Center, Australia) tropical limited-area model is used for the experiments performed with the options of "rainfall assimilation" and "dynamic nudging". For the experiments RA (with rainfall assimilation) and RAN (with rainfall assimilation and dynamic nudging), 6-h accumulated NRL rainfall data are ingested in the model within each of the 4*6h initial (assimilation) periods, valid respectively at 24h, 18h, 12h, 6h prior to the base time of the simulation (23UTC 3 Feb 2002). To help make the momentum field more consistent with the mass field during the initialization, dynamic nudging (using conventional observations) is used in RAN. Inclusion of NRL rainfall data improves the track in all the experiments, with the RAN experiment giving the most significant improvement.

f. Other Cooperative/RCPIP Progress

- **The 3rd Regional Workshop on Storm Surge and Sea Wave Forecast**

The 3rd JCOMM Regional Workshop on Storm Surge and Sea Wave Forecast and the Training Course for the Forecast Model were held at Beijing National Marine Environment Forecast Center from the 25th to 29th of July 2005. 30 representatives from 20 countries participated in the meeting.

This training lasted for 5 days, divided into 2 parts: (1) workshop; (2) training. 5 experts from Norway, Japan, India, Thailand and China conducted the training on forecasting models for ocean storm surge and sea waves. The training enhanced the capacity building of the marine meteorological forecasts, and it facilitated the improvement of marine disaster prevention and mitigation. Hence, the training was highly appreciated by JCOMM and its Member countries.

3. Opportunities for Further Enhancement of Regional Cooperation

The International Workshop on Tropical Cyclone Landfall Processes was organized by WMO Commission on Atmospheric Science (CAS) Tropical Meteorology Research Program (TMRP), and held in Macao during 22-25 March 2005. Four projects were recommended in the meeting, and they would further enhance regional cooperation. The following projects were recommended:

- Project 1: Model Inter-comparison for Prediction of TC Landfall.
- Project 2: Project on East Asian International Program for a Forecast Demonstration Project on TC Landfall.
- Project 3: East Asia TC Advanced Forecast Guidance Project.
- Project 4: Pacific THORPEX Regional Campaign linked with the International Polar Year in 2008.

In **Hong Kong, China**,

I. Overview of Meteorological and Hydrological Conditions during the Year (with focus on impacts of tropical cyclones which occurred and affected Members)

1. Meteorological Assessment

One tropical cyclone affected Hong Kong from 1 January to 15 September in 2005. It was Severe Tropical Storm Sanvu in August. Its track is shown in Figure 1.

In Hong Kong, the Standby Signal No. 1 was issued for the first time in the year at 10.40 a.m. on 12 August when Sanvu was about 770 km to the east-southeast. Locally, squally showers and thunderstorms set in that evening as Hong Kong came under the influence of Sanvu. It came closest to Hong Kong at around 1 p.m. on 13 August when it was about 300 km to the east-northeast. The lowest hourly sea-level pressure of 997.0 hPa was recorded at the Hong Kong Observatory Headquarters at 3 p.m. that afternoon. All tropical cyclone warning signals were cancelled at 6.45 p.m. the same day as Sanvu gradually moved away from Hong Kong.

The rainbands of Sanvu brought heavy squally showers to Hong Kong on 13 August. More than 80 millimetres of rainfall were recorded at the Observatory Headquarters. The Amber Rainstorm Warning Signal was in force between 11.40 a.m. and 1.15 p.m. on 13 August, and between 8.45 p.m that night and 0.20 a.m. the next day.

2. Hydrological Assessment:
No flooding was reported during the passage of Sanvu.

3. Socio-Economic Assessment
No damage was caused by the passage of Sanvu.

II. Meteorology

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

1a. Hardware and Software Progress

In the twelve months since October 2004, the total page view of the World Meteorological Organization (WMO) Severe Weather Information Centre (SWIC) website exceeded 7 million, a growth of more than 31% compared with the previous 12 months. These statistics demonstrated a continuing growth in demand for severe weather information worldwide. Recognizing its value, the Commission for Basic Systems at the 13th Session in St. Petersburg (23 February - 3 March 2005) declared the SWIC project an operational component of the Public Weather Service Programme of WMO on 23 March 2005.

An animation function was added to the SWIC tropical cyclone web-page in late 2004 to enable the public and the media to retrieve the past 7-day movement of all tropical cyclones.

1b. Implications for Operational Progress: Nil.

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

In March 2005, meteorologists from Guangdong Meteorological Bureau, Hong Kong Observatory (HKO) and Macao Geophysical and Meteorological Bureau commemorated 10 years of "Co-ordinated Weather Monitoring in Pearl River Delta Region". The aim of the project was to facilitate and enhance cooperation among the three meteorological services in setting up weather equipment for monitoring and conducting research into severe weather affecting the Pearl River Delta area including tropical cyclones.

With effect from April 2005, tropical cyclone forecasts based on the Hong Kong Observatory's Operational Regional Spectral Model (ORSM) were disseminated to WMO Members whenever a tropical cyclone classified by HKO as a tropical depression or stronger is located within the region 10^{o}-30^{o}N, 105^{o}-125^{o}E. This was done under two new GTS bulletins with headers FXPQii VHHH and FXSSii VHHH. The GTS bulletins were issued twice a day, at around 05 and 17 UTC for forecasts based on the 00 and 12 UTC 60-km ORSM model runs respectively. Six-hourly forecast positions and intensity changes (in terms of minimum sea level pressure) up to 72 hours ahead are provided in the bulletin. For completeness, initial tropical cyclone positions and intensity as analyzed by forecasters at 00 and 12 UTC were also included.

Under a cooperative research project between the Observatory and Japan Meteorological Agency (JMA) on the utilization and verification of JMA's Ensemble Prediction System (EPS) tropical cyclone track data, two new products, namely ensemble mean track and scalable graphical display (in SVG format) of all member tracks, were developed and put into operation for reference by forecasters.

1d. Training progress

A HKO officer attended the Typhoon Committee Roving Seminar on Operational Application of Multi-model Ensemble Typhoon Forecasts in Beijing, China during 22-24 November 2004. A paper on the recent advances in operational forecasting of tropical cyclones in Hong Kong was presented.

1e. Research Progress

A study on the long-term change in tropical cyclone activity in the western North Pacific was carried out. The results were presented at the 19th Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology held in Yangjiang, China in March 2005.

1f. Other Cooperative/RCPIP Progress

The Expanded Best Track (EBT) data for the period 1978 to 1995 in respect of Hong Kong, China was compiled and sent to the Regional Specialized Meteorological Center (RSMC), Tokyo in January 2005.

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

2a. Hardware and Software Progress

In preparation for the cessation of the operation of Geostationary Operational Environmental Satellite-9 (GOES-9) for the Asia Pacific region, HKO set up ground reception systems to receive satellite images from the Fengyun-2C (FY-2C) satellite of the China Meteorological Administration and the High Resolution Image Data (HiRID) broadcasts from JMA's Multi-functional Transport Satellite-1R (MTSAT-1R). A visible image of Severe Tropical Storm Sanvu from FY-2C prior to its landing on the coast of eastern Guangdong on 13 August 2005 is shown in Figure 2. Images of FY-2C and MTSAT-1R were made available on the website of the HKO commencing mid-2005.

Composite images of reflectivity and dual-Doppler wind were successfully generated from radars in Hong Kong and the Guangdong Province of China in a trial to composite the data from these two radars. These images would be useful in monitoring tropical cyclones which approach southern China.

Algorithms were developed to compute windshear using data from the infrared Doppler LIght Detection And Ranging (LIDAR) system at the Hong Kong International Airport (HKIA) under rain-free conditions, including those occurring between the rainbands of tropical cyclones. Their performance was being evaluated in preparation for integration into HKO's Windshear and Turbulence Warning System.

2b. Implications to Operational Progress

Enhancements to HKO's tropical cyclone forecasting service in 2005 included enriching tropical cyclone information in the weather bulletins for the south China coastal waters for the benefit of fishermen:

(a) provision of tropical cyclone information whenever a tropical cyclone is located in the area of 10-30°N and 105-130°E, extending the eastern boundary of the area from 125°E to 130°E;

(b) addition of information on tropical cyclone intensity in terms of the maximum sustained wind speed near its centre;

(c) extension of the weather outlook to cover up to 72 hours ahead.

An enhanced version of the Tropical Cyclone Information Processing System Version 2 (TIPS-2) began operation in the tropical cyclone season of 2005 to support tropical cyclone forecast operations. New features of TIPS-2 included the automatic ingestion of tropical cyclone related data from the GTS; overlaying of satellite and radar imageries on tropical cyclone forecast tracks; more versatile methods for manipulation of tropical cyclone track; and tools for estimating critical operational parameters such as the onset time of strong winds and gale as well as the distance and time of closest approach of a tropical cyclone.

The probability of occurrence of significant crosswinds at HKIA was compiled from runway wind records and historical tropical cyclone database for reference by Aviation Forecasters.

2c. Interaction with Users, other Members, and/or other Components

A HKO officer attended the Typhoon Committee Regional Workshop on Effective Tropical Cyclone Warning in Shanghai, China during 24-28 April 2005. A paper on the strategies of tropical cyclone warning to maximize relevance and effectiveness was presented.

2d. Training progress

Between October 2004 and October 2005, overseas training related to tropical cyclones were undertaken on two occasions. In addition to the training in 1d, another officer attended the RAII/V Training Workshop on Ensemble Prediction Systems organized by WMO in Shanghai, China in April 2005.

2e. Research Progress

In addition to the study mentioned in sub-paragraph 1e of Section I, a study on the impact of remote sensing data and data assimilation strategies in the mesoscale modeling of landfalling tropical cyclones was completed.

The following tropical cyclone related research projects were undertaken in 2005:

(a) A cooperative research project between HKO and JMA on the utilization and verification of JMA EPS tropical cyclone data for tropical cyclones over the South China Sea.

(b) Ensemble weather forecast for weather scenarios associated with tropical cyclones.

(c) Verification of ECMWF EPS in respect of local high winds forecast.

A list of tropical cyclone related reports or papers published during the year is given in Appendix 1.

2f. Other Co-operative/RCPIP progress

Under the Typhoon Committee Research Fellowship Scheme, Dr Vicente B. Malano from PAGASA undertook a two-month attachment programme from 20 September to 19 November 2005 at

HKO. The research topic was “Impact of Moisture Data on TC forecasting in South China Sea and Western North Pacific”.

HKO continued to exchange radar images with Guangdong Meteorological Bureau for monitoring tropical cyclones.

3. Opportunities for further Enhancement of Regional Co-operation

A lightning location network covering the Pearl River Estuary was installed by HKO in collaboration with the Guangdong Meteorological Bureau and Macao Geophysical and Meteorological Bureau. This network is useful for monitoring the locations of lightning associated with different weather systems including tropical cyclones. Based on this network, a lightning location information service was launched to the public and special clients in June 2005.

In **Japan,**

Activities of the RSMC Tokyo - Typhoon Center

1. Provision of RSMC Products

The RSMC Tokyo-Typhoon Center (hereafter refered to as the Center) has been providing the Typhoon Committee Members with various kinds of products on tropical cyclones in the western North Pacific and the South China Sea through the GTS and the AFTN. Table 1 shows the total numbers of the products provided by the Center in 2005 (as of 30 September).

2. Track Forecast

Operational track forecasts for 19 tropical cyclones which attained TS intensity or higher in 2005 (as of 30 September) were verified against best track data of the Center. Figure 1 shows annual mean errors of 24-hour (from 1982), 48-hour (from 1988) and 72-hour (from 1997) forecasts of center positions. The annual mean position errors for this year are approximately 100 km (125 km in 2004) for 24-hour forecast, 174 km (243 km) for 48-hour forecast and 278 km (355 km) for 72-hour forecast. The annual mean position errors for 24-hour forecast in 2005 are smallest after each forecast started operationally. The annual mean ratios of EO (position errors of operational forecasts) to EP (position errors of PER-method forecasts) are 51 % (54 % in 2004) for 24-hour forecast, 37% (47 %) for 48-hour forecast and 37% (45%) for 72-hour forecast, which are also lowest after inauguration of each operational forecast. Position error statistics of 24-, 48- and 72-hour forecasts for each tropical cyclone are shown in Table 2.

3. Intensity Forecast

Table 3 gives root mean square errors (RMSEs) of 24-, 48- and 72-hour intensity forecasts for each tropical cyclone in 2005 (as of 30 September). The annual mean RMSEs of central pressure forecasts were 12.2 hPa (11.4 hPa in 2004), 16.4 hPa (16.1 hPa), and 19.4 hPa (18.6 hPa) for 24-, 48- and 72-hours, respectively, while those of maximum wind speed forecasts for 24 hours were 5.5 m/s (5.1 m/s in 2004), 7.5 m/s (7.1 m/s) and 10.4 m/s (8.1 m/s), respectively. The overall performance of intensity forecasts in 2005 was a little worse than in 2004.

4. RSMC Data Serving System

The Center operates the RSMC Data Serving System (RSMC-DSS) to allow TC Members to retrieve NWP products such as GPVs and observational data through the Internet. RSMC-DSS is serving nine user countries/territories as of 30 September. The products and data being provided through the system are listed in Table 4.

5. JMA Numerical Typhoon Prediction (NTP) Website

The Center has officially operated the Numerical Typhoon Prediction (NTP) Website with cooperation of eight NWP centers; BOM (Australia), CMC (Canada), DWD (Germany), ECMWF, KMA (Republic of Korea), NCEP (USA), UKMO (UK) and JMA since October 2004.

The NTP Website offers predictions of tropical cyclone tracks performed by the models of major NWP centers in the world to assist the NMHSs of the Typhoon Committee (TC) Members in better tropical cyclone forecasting and warning services.

The contents of the NTP Website includes:

1. a data table and a chart of the latest predicted positional data of the participating NWP centers with analysis data of JMA, which have several useful functions such as deriving an ensemble mean from any combination of the centers' predictions of a user's choosing, and
2. maps of the NWP models of the participating NWP centers.

Ten TC Members except Japan have already registered for users of the NTP Website as of 30 September.

6. Migration of SAREP and RADOB to BUFR

The World Meteorological Organization (WMO) is now implementing the migration from Traditional Alphanumeric codes (TACs) to Table Driven Code Forms (TDCFs) based on the migration plan which was designated by the Commission for Basic Systems (CBS) and endorsed at the World Meteorological Congress.

The migration plan includes SAREP and RADOB which are widely used by the Members of the Typhoon Committee for exchanging information regarding tropical cyclones. Since the plan calls for migration of SAREP and RADOB by 2006 and 2008, respectively, the Members concerned are urged to take necessary actions according to their national migration plan.

The Center proposed a template and descriptors of the SAREP report in BUFR format, and ECMWF reported that there was no problem in them. Therefore, the template and descriptors were registered as formal ones by WMO. Prior to the dissemination of the SAREP report in BUFR format, the Center asked HKO to cross-check the sample reports in July 2005, and HKO kindly examined and decoded them correctly.

The Center plans to start disseminating SAREP report in BUFR format in November 2005, while it will continue disseminating SAREP in the present TAC format. One year after the dual exchange started, the Center will discontinue disseminating the SAREP report in TAC format in November 2006 if Members are ready in receiving and decoding the SAREP report in BUFR format.

The Center will implement the migration of RADOB and SAREP to BUFR with sufficient coordination and collaboration with the Members.

7. Expanded Best Track Data Set for the Western North Pacific and the South China Sea

At the thirty-sixth session of the Typhoon Committee held in Kuala Lumpur, Malaysia in December 2003, a plan to produce an "Expanded Best Track Data Set for the Western North Pacific and the South China Sea" (hereafter EBT) was approved. Each Member should send observational data, data related to disaster and so on to be included in EBT to the Center, and the Center would put the data into EBT after basic screening.

TCS requested all Members to provide the data from 1996 to 2004 by March 2005. Seven Members provided the data for the Center as of 31 October 2005. The Center is screening the data before putting the data into EBT.

Considering that EBT would contribute to the disaster preparedness as an important database for each Member, the Members that did not provide the relevant data for the Center are requested to provide the data.

8. Publication

The Center published:

1) "Annual Report on Activities of the RSMC Tokyo-Typhoon Center in 2004" in October 2005. It is now available at the website of the Center (http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm).
2) "Technical Review (No.8)" in November 2005 (now editing) that contains the following papers:
   - Verification of the guidances during the period of typhoon Songda (0418)
   - Estimation of the Radius of Probability Circle in Typhoon Track Forecast.

It will be published by the end of this year.

9. Training

1) International seminar

The "International Training Seminar on Typhoon Monitoring and Forecasting in the Western North Pacific" was held from 17 February to 4 March 2005 in Tokyo with participation of four experts from four countries; Cambodia, Laos, Micronesia, and Philippines. The purpose of the seminar is to share recent knowledge and techniques of typhoon monitoring and forecasting with forecasters of NMHSs in the region through lectures, on-the-job training and discussions. The seminar included lectures on typhoon analysis/forecasting and NWP and its products, and practical training on typhoon analysis/forecasting, etc.

2) Attachment to RSMC

Two forecasters from Macao, China and Singapore visited at the Center from 20 to 29 July 2005 for the on-the-job training for typhoon operations. The training was carried out with the support of WMO in response to the proposal presented at the thirty-third session of the Typhoon Committee. During the two weeks the two forecasters experienced the analysis and forecasts for Dianmu (0406) in reference to the operational procedures of the Center.

3) Training Course on Typhoon Forecast by using NWP Technique

"Training Course on Typhoon Forecast by using Numerical Weather Prediction (NWP) Technique" was held at Thailand Meteorological Department (TMD) in Bangkok, Thailand from 22 to 31 August 2005. The purpose of the training course is for the staff of TMD to understand the fundamental knowledge essential for operation, development and improvement of NWP system as well as application of NWP to typhoon forecast. TMD invited Head of the Center who gave lectures on the overview of typhoon, analysis and forecast method of typhoon at the Center, the overview of NWP system, quality control, data assimilation, physical processes of NWP model, verification, application of NWP, and finite difference method.

10. Implementation Plan

Table 5 shows the implementation plan of the Center for the period from 2005 to 2009.

Table 1 Monthly and annual total numbers of products issued by the RSMC Tokyo - Typhoon Center in 2005 (as of 30 September)

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TCNA20	15	0	11	18	0	41	85	108	122				**400**
TCNA21	19	0	18	22	4	42	95	125	144				**469**
WTPQ20-25	37	0	37	45	10	67	197	254	294				**941**
WTPQ30-35	9	0	9	12	2	21	49	67	88				**257**
FXPQ20-25	29	0	25	33	7	62	141	185	213				**695**
FKPQ30-35	19	0	19	22	5	38	97	124	145				**469**
AXPQ20	0	1	1	0	1	0	1	3	7				**14**

Notes:

- via the GTS or the AFTN -

SAREP	TCNA20/21 RJTD
RSMC Tropical Cyclone Advisory	WTPQ20-25 RJTD
RSMC Prognostic Reasoning	WTPQ30-35 RJTD
RSMC Guidance for Forecast	FXPQ20-25 RJTD
Tropical Cyclone Advisory for SIGMET	FKPQ30-35 RJTD
RSMC Tropical Cyclone Best Track	AXPQ20 RJTD

Table 2 Mean Position Errors of 24-, 48- and 72-hour Operational Forecasts in 2005 (as of 30 September)

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast			
			Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num.	EO/EP (%)
STS	KULAP	(0501)	138	87	11	46	332	153	7	49	706	299	3	95
STS	ROKE	(0502)	178	107	6	104	98	21	2	0	0	0	0	0
TY	SONCA	(0503)	108	83	14	37	225	128	10	27	505	53	6	29
TY	NESAT	(0504)	74	41	38	42	120	81	33	29	225	129	28	32
TY	HAITANG	(0505)	95	45	25	47	122	67	21	22	142	69	17	14
TS	NALGAE	(0506)	140	86	12	78	144	110	8	26	200	76	4	19
STS	BANYAN	(0507)	138	56	21	51	324	123	17	56	573	193	13	71
TS	WASHI	(0508)	78	22	5	63	278	0	1	0	0	0	0	0
TY	MATSA	(0509)	75	50	24	56	91	54	20	36	188	122	16	52
STS	SANVU	(0510)	117	48	6	43	274	29	2	0	0	0	0	0
TY	MAWAR	(0511)	74	43	13	27	210	72	9	20	355	212	5	13
STS	GUCHOL	(0512)	107	82	29	68	188	112	25	44	318	185	21	43
TY	TALIM	(0513)	92	43	35	47	129	86	31	29	158	66	27	23
TY	NABI	(0514)	75	33	21	57	136	61	17	40	193	92	13	32
TY	KHANUN	(0515)	105	67	20	65	157	87	16	40	285	165	12	53
TS	VICENTE	(0516)	83	43	5	10	262	0	1	0	0	0	0	0
TY	SAOLA	(0517)	129	73	19	42	263	83	15	33	278	165	11	19
TY	DAMREY	(0518)	115	81	23	72	241	153	19	77	468	257	15	101
TY	LONGWAN(	(0519)	78	37	24	61	145	61	20	42	226	84	16	42
Mean(Total)			100	65	351	51	174	116	274	37	278	198	207	37

EO/EP indicates the ratio of EO (mean position error of operational forecasts) to EP (mean pos forecasts by the persistency method)

Table 3 Root Mean Square Errors (RMSEs) of 24-, 48- and 72-hour intensity forecasts For each tropical cyclone in 2005 (as of 30 September)

Tropical Cyclone			RMSE of 24-hour Forecast			RMSE of 48-hour Forecast			RMSE of 72-hour Forecast		
			Central pressure (hPa)	Maximum Winds (m/s)	Number	Central pressure (hPa)	Maximum Winds (m/s)	Number	Central pressure (hPa)	Maximum Winds (m/s)	Number
STS	KULAP	(0501)	2.7	1.3	11	7.1	4.1	7	7.2	5.4	3
STS	ROKE	(0502)	8.4	5.3	6	2.8	1.8	2	0.0	0	0
TY	SONCA	(0503)	25.2	10.8	14	29.6	11.9	10	28.6	12.4	6
TY	NESAT	(0504)	14.4	5.4	38	16.4	6.4	33	12.7	5	28
TY	HAITANG	(0505)	10.5	4.2	25	10.9	5.4	21	22.6	9.3	17
TS	NALGAE	(0506)	7.3	4.3	12	9.3	6	8	11.5	7.6	4
STS	BANYAN	(0507)	7.9	6	21	14.9	10.9	17	20.3	14.4	13
TS	WASHI	(0508)	3.6	2.3	5	6.0	18	1	0.0	0	0
TY	MATSA	(0509)	9.1	2.9	24	12.3	5.6	20	18.5	8.1	16
STS	SANVU	(0510)	3.1	1.8	6	7.0	6.6	2	0.0	0	0
TY	MAWAR	(0511)	6.5	3.3	13	5.8	2.8	9	8.0	3.8	5
STS	GUCHOL	(0512)	17.0	7.1	29	20.3	7.9	25	20.2	7.1	21
TY	TALIM	(0513)	12.7	4.7	35	17.7	6.9	31	16.4	6.9	27
TY	NABI	(0514)	11.5	6.3	21	20.3	7.1	17	29.1	10.7	13
TY	KHANUN	(0515)	6.8	3.9	20	13.4	6.5	16	18.0	7.8	12
TS	VICENTE	(0516)	7.5	5	5	14.0	7.7	1	0.0	0	0
TY	SAOLA	(0517)	6.8	3.6	19	13.1	5.4	15	15.4	6.8	11
TY	DAMREY	(0518)	11.5	5.9	23	19.6	11.1	19	22.6	24	15
TY	LONGWANG	(0519)	15.3	7.3	24	16.3	7.4	20	21.0	9.9	16
Mean(Total)			12.2	5.5	351	16.4	7.5	274	19.4	10.4	207

Table 4 List of GPV products and data on the RSMC Data Serving System

Area	20S-60N, 80E-160W	20S-60N, 60E-160W
Resolution	2.5×2.5 degrees	1.25×1.25 degrees
Levels and elements	Surface (P,U,V,T,TTd,R) 850hPa (Z,U,V,T,TTd,ω) 700hPa (Z,U,V,T,TTd,ω) 500hPa (Z,U,V,T,TTd,ξ) 300hPa (Z,U,V,T) 250hPa (Z,U,V,T) 200hPa (Z,U,V,T) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T)	Surface (P,U,V,T,TTd,R)** 1000hPa (Z,U,V,T,TTd) 925hPa (Z,U,V,T,TTd,ω) 850hPa (Z*,U*,V*,T*,TTd*,ω,ψ,χ) 700hPa (Z*,U*,V*,T*,TTd*,ω) 500hPa (Z*,U*,V*,T*,TTd*,ξ) 400hPa (Z,U,V,T,TTd) 300hPa (Z,U,V,T,TTd) 250hPa (Z,U,V,T) 200hPa (Z*,U*,V*,T*,ψ,χ) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T) 70hPa (Z,U,V,T) 50hPa (Z,U,V,T) 30hPa (Z,U,V,T) 20hPa (Z,U,V,T) 10hPa (Z,U,V,T)
Forecast hours	(00 and 12 UTC) 0, 6, 12, 18, 24, 30, 36, 48, 60 and 72 hours	(00 and 12 UTC) 0 – 84 every 6 hours In addition (12 UTC), * 96, 120, 144, 168 and 192 hours ** 90 – 192 every 6 hours
Frequency (initial times)	Twice a day (00 and 12 UTC)	Twice a day (00 and 12 UTC)

Area	Whole globe		Whole globe
Resolution	2.5×2.5 degrees		1.25×1.25 degrees
Levels and elements	Surface(P,R,U,V,T) 1000hPa(Z) 850hPa(Z,U,V,T,TTd) 700hPa(Z,U,V,T,TTd) 500hPa(Z,U,V,T) 300hPa(Z,U,V,T) 250hPa(Z,U,V,T)* 200hPa(Z,U,V,T) 100hPa(Z,U,V,T)* 70hPa(Z,U,V,T)* 50hPa(Z,U,V,T)* 30hPa(Z,U,V,T)*	Surface (P,U,V,T,TTd*) 1000hPa (Z,U,V,T,TTd*) 850hPa (Z,U,V,T,TTd) 700hPa (Z,U,V,T,TTd) 500hPa (Z,U,V,T,TTd*) 400hPa (Z,U,V,T,TTd*) 300hPa (Z,U,V,T,TTd*) 250hPa (Z,U,V,T) 200hPa (Z,U,V,T) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T) 70hPa (Z,U,V,T) 50hPa (Z,U,V,T) 30hPa (Z,U,V,T) 20hPa (Z,U,V,T) 10hPa (Z,U,V,T)	Surface (P,U,V,T,RH,R) 1000hPa (Z,U,V,T,RH,ω) 925hPa (Z,U,V,T,RH,ω) 850hPa (Z,U,V,T,RH,ω,ψ,χ) 700hPa (Z,U,V,T,RH,ω) 600hPa (Z,U,V,T,RH,ω) 500hPa (Z,U,V,T,RH,ω,ξ) 400hPa (Z,U,V,T,RH,() 300hPa (Z,U,V,T,RH,() 250hPa (Z,U,V,T) 200hPa (Z,U,V,T,(,() 150hPa (Z,U,V,T) 100hPa (Z,U,V,T) 70hPa (Z,U,V,T) 50hPa (Z,U,V,T) 30hPa (Z,U,V,T) 20hPa (Z,U,V,T) 10hPa (Z,U,V,T)
Forecast hours	(00 and 12 UTC) 24, 48 and 72 hours In addition (12 UTC), 96 – 192 every 24 hours * 96 and 120 only	(00 and 12 UTC) 0 hours * 00UTC only	(00 and 12 UTC) 0 – 84 every 6 hours In addition (12 UTC), 96 – 192 every 12 hours
Frequency (initial times)	twice a day (00 and 12 UTC)		twice a day (00 and 12 UTC)

Area	Whole globe
Resolution	2.5×2.5 degrees
Levels and elements	Surface (P) 1000hPa(Z) 850hPa (T,U,V) 500hPa (Z) 250hPa (U,V) *Above GPVs are ensemble mean and standard deviation of ensemble forecast memers.
Forecast hours	Every 12 hours from 0 192 hours
Frequency (initial times)	Once a day (12 UTC)

Notes:

P : pressure reduced to MSL	R : total precipitation	RH :relative humidity
T : temperature	TTd: dew point depression	U : u-component of wind
V : v-component of wind	Z : geopotential height	(: relative vorticity
(: velocity potential	(: stream function	(: vertical velocity

Products/ Data	Satellite data	Typhoon Information	Global Wave Model (GRIB)	Observational data
Contents	MTSAT-1R data (GRIB) • Equivalent blackbody temperature	Tropical cyclone related information (BUFR) •Position, etc.	• Significant wave height • Prevailing wave period • Prevailing wave direction Forecast hours: 0, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84 (00 and 12 UTC); 96, 108, 120, 132, 144, 156, 168 ,180 and 192 hours (12 UTC)	(a) Surface data (SYNOP, SHIP) (b) Upper-air data (TEMP, parts A-D) (PILOT, parts A-D)
Frequency (initial times)	4 times a day (00, 06, 12 and 18 UTC)	4 times a day (00, 06, 12 and 18 UTC)	Twice a day (00 and 12 UTC)	(a) Mainly 4 times a day (b) Mainly 2 times a day

Table 5 Implementation Plan of the RSMC Tokyo-Typhoon Center (2005-2009)

PRODUCT	2005	2006	2007	2008	2009	REMARKS
Satellite Observation						
GMS S-VISSR*	—					24 times/day (full-disk)
MTSAT HiRID	···—	—	—			All observed cloud images (full or half-disk)
MTSAT HRIT	···—	—	—	—	—	All observed cloud images (full or half-disk)
GMS/MTSAT WEFAX*	—	—	—			8 times/day (4-sector), 24 times/day (Image H), 24 times/day (Image I or J)
MTSAT LRIT	···—	—	—	—	—	24 times/day (full-disk), 24 times/day (polar-stereo East Asia)
Cloud motion wind (SATOB)	—	—	—			4 times/day
Cloud motion wind (BUFR)	—	—	—	—	—	4 times/day
Analysis						
SAREP (for tropical cyclones, TACs)	—	—	—···			4-8 times/day Dvorak intensity*** (estimation included)
SAREP (for tropical cyclones, BUFR)	···	···	—	—	—	
Report of typhoon analysis**	—	—	—	—	—	8 times/day
Sea Surface Temperature	—	—	—	—	—	
Objective analysis						
pressure pattern, etc	—	—	—	—	—	FAX
stream lines	—	—	—	—	—	FAX****
Cloud distribution	—	—	—	—	—	GPV****
Forecast						
RSMC Prognostic Reasoning	—	—	—	—	—	2 times/day
RSMC Guidance for Forecast	—	—	—	—	—	TYM up to 84 hours 4 times/day; GSM up to 90 hours 2 times/day
NWP products						
pressure pattern, etc	—	—	—	—	—	FAX, GPV (GSM)
stream line	—	—	—	—	—	FAX****
Numerical Typhoon Prediction Web Site						
tracks and prediction fields, etc	—	—	—	—	—	mostly updated 2 times/day up to 84 hrs
RSMC Tropical Cyclone Advisory**	—	—	—	—	—	4 times/day up to 72 hrs; 8 times/day up to 24 hrs
Others						
RSMC Tropical Cyclone Best Track	—	—	—	—	—	GTS
Annual Report	—	—	—	—	—	
Technical Review	···	···	···	···	···	(as necessary)

SUPPORTING ACTIVITY	2005	2006	2007	2008	2009	REMARKS
Data archive	—	—	—	—	—	
Monitoring of data exchange	—	—	—	—	—	
Dissemination of products	—	—	—	—	—	RSMC Data Serving System

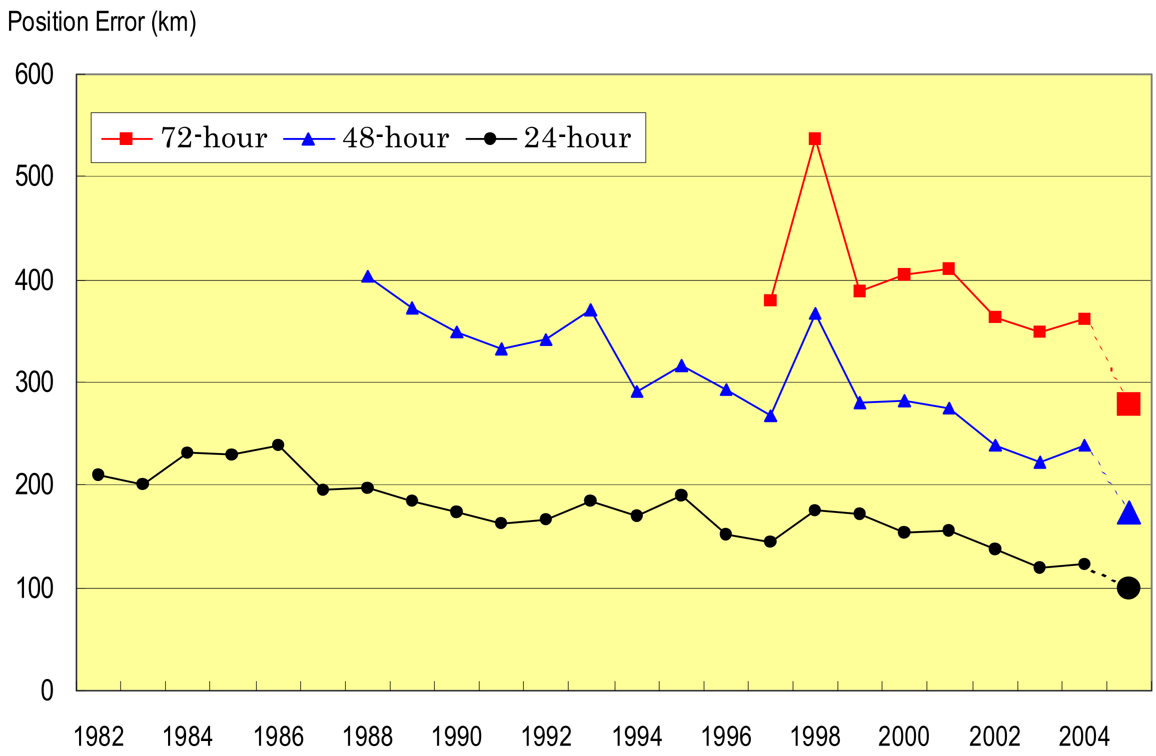
* WEFAX from GOES-9 GVAR is disseminated via GMS-5 and S-VISSR from GOES-9 GVAR is disseminated to registered NMHSs through the Internet in place of S-VISSR via GMS-5.

** "RSMC Tropical Cyclone Advisory" involves "Report of typhoon analysis"

*** 8 times a day for CSC (Cloud System Center) position, system size and moving.

**** Some of these products will be disseminated within the capacity of traffic of the GTS and JMH.

Figure 1 Annual means of position errors of 24-, 48- and 72-hour operational track forecasts (as of 30 September)



In Republic of Korea,

Review of the Committee's activities during 2005

1. Participation in WMO pilot projects

KMA is participating in two pilot projects - the Pilot Project on World City Forecasts and the Pilot Project on the "Severe Weather Information Center (SWIC)" website - sponsored by WMO. KMA has been involved in those two projects from the beginning and actively participate. The KMA's official track and position information of tropical cyclone is available both on the SWIC and on the KMA web sites in English for the Pilot Project on the SWIC. To support the WMO Pilot Project on world city forecasts, KMA is broadcasting the 5 days forecasts of six major cities in Korea through GTS twice a day at 06 and 18 Local Standard Time. These forecasts are shown on the pilot web site titled "World Weather Information Service".

2. Upgrade of NWP system on a new supercomputer X1E

The new supercomputer of KMA, Cray X1E which is a vector parallel machine with the maximum performance of 18 Tflops, has been under installation in two phases. The first phase Cray system X1 of 2 TFlops was set up in November 2004. The second phase system of 16 TFlops will be installed by October 2005. The migration of NWP system from the existing NEC SX5 to the first phase Cray X1 was finished at the end of 2004 with the rigorous evaluations of the performance.

In 2005, as KMA had more powerful computational capability due to the new supercomputer, upgrading of the existing models were undertaken and several numerical models were newly introduced. The global model's resolution was raised from T213L30 to T426L40 and its physics processes have been tuned up for the best model performance. The interim verification result showed that this high-resolution global model has the positive ability in the prediction of typhoons. The regional model's domain was enlarged in order to better represent the weather system propagating from the west. The number of the vertical levels of the ensemble prediction system was raised from 30 to 40. The Semi-Lagrangian T213 global model which had been introduced from the Japan Meteorological Agency (JMA) was upgraded to T426L40 and under test operation. As a candidate for the next generation regional model, Korean version of the Weather Research and Forecasting (WRF) Model, which has 10 km horizontal resolution and 31 vertical levels, is under development.

Ms. Sugunyanee Yavinchan of the Thai Meteorological Department was awarded as a research fellow under the Typhoon Committee Fellowship Scheme in 2005, and the Typhoon Research Center of the Kongju University invited her for a collaborative study on typhoon during August 1 to October 31. She is currently working on the evaluation of the model performance in typhoon prediction in the high-resolution global model (T426L40).

3. Observational data by Geostationary meteorological satellite

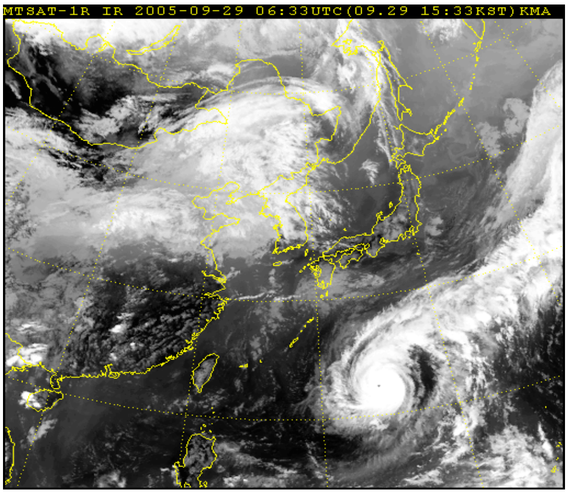
KMA has continued its effort to better utilize satellite data. KMA has produced in real time the image for tropical cyclone analysis using the geostationary satellite observation data since 2001 and attempted to analyze the intensity of the tropical cyclone using the Dvorak method.

The typhoon intensity index has been analyzed for about 20 typhoon cases every year since 2001. This analysis is performed every 3 or 6 hours from the typhoon formation to decaying stage. The central pressure, maximum wind speed, radius of storm, and gale force wind are analyzed from the index. These output turned out to be useful through comparison with those values from foreign tropical storm centers. To adopt Dvorak method in operation, KMA set up a software tool named SATDIS (Satellite Data Display System), which was originally developed by MSC/JMA and converted to a Korean version in 2001. Also, KMA has utilized 3.9μm channel of GOES-9 and 3.7μm channel of MTSAT-1R for the analysis of typhoon intensity since 2003(Figure 1.). The microwave channel could provide additional information for when the center fixing using GOES-9 data and MTSAT-1R data and could give critical information when it is difficult to apply the Dvorak method.

The launch of Japan's Multi-functional Transport Satellite, MTSAT-1R as the replacement for GMS-5, occurred successfully on 26 February 2005. The satellite went fully operational at 03UTC on 28 June 2005, following successful in-orbit testing. MTSAT-1R carries an aeronautical mission to assist air navigation, plus a meteorological mission to provide imagery coverage over the Asia-Pacific region. The meteorological mission includes an imager giving nominal hourly full earth disk images like those from GOES-9. Since May 2003 U.S.A.'s GOES-9 geostationary meteorological satellite has been backing up Japan's GMS-5 due to the deterioration GMS-5 and the failure of MTSAT, and has been the main source of geostationary satellite imagery for the Asia-Pacific region.

Digital image data for Medium-scale Data Utilization Stations (MDUS) are called High Resolution Image Data (HiRID) and will be disseminated via MTSAT-1R in place of Stretched Visible Infrared Spin Scan Radiometer data (S-VISSR) transmissions from GMS-5. MTSAT-1R will be equipped with an infrared sensor at 3.7 microns (IR4) in addition to the infrared sensors (IR1-3) and visible sensors (VIS) on GMS-5. IR4 channel is effective in detecting low-level cloud/fog at night. The observation data with all the sensors is disseminated by HiRID. Data in all infrared channels (IR1-4) of MTSAT-1R has 1024 (10-bit) quantization levels which are increased from 256 (8-bit) levels on GMS-5. The format of the upper 8-bit data of IR 1-3 and visible (VIS) data of MTSAT-1R is the same as for S-VISSR data.

By way of history, the first direct broadcast test transmissions to all ground stations in the Asia-Pacific region from MTSAT-1R occurred on 31 May 2005. The Korea Meteorological Administration (KMA) received its first images in 13 June 2005, by upgrading GOES-9 receiving system. KMA has operated the receiving and analyzing system of MTSAT-1R satellite HiRID data since 1 July 2005, and terminated the reception of GOES-9 GVAR data on 31 July 2005. KMA currently provides the satellite products from MTSAT-1R such as fog and stratus analysis, yellow sand analysis, cloud products, atmospheric motion vectors, etc.

(a) 

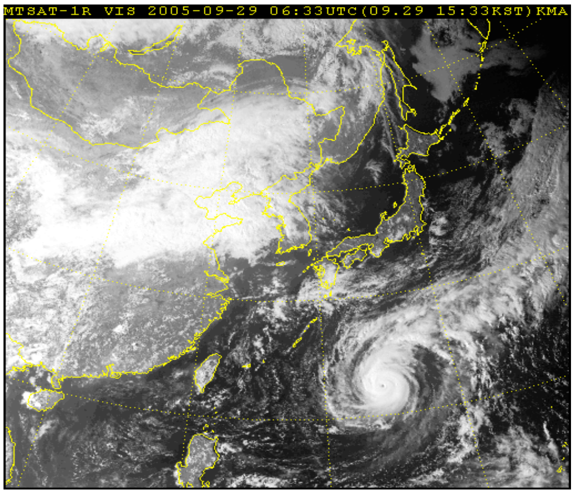
(b) 

Figure 1. The MTSAT-1R infrared(a) and visible(b) channel image.

In **Macao, China**

II. Meteorology

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

1a. Hardware and Software Progress

Permanent power supply of the AWS in "Wan Shan" and "Gao Lan" island were installed to substitute the solar cell, thus to improve the stability of operation.

As air quality and visibility, such as hazy condition which greatly reduce visibility, were generally affected during the approaching of tropical cyclone when the subsiding air at its periphery brought fine and hot weather with generally calm wind condition as well. Thus, in cooperation with City University of Hong Kong, a LIDAR system will be implemented for long term monitoring of airborne aerosols in Macao.

1b. Implications for Operational Progress

Initiate by Hong Kong Observatory (HKO) and with collaboration of Macao and Guangdong, a lightning location detecting sub-station was installed at Taipa Grande headquarters of SMG. It is a part of the Pearl River Delta Lightning Location Detecting Network System with coverage throughout Hong Kong-Macao-Guangdong. The network includes five detecting sensors with its highest detection accuracy performance up to 500 meters and are located at different sites, one in Sanshui of China, three in Hong Kong and one in Macao. The opening ceremony was held on July 12 in Guangdong. The network is helpful for enhancing the monitoring and alerting capability for lightning and thunderstorm during severe weather. An internet connection with HKO for real time lightning data exchange was setup.

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

One meteorologist attended "Regional Workshop on Effective Tropical Cyclone Warning" held in Shanghai, China during 24-28 April 2005 and sharing on "Effective Tropical Cyclone Warning Dissemination in Macao".

One female meteorologist attend the "5th on-the job training in typhoon operational forecasting" held in RSMC Tokyo-Typhoon Center, Japan Meteorological Agency from 20-29 July 2005.

One meteorologist attend the "3rd Regional Workshop on Storm Surge and Wave Forecasting" held in Beijing, China from 25-29 July 2005.

3

1d. Training progress

Other overseas training Opportunities/Courses/Seminars/Workshops attended by SMG personnel:

Overseas Training Course/Seminar/Workshop Venue Duration No. of participants

Third WMO International Workshop on Monsoon Studies (IWM-III) Hangzhou, China 2-6 Nov 2004 2

International Symposium on Tropical Weather and Climate Guangzhou, China 7-11 Nov 2004 2

Conference on Tendancy of Guangdong Earthquake Guangzhou, China 16-17 Nov 2004 1

Meeting on Data Assimilation Guangzhou, China 19 Nov 2004 1 Visit to Guangdong Meteorological Bureau Guangzhou, China 7 Dec 2004 11

5th Seminar on Urban Air Quality in Pearl River Delta Region Guangzhou, China 24-26 Nov 2004 2

Training Course on Lightning Location Detecting Network System Hong Kong, China 5-6 Jan 2005 1

Training Workshop on ISCS and SADIS Workstation Operation and Display of WAFS Products using GRIB and BUFR Code Forms

Bangkok, Thailand 25-27 Jan 2005 1 WMO Technical Conference on Public Weather Services St. Petersburg, Russian Federation 21-22 Feb 2005 1

19th Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology held Yangjiang, China 1-3 Mar 2005 6

Seminar on Climatic Tendency Prediction and Regional Meteorological Cooperation Zhuhai, China 3-4 Mar 2005 2

Seminar on Climatic Tendency Prediction of southern China during the Rainy Season of 2005 Zhanjiang, China 14-15 Mar 2005 1

Seminar on Monitoring Experiment and Research of Heavy Rain in southern China Guangzhou, China 4-5 Apr 2005 1

First Session of the Forum on Regional Climate Monitoring-Assessment-Prediction Beijing, China 7-9 Apr 2005 1

9th Management Committee Meeting and Working Group Meeting of COST Action 720 –Integrated ground-based remote-sensing stations for atmospheric profiling Helsinki, Finland 13-15 Apr 2005 1

RAII/V Training Workshop on Ensemble Prediction Systems Shanghai, China 18-23 Apr 2005 14

Regional Workshop on Effective Tropical Cyclone Warning Shanghai, China 24-28 Apr 2005 1

3rd Meteorological Technical Conference between China-Macao-Portugal Shanghai, China 11-13 May 2005 3

Lecture on Earthquake and Tsunami Hong Kong, China 18-20 May 2005 3

Visit to Hong Kong Observatory Hong Kong, China 3 Jun 2004 3

9th Meeting of the Communications/Navigation/Surveillance and Meteorology Sub-Group (CNS/MET/SG/9) of APANPIRG Bangkok, Thailand 11-15 Jul 2005 1

Total: 21 46

1e. Research Progress

Following were papers presented by our colleagues at the 19th Guangdong-Hong Kong-Macao Seminar

on Meteorological Science and Technology held in Guangzhou, China on March 2005:
(1) Application of QuikSCAT wind data in the Strong Wind Forecasts of the South China Sea Tropical Cyclones.
(2) Initial study on the storm surge in Macao.
(3) The Cumulative Probability of Macao 1971-2000 Precipitation and the Application of Standardized Precipitation Index (SPI).
(4) Degree days and the consumption of electricity in Macao. Paper on “Numerical Study on Landfall Process of Typhoon Vongfong(0214)” was presented at the “WMO International Workshop on Tropical Cyclone Landfall Processes” which was held in Macao, China on 21-25 March 2005.

In cooperation with “China Meteorological Press”, a book in English version namely “MMGB Collected Papers (Vol.1 English Version) --- Asia Summer Monsoon and Mesoscale Numerical Simulation úW Vol.1 were published on March 14 2005.

1f. Other Cooperative/RCPIP Progress: Nil

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

2a. Hardware and Software Progress

New Radar Processing and Visualization software - Interactive Radar Information System (IRIS) was installed and operated which improve the capability and availability of radar products and data exchange. Radar scanning is also shortened from 15 minutely to 12 minutely to enhance severe weather monitoring.

FY-2C satellite ground receiving system was installed which greatly enhance the monitoring and analyzing of severe weather. The system can also receive MTSAT signal if software is upgraded in order to generate image products.

A new Linux HPC Cluster is under installation. The cluster includes 10 computing nodes and a master node with IBM eServer, Redhat Linux and Cisco gigabit network connection which will provide a better platform to run the existing MM5 model. Hopefully, a 2 hours run will be improved to be within 30 minutes. SMG will also implement more applications on this system in the coming future.

Two AWS stations of wind sensors in bridges were upgraded in February. In order to enhance the protection of computer network system, the Anti-Virus software and email filtering software were renew as well as Anti-Spyware software is being implement.

A new AWS station was setup in April in the “Sai Van Bridge” for measuring wind speed and direction, which help enhance the monitoring of winds and the issue of warnings especially under tropical cyclone condition. The “Sai Van Bridge” is the third bridge between Macao and Taipa Island and is double-deck design bridge allows six lanes in the upper layer and four lanes in the lower layer which is shaped like a tube.

Installed a GPS receiver and Micro Phase Stepper to achieve the Standard Timing System, it is an improvement to let the system has “common view” function.

A VPN backup link is established for the purpose of backup the 64K leased line between SMG headquarter to SMG Webserver’s datacenter (located in ISP's data center). The VPN backup based on broadband internet connection is more stable especially during thunder storm period.

2b. Implications for Operational Progress

A new software is developed to decode and display the upper-air wind and temperature forecasts of the GRID code forms which are distributed through World Area Forecast Centres of London and Washington. It is an essential part of the flight documents provided to airlines.

The web page under "Aviation Weather" in the SMG internet homepage is re-constructed to be more informative.

XML format of all weather information were provided to Macao government internal usage thus to enhance data dissemination.

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

A new hidden homepage written in Java language was provided to Macao local television media in due to reinforce better service and easiness of the delivery of meteorological information and data.

The increase popularity of intellectual mobile phone and Personal Digital Assistant(PDA) provides increasing demand for people to access meteorological information with these tools in connection to the web. Therefore, a program of "Mobile Web Weather Service" was launched on February. With the new service, one could easily access meteorological information and warnings with mobile phone or PDA through the site: http://mobile.smg.gov.mo The disastrous tsunami event occurred in Indian Ocean on 26 December arose global attention on natural disaster. Hence, program on lecture project provided by our colleagues to local high schools' students from February 23 to March 29 in order to promote knowledge of general science on meteorology and geophysics.

Lecture topics included "Climate Change", "Earthquake and it's Effect", "Tropical Cyclone", "Knowing Rainstorm", and "Air Pollution and Health". Totally 24 lectures were delivered with 4739 students attended.

To enhance capability of safety management of heavy rainstorm especially to school student. Rainstorm exercise was performed with cooperation with the Education and Youth Affairs Bureau.

2d. Training progress

Eight colleagues from our bureau continued attend the Higher Diploma Course on Meteorology course in Macao Polytechnic Institute.

A short course on operational meteorology was provided to new colleagues. The course include subjects on Meteorological Telecommunication, Meteorological Instrument and Method of Observation and Weather Reporting, Weather Analysis and Forecasting, Meteorological Observation and Forecasting for International Air Navigation.

Dr. Masaru Chiba of MRI-JMA gave introduction of the Meteorology Research Institute of JMA during his visit to SMG on February 23 2005 while Dr. Yaping Shao delivered lecture on "Modeling and Data Assimilation of Atmosphere and Surface Interaction" during the same visit.

Professors Li Chong-yin and Dr. Gao Junsheng of Institute of Atmospheric Physics, Chinese Academy of Sciences, delivered lectures on "Climate Change and its Research", "ENSO and its Influence" as well as "Disease and Weather", while Dr. Zhou Wen of Sun at-sen University gave lecture on "The

Mechanism that Influence the Interdecadal Variation of the East Asian Winter Monsoon" during the period from 13 to 15 June 2005. Training course on Meteorology were held in cooperation with the Department ofAtmospheric Science, Nanjing University during January and July. 16 meteorologists from our bureau attended the course. The course include subjects on Principle of Meteorology and Diagnostic Analysis, Dynamic Meteorology and Numerical Weather Prediction, Climatology and Climate Diagnosis.

Ten IT staffs attend "e-Macao Extented Team Training". This training that last about a year and is provided by Macao Government, covering uml, java, web services and utilization of open source development tools.

2e. Research Progress

Meteorological research in collaboration with Department of Atmospheric Physics of Sun Yat-sen University, Guangzhou, China is continued. Eight research papers were published in different scientific journals and proceedings from October 2004 to October 2005:

1. Numerical Simulation of the Effect of Soil Drought on Short-Term Climate in North China, Plateau Meteorology, Vol.23 No.5, Oct. 2004, pp580-586(in Chinese)
2. Mesoscale Characteristics and Causes of Tropical Storm Fitow(0114) Heavy Rain, 9 Journal of Tropical Meteorology, Vol. 21 No.1, Feb. 2005, pp24-32(in Chinese)
3. The Effect of Ageostrophic Forcing on Typhoon Fitow(0114) Heavy Rain, Acta Meteorologica Sinica, Vol. 63 No.1, Feb. 2005, pp69-76(in Chinese)
4. The Climatic Characteristics of Maintaining Period of South China Sea Summer Monsoon I - 40 Yearly Average, Journal of Tropical Meteorology, Vol. 21 No.2, Apr. 2005, pp113-122(in Chinese)
5. Effect of Condensational Heating over the Bay of Bengal on the Onset of the South China Sea Monsoon in 1998 (English Version), Meteorology and Atmospheric Physics 90, pp37-47 (2005), pub. Online on April 5, 2005
6. Climatological Characteristics of the Maintaining Period of South China Sea Summer Monsoon II - Interdecadal Variation, Journal of Tropical Meteorology, Vol. 21 No.2, Apr. 2005, pp123-130(in Chinese)
7. Simulation Study on Cause of Tropical Storm Fitow(0114) Heavy Rain, Journal of Tropical Meteorology (English Version), Vol. 11 No.1, Jun. 2005, pp42-50.
8. Effect of Condensation Heating and Surface Fluxes on the Development of a South China Mesoscale Convective System (MCS), Journal of Tropical Meteorology, Vol. 21 No.4, Aug. 2005, pp368-376(in Chinese)
9. Numerical Experiment Research of a Marine Fog Event in the Pearl River Estuary Region, Acta Meteorologica Sinica (English Version), Vol. 19 No.2, 2005, pp231-240.

2f. Other Co-operative/RCPIP progress

Nil.

3. Opportunities for further Enhancement of Regional Co-operation

Nil.

In Malaysia

1.1 Enhancement of Facilities in the Malaysian Meteorological Department (MMD)

For the year under review, MMD has made substantial investment to enhance its facilities and infrastructure to further improve its observation network, forecasting capabilities and dissemination of weather, marine and seismological related information. One most notable development after the 2004 December 26 tsunami is the establishment of a National Tsunami Warning Center in MMD. This center is expected to be operational by the end of 2005. The tsunami warning system that includes tide gauge sensor and drifting buoys to monitor changes in the sea level will also be used to monitor storm surges caused by tropical storm or typhoons and the warning dissemination system will also be in times of disasters caused by tropical storms.

The department acquired a High Performance Computing Cluster (HPC) in the middle of 2005 for the purpose of enhancing our numerical weather prediction capabilities. The HPC cluster consists of 2 dual processor Head Management Unit and 9 quad processor compute nodes running on HPC Cluster Operating Environment (Rocks Linux Cluster Distribution). It was commissioned on 12 August 2005 to run operationally the 5^{th} Generation MM5 NWP model. The MM5 model is run twice a day at 00Z and 12Z cycles at a resolution of 36 km over the whole Southeast Asian region and 12 km over the Malaysian region with 23 vertical levels in the sigma coordinate. The initial field and boundary conditions are obtained from NCEP gfs (AVN) forecast. MMD would like to acknowledge the assistance provided by three experts from China Meteorological Agency who visited the department for a period of one month each from August to October 2005 to help in the data assimilation and initialization component of the model.

Since January 2005 all 36 principal meteorological stations were switched to the Automatic Weather System (AWS) and all meteorological parameters are automatically transmitted to a central server in the headquarters for further processing and archival. 21 new auxiliary stations using the AWS became operational this year, in addition to the 63 already in operation in Peninsular Malaysia.

In 2005, 15 stations under the marine meteorology observation program became operational throughout the country, 7 in Peninsular Malaysia and 8 in the states of Sabah and Sarawak. All stations are equipped with automatic weather observation system and 4 of these stations also measures sea parameters like wave height, sea current, sea level and sea surface temperature.

A new weather radar became operational in May 2005. It is located in Alor Star to give better coverage of the northwestern region of Peninsular Malaysia. Towards the end of 2004 the receiving and processing system for the FY-2C geostationary satellite was commissioned and it is now fully operational. Currently upgrades to the GMS receiving and processing systems are being carried out to receive the next generation MTSAT satellite data which has replaced the GMS.

1.2 Training

The Malaysian Meteorological Department (MMD) hosted the Typhoon Committee Roving Seminar on Operational Application of Multi-Model Ensemble Typhoon Forecasts from 25 to 27 November 2004 at its headquarters' in Petaling Jaya. It was attended by 11 participants which also included one participant each from Singapore, Thailand and Cambodia. The resource persons were Dr. Nobukata Mannoji from JMA and Prof. Johnny C.L. Chan from City University of Hong Kong.

Personnel from MMD participated in numerous international training workshops, seminars and conferences related to meteorology and disaster management that were held internationally and within the country. Some of the international seminars, conferences, workshops, symposiums, meetings attended by staff from MMD between January and September 2005 are listed in the following table.

Seminars/Conferences/Workshops/Symposiums/meetings	Duration	Place
Technical vist to International Tsunami Information Center and Pacific Tsunami Warning Center.	4 - 7 Jan	Honolulu, Hawaii, USA
World Conference on Disaster Management	18 - 22 Jan	Kobe, Japan
Discussion with (NOAA) dan Pacific Tsunami Warning Centre (PWTC) regarding the establishment of a Tsunami Early Warning system	22-29 Jan	Washington, Seattle and Honolulu,USA
ASEAN-China Workshop on Earthquake-Induced Tsunami warning	25-26 Jan	Beijing, China

The ministerial Meeting on Regional Cooperation on Tsunami Early Warning Arrangements	28-29 Jan	Phuket, Thailand
IOMEC Conference Special Session on IO Tsunami	14-18 Feb	Perth, Australia
Experts' meeting on tsunami early warning system	21-22 Feb	Bangkok, Thailand
APT-ITU Joint Meeting on the Role of ICT for Disaster Reduction	28 Feb - 5 March	Bangkok, Thailand
International coordination meeting for the development of a tsunami warning and mitigation system for the Indian Ocean within a global framework	3-8 March	Paris, France
JICA Regional Seminar on Tsunami Early Warning System	6-19 March	Japan
Multidisciplinary workshop on the Exchange of Early warning and Related information including Tsunami Warning in the Indian Ocean	16-18 March	Jakarta, Indonesia
Indian Ocean RIM Association for Regional cooperation (IOR-ARC) Workshop on Disaster Mitigation and Management, Tropical Cyclones	16-17 March	Delhi, India
International Training Symposium for Typhoon and Flood Disaster Reduction	21- 25 March	Taiwan
Special Meeting of the ASEAN Sub-Committee on Meteorology and Geophyscis (SCMG) on Tsunami Early Warning System	7 - 8 April	Singapore
Training course on weather Forecasting for Operational Meteorologists	10 April - 5 May	Seoul, Korea
Workshop on Hurricane Forecasting and Warning and Public Weather Services	11-23 April	Miami, USA
Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation system for the Indian Ocean	14-16 April	Mauritius
RA II & V Training workshop on Ensemble Prediction System	18-23 April	Shanghai, China
Regional workshop on Tropical Cyclone Warning	24-28 April	Shanghai, China
International Training Course on Monsoon Meteorology	24 April - 20 May 2005	Nanjing, China
The Seventh Joint Meeting of Seasonal prediction on East Asian Summer Monsoon	11 - 13 May	Nanjing, China
Asia Pacific All Hazards Workshop	6 - 10 June	Honolulu, Hawaii
The UN/ISDR and UNESCO/IOC Study Tour on National Tsunami Warning System Implementation for High Level Administration Responsible for Tsunami Warning Activities	11-14 July	Tokyo, Japan
The Third Regional Workshop on Storm Surge and Wave Forecasting - A Hands on Forecast Training Laboratory	25-29 July	Beijing, China
The UN/ISDR and UNESCO/IOC Study Tour on National Tsunami Warning System Implementation for High Level Administration Responsible for Tsunami Warning Activities	26-29 July	Hawaii, USA
First Meeting of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICD/IOTWS)	3 - 5 August	Perth, Australia
Asian Conference on Disaster Reduction	27- 29 Sept	Beijing, China
i) Twentieth Session of the Intenational Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) ii) The International Workshop on Large Recent Tsunami in the Indian Ocean and Other regions	29 Sept - 7 Oct.	Santiago and Valparaiso, Chile

1.3 Research

In MMD, research work is mainly focused on (i) understanding the atmospheric process at the local scale on diurnal timescales to improve the short range prediction of heavy rainfall events, (ii) cold surges and intraseasonal oscillation during the winter monsoon to better predict widespread heavy rainfall episodes. In addition studies are also being carried out to understand the interannual variability of the monsoons and the impact of ENSO on the Malaysian weather and the scale of impact for different seasons of the year and different regional locations.

In the **Philippines,**

I. Overview of Meteorological and Hydrological Conditions during the Year
(Combined Meteorological, Hydrological and Socio-economic Assessments)

The occurrence of a series of extreme weather disturbances in the country that caused hundreds of casualties and considerable damage to properties and infrastructure once again highlighted the important role of PAGASA in disaster preparedness. The flash floods in November 2004 claimed thousands of lives in the province of Quezon, Aurora and Nueva Ecija in Luzon. It created an unsurpassed awareness on the need for a reliable early warning system. This prompted the government to set its focus on upgrading the forecasting capabilities of PAGASA through a Memorandum Circular issued by the National Disaster Coordinating Council (NDCC) in January 2005.

The NDCC Memorandum instituted the Four-Point Action Plan in Disaster Risk Mitigation which provided the impetus for PAGASA to pursue an upgrading of its monitoring facilities in order to improve its forecasting and warning services. The funding support for the implementation of projects is being sourced from the national budget and from foreign grants.

II. METEOROLOGY

2.1 Progress in member's Regional Cooperation and Selected RCPIP Goals and Objectives

2.1.1 Hardware and software progress

a. Philippine Interactive Climate and Weather Information Network (PICWIN)

In keeping up with the global boom in the information technology, the PAGASA is currently working on the Philippine Interactive Climate and Weather Information Network (PICWIN) project. This project involves the provision of a cellular-based meteorological telecommunication (CMT) to PAGASA field stations for data transmission and dissemination of forecasts and warnings. The project will enhance the agency's capability in weather, climate and hydrological forecasting and warning through the timely reception of observed data and faster dissemination of forecasts and warnings.

The PICWIN project also includes the acquisition of a PC cluster computing system. It aims to increase the computing speed of PAGASA for numerical modeling purposes. This project is supported by the e-Government fund administered by the Commission on Information and Communications Technology.

b. Receiving system for WAFS products

To support the meteorological aviation service, a receiving system for the World Area Forecast System (WAFS) products was acquired. With the acquisition of the receiving system for WAFS products, the PAGASA is able to provide improve meteorological services to the aviation industry.

c. Rehabilitation of weather radars

The government through the Department of Science and Technology (DOST) provided PhP17 million (US$300,000) for the repair of the five (5) existing weather radars which are strategically situated in areas that are frequently hit by tropical cyclones. The devastating floods landslides that occurred late last year highlighted the need to upgrade equipment and facilities of PAGASA.

2.1.2 Implications to operational progress

The PAGASA continuously envisions to provide timely and reliable services to the country. The establishment of a cellular-based communication system or also known as short messaging system (SMS) is a cheap and reliable means of communication. This will enable PAGASA to have timely collection of data at the weather and flood forecasting center and prompt dissemination of forecasts and warnings to the public.

The new WAFS receiving system offers PAGASA the capability to provide a wide range of forecast information for civil aviation. This will help ensure efficient and safe operations of international as well as local airliners.

The newly rehabilitated radars which are strategically located in areas often affected by severe weather systems will enable PAGASA to monitor developments in the surrounding areas in real-time for improved weather forecasting and warning services.

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

a. Enhancement of Marine Weather Services

Maintaining its commitment to improve the delivery of marine forecasting services, the PAGASA has recently renewed its collaboration with the Department of Transportation and Communication (DOTC), Philippine Coast Guard (PCG), Maritime Industry Authority (MARINA) and the Philippine Ports Authority (PPA). It reiterated its call for a wider linkage in the establishment of a clear protocol on the acquisition of meteorological data at sea. Such concerns relate to the recruitment of additional ships under the WMO-guided Voluntary Observing Ship Program (VOS), the provision and installation of instruments and other equipment on ships and related coastal infrastructure, human resource development, establishment of timely and efficient data transmission system and the implementation of new guidelines for the proposed scheme. On October 3-4, 2005, the PAGASA conducted a seminar/workshop attended by representatives from the cooperating agencies, together with ship owners. This undertaking is geared towards the establishment of an effective marine forecasting and warning services in the country.

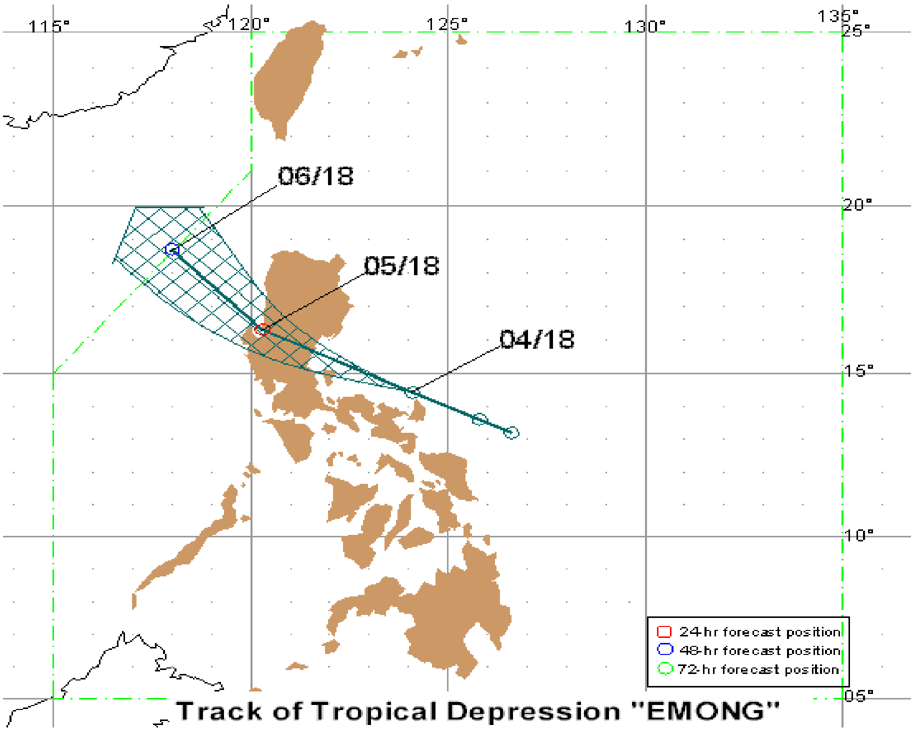
b. Introduction of marine gale warning system

The marine gale warning provides, among others, information on the threat of gale force winds associated with severe weather disturbances and the resulting sea conditions. It is issued twice daily at 5AM and 5PM during severe weather conditions when the expected gale force winds is at least 34 knots (64 kph) within Philippine territorial seas. Like the tropical cyclone bulletins, the warning will be used by government agencies concerned with maritime safety.

c. Improvement of Severe Weather/Typhoon Bulletins

Severe Weather/Typhoon Bulletins issued by PAGASA whenever a tropical cyclone threatens any part of the country contains a graphical presentation with a map of the Philippines and surrounding seas within the Philippine Area of Responsibility. The bulletin also include the past and current positions of the tropical cyclone, and its forecast track for the next 36 hours. Previously, a line is used to depict the cyclone's forecast track, which corresponds to the path of the cyclone's center, or "eye". However, this does not take into consideration the size of the cyclone and the forecast error.

Last July 2005, the PAGASA introduced a new feature in presenting the forecast tracks of tropical cyclones. An example of an actual presentation is shown below:



Source: Severe Weather Bulletin No. 3, issued 5:00 a.m., 05 July 2005.

Figure 6. Improved version of the tropical cyclone map

Starting from a point representing the cyclone's current position, a gradually widening swath of area is projected to identify the places over which the cyclone would most likely traverse. This allows for an acceptable margin of error in projecting the movement of the cyclone. This considers the inherent complexity of the atmospheric processes involved and the limitations of the current level of knowledge in the science of meteorology in general and of weather forecasting technology in particular.

2.1.4 Training progress

a. Foreign

Name	Title	Date & Venue	Sponsor
Rosa Perez	1st Lead Authors Meeting for the Working Group II Contribution to the IPCC Fourth Assessment Report	20 – 23 Sept 04 Austria	IPCC
Mario Palafox	National Weather Service Pacific International Training Desk	25 Oct–11 Dec 04 Hawaii	NOAA and National Weather Service Pacific Region

Thelma Cinco	Climate Data Management for RA V	29 Nov–03 Dec 04 Australia	WMO
Flaviana Hilario	Meeting of the Expert Team on Climate Information And Predication Services (CLIPS) operation, including Product Generation with Emphasis on Countries in Need	12 – 15 Oct 04 United Republic of Tanzania	WMO
Edna Juanillo	22nd Session of the Intergovernmental Panel on Climate Change	09 – 11 Nov 04 India	IPCC
Carina Lao	1st THORPEX International Science Symposium	06 – 10 Dec 04 Canada	WMO
Martin Rellin, Jr. Margaret Bautista	37th Session of the Typhoon Committee of the Economic & Social Commission for Asia & the Pacific/World Meteorological Organization	16 – 20 Nov 04 China	ESCAP/WMO
Thelma Cinco	Group Training Course on Development of Strategies on Climate Change	11 Jan – 03 Mar 05 Japan	JICA
Rosa Perez	International Workshop on Community Level Adaptation of Climate Change	16-18 Jan 05 Bangladesh	Bangladesh Center for Advanced Studies
Bernadeth Lucillo	Seminar on Policy Implementation & Alternative Technologies Concerning Ozone Layer Protection	16 Jan – 19 Feb 05 Japan	WMO
Rolymer Canillo	Asia Pacific Training Workshop on International Satellite Communication System	25 – 27 Jan 05 Thailand	United Kingdom
Nancy T. Lance	2nd Workshop on Earthquake Engineering for Nuclear Facilities, Uncertainties in Seismic Hazard Assessment	14 – 25 Feb 05 Italy	International Center for Theoretical Physics
Lourdes V. Tibig	Meeting of the Implementation Coordination Team on Impacts of Climate Change /Variability & Natural Disasters on Agriculture	21 – 23 Feb 05 New Zealand	World Meteorological Organization
Flaviana D. Hilario	Joint Integrated Global Water Cycle Observing (IGWCO) Coordinated Enhanced Observing Period (CEOP) Workshop	28 Feb – 04 Mar 05 Japan	Japan Aerospace Exploration Agency
Rosa T. Perez	2nd Lead Author's Meeting for the Working Group II for the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report	14 -17 Mar 05 Australia	IPCC Trust Fund
Nathaniel T. Servando	International Workshop on Tropical Cyclone Landfall Processes	21 – 25 Mar 05 PR of China	WMO
Daisy F. Ortega	1st Session of the Forum on Regional Climate Monitoring -Assessment-Prediction for Asia	07 – 09 Apr 05 PR of China	China Meteorological Administration
Bonifacio G. Pajuelas	Spring Colloquium on Regional Weather Predictability &	11 – 22 Apr 05 Italy	International Center for Theoretical

	Modeling		Physics
Roberto T. Rivera	RA IV Workshop on Hurricane Forecasting & Warning & Public Weather Services	11 – 23 Apr 05 USA	WMO
Vicente B. Malano	RA II/V Training Workshop on Ensemble Prediction Systems	18 – 23 Apr 05 PR of China	WMO
Graciano P. Yumul Rosa T. Perez	Regional Workshop on Effective Tropical Cyclone Warning	24 – 28 Apr 05 PR of China	Typhoon Committee Trust Fund
Sharon Juliet M. Arruejo	International Training Course on Monsoon Meteorology	24 Apr – 20 May 05 PR of China	WMO (airfare) & Regional Meteorological Training Center
Catalino L. Davis	WMO Technical Conference on Meteorological & Environment Instruments & Methods of Observation (TECO-2005)	04 – 07 May 05 Romania	WMO
Efigenia C. Galang	Regional Training Seminar for National Trainers of RA II & RA V	16 – 27 May 05 Malaysia	WMO
Lourdes V. Tibig	22nd Session of the Subsidiary Body for Scientific & Technological Advice (SBSTA) & the Subsidiary Body for Implementation of the United Nations Framework Convention for Climate Change (UNFCCC)	15 – 27 May 05 Germany	UNFCCC
Rolu P. Encarnacion	6th Session of the Intergovernmental Oceanographic Commission (IOC) Sub-Commission for the Western Pacific (WESTPAC IV)	23 – 27 May 05 Viet Nam	IOC/WESTPAC
Angeles Doniego Nestor Nimes	Protocol of the 13th Session of the Joint Committee on Science and Technology Cooperation between China & the Philippines	19 – 25 June 05 China	Institute of Geophysics, China Earthquake Administration (IGCEA)
Martin F. Rellin, Jr. Alan L. Pineda Nancy T. Lance	Joint Technical Discussion and Studies concerning the PAGASA Modernization Program	03 – 07 Jul 05 Spain	National Meteorological Institute (INM)
Rosa T. Perez	IGES Consultation on proactive Micro-Adaptation: Implications for International Climate Negotiations & Sustainable Development	13 – 14 Jul 05 Japan	Institute for Global Environment Strategies (IGES)
Rosalina G. de Guzman Anthony Joseph R. Lucero Daisy F. Ortega Hannagrace F. Cristi	Climate Forecast Application Workshop	18 – 21 July 05 Thailand	Asian Disaster Preparedness Center (ADPC)
Fredolina D. Baldonado	3rd Regional Workshop on Storm Surge and Wave Forecasting	25 – 29 Jul 05 PR of China	WMO
Cynthia P.	9th Asia Pacific Regional	25 – 29 Jul 05	International

Celebre	International Astronomical Union Meeting (APRIM 2005)	Indonesia	Astronomical Union
Carina G. Lao Fredolina D. Baldonado	13th Session of the Joint Commission on Scientific & Technological Cooperation between the Government of China & the Philippines	31 Jul – 06 Aug PR of China	People's Republic of China
Nathaniel T. Servando	2nd ASEAN Science Congress, & Sub-Committee on Meteorology & Geophysics Conference	04 – 07 Aug 05 Indonesia	Government of Indonesia

b. Local trainings/seminars/workshops/conferences conducted by PAGASA

Course Title	Date
Agro-climatology Training Course	06-16 Dec 2005
Computer Literacy Program (PowerPoint Module)	15-22 Mar 2005
Computer Programming Course (Visual Basic and C+ Programming Language)	Feb-Mar 2005
Conduct of Refresher Course for Operational Forecasting: ADPC	Mar.-May 2005
Training on Climate Prediction Tools: ADPC	13-15 July 2005
Meteorological Technicians Training Course (MTTC)	Feb-Sep. 2005
Training for Port Meteorological Liaison Officers (PMLO)	5-6 July 2005
Short Course in Linux and its Application	22-29 August 2005

2.1. 5 Research Progress

Development of Typhoon Wind Damage Scale

One way of addressing damage from strong winds and other hazards associated with typhoons is to express the intensity in terms of potential effects of the wind on local structures, vegetation and safety of the general public. Using a typhoon damage model, the typhoon damage scale can be generated with accurate wind observations and precise damage reconnaissance survey. The typhoon damage scale gives an indication of the degree of potential damage in different localities given a forecast typhoon track and wind speed. The damage scale will be very useful for policy and decision-makers in the preparation of contingency plans and emergency response in the event of a typhoon. As a result, local communities will be able to assess the degree of cyclone threat and take appropriate action using the typhoon damage scale as basis.

Stochastic Modeling of Daily Rainfall

The objective of this study is to develop a statistical scheme to predict accumulated 24-hour rainfall amount. In this study climatic variables are correlated and used to predict the intensity and variability of rainfall using the transfer's function model. The predicted rainfall distribution and intensity will be useful as input for flood forecasting models.

2.1.6 Other Cooperative Progress

Bridging the Gap Between Seasonal Climate Forecasts and Decision Makers in Agriculture

Rainfed agriculture in the Philippines is greatly affected by the El Nino Southern Oscillation (ENSO). One possible way to address the problem is through the provision of seasonal climate forecasts (SCF). The framework would be to promote more sustainable and extensive adoption of SCF. This project would enable policymakers to utilize and integrate SCF in decision-making and for farmers to apply the SCF in their farming operation. The application of SCF will increase the income of rural communities and contribute to national productivity.

In Thailand

Overview of Meteorological and Hydrological Conditions during the Year

(1) Meteorological Assessment

During 1st October 2004 – 15th September 2005, Thailand was affected by one typhoon, one tropical storm and three tropical depressions.

2. Hydrological Assessment

In 2005, there are four storms hit Thailand. The first one, low pressure trough aligned along North and North-east direction, occurred on July 13, 2005 and caused heavy rainfall in the central part of Thailand, especially Bangkok. The maximum daily rainfall recorded as 173 mm. caused flood inundation in many parts of Bangkok. The appearance of low pressure trough favoured for Washi to originate and resulting in rainfalls with flash flood in some part of the northern.

The second one, depression in the Northern part of Thailand, occurred during August 12-15, 2005 and caused severe flood in the northern part of Thailand eg. ChiengMai, ChiengRai, Mae Hongsorn. The two-day rainfall was recorded as 145 mm. Many areas in ChiengMai were inundated and not only bridges were flooded away but also mud slides and debris flow happened in Mae Hongson province. The flood volume of 250 mm was estimated to fill in the space of Bhumiphol dam after drained down from Chieng Mai province.

The third one, depression in the Northern and North-eastern part of Thailand, occurred during August 26-30, 2005 and caused minor flood inundation in Ampor Mae Chan, ChiengRai. The maximum average daily rainfall was recorded as 50 mm on August 27, 2005.

The last one, depression in the Central part of Thailand, occurred during September 6-15, 2005 and caused minor flood in the Northern and North-eastern parts of Thailand eg. ChiengMai, Lam Pang, Sukhothai.

3. Socio-e-economic Assessment

The above mentioned typhoon, tropical storm and depressions had caused severe floods in many areas of Thailand especially in northern and central parts of Thailand. The summary of damages induced by them are shown as in Table 1 – 5 respectively.

Meteorology

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

a. Hardware and/or Software Progress

+ TMD has set up a plan to upgrade hardware, software and equipment of the GTS between Bangkok-Singapore and Bangkok- New Delhi in the near future. National budget has been set up this year for this purpose.

b. Implications to Operational Progress

+ NWP models have been run at TMD with a number of domains: global (100 km resolution), Southeast Asia (48 km resolution), Thailand (17 km resolution), and Bangkok (5 km resolution). All models are based on the Unified Mode. At present, TMD usually runs the Global, the Southeast Asia, and the Thailand models as a part of its operation for 168, 72 and 36 hours forecasts respectively. The Southeast Asia Model products and the Thailand Model products are also provided on website of TMD.

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

+ TMD continued its participation in the World Weather Information Service (WWIS) by providing weather information as well as weather outlook for each of 15 tourist destinations of Thailand in order to make it possible and easy for the tourists to access the information of those places.

+ Aside from radar, satellite, synoptic data and NWP products from Thailand model, TMD has also brought NWP products from other weather centers to jointly use for its weather analysis and forecasting.

+ TMD has increasingly exchanged data and information on the tropical cyclones between NMHSs via Internet. We also made available of Thailand's weather data and tropical cyclone forecasts on TMD's website.

d. Training Progress

+ TMD successfully organized one Training Course on Typhoon Forecast by Using NWP Technique at the headquarters in Bangkok from 22 to 31 August 2005. The Japan Meteorological Agency kindly supported an expert, Mr. Mannoji Nobutaka, Head of National Typhoon Center, as the lecturer of the course.

e. Research progress

+ Participation of one meteorologist from TMD in the Evaluation of the Model Performance in Typhoon Prediction in the high-resolution global of KMA for 3 months (1 August – 30 Oct 2005) at the Typhoon Research Center, Kongju National University, Republic of Korea

e. Other Cooperative/RCPIP Progress: Nil

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

a. Hardware and/or Software Progress

+ To strengthen disaster watch and warning of the Nation, three more rain-gauge stations were set up : one in Rayong, two in Chaing Mai.

+ The progress on installation of equipment under aeronautical meteorological project at Suvarnabhumi Airport, the new International Airport of Thailand had been made as below :

- The Automatic Weather Observation System (AWOS) and the Doppler Radar had completely been installed during the year.
- Other necessary systems such as lighting protection system and wind shear observation system has been installing and expected to be completed early next year.

b. Implication to Operation Progress

+ TMD increased an application of NWP for forecasting tropical cyclones and organized training courses in this field for its forecasters during the year in order to increase knowledge and NWP technique for them and expand a number of NWP trained staff. The efforts had been made to meet the goals of improving accuracy and efficiency of weather forecast.

+ Disaster warning and preparedness project in local areas is planned to implement in cooperation with the Local Authority Unit, for the safety and well prepared of people in disaster risk areas.

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

+ TMD has improved the provision of tropical cyclones data and information to meet the requirement of the users in Thailand as below : -

- Using more graphics and satellite imagery to show the storm natures and tracks.
- Providing weather report and warning via mobile phone.
- Providing live TV broadcasting of weather forecast by Forecasters from TMD's studio

+ To be able to reach people directly all, TMD produces and broadcasts weather report and forecast, warning and other meteorological knowledge via 6 TMD'radio broadcasting stations located in each part of Thailand. The interesting broadcasting programme includes :

- TMD Hour for Public
- Our Weather Situation
- TMD Radio for Community

+ Educate meteorological and disaster related knowledge to 1,244 students to understand the real nature of meteorology.

d. Training Progress

Local Training

Since 1 October 2004 till 30 September 2005, TMD had provided training courses to its staffs on the regularly basis with the hope to be able to enhance their potentials in order to prepare them to cope with the advanced technology and concerned recent academic development. The local training had been conducted in country are shown in Table 3

Table 5 : The list of the local training course provided by the TMD for its staffs

No.	Course Title	Duration	No. of Participants
1.	Computer Training Course for Administrators	13 – 17 Dec. 2004	32
2.	Training course and Demonstration on Fire Disaster Protection.	4 Mar. 2005	50
3.	Training Course on Knowledge Management towards Quality Organization	22 Mar. 2005	87
4.	Training Course on Organization of Learning and Knowledge Management	22 – 23 Mar. 2005	140
5.	Training Course on Capacity Building of Civil Servants to meet the Major Competency	18 – 19 Apr. 2005	71
6.	Training Course for Teachers on "Thailand Climate"	26 – 27 Apr. 2005	53
7.	Training Course on Guidelines for Excel Loader Practices	15 – 16 Jun. 2005	86
8.	The 1st Training Course on Roles and Duties of Meteorological Stations	12 – 14 Jul. 2005	35
9.	The 2nd Training Course on Roles and Duties of Meteorological Stations	26 – 28 Jul. 2005	33
10.	Training Course on Technology of Grid System	19 – 20 Jul. 2005	50
11.	Training Course on Application of Weather Models	26 – 29 Jul. 2005	45
12.	Training Course on e-Documentary System	15 – 19, 22 Aug. 2005	229
14.	Training on Typhoon Forecast by Using NWP Technique"	22 – 31 Aug. 2005	35

Overseas Training

During 1 October 2004 – 30 September 2005, the staffs of the TMD had joined overseas training as shown in Table 4

Table 6: The overseas training courses which the staffs of the TMD had joined.

No.	Course Title (s)	Duration	Country	No. of participant (s)
1.	Short Term Exchange Programme in Science and Engineering "Introduction to Atmospheric Environment Science and Soi	1 Oct. 2004 – 30 Sep. 2005	Japan	1

	Engineering and Independent Study"			
2.	Pre-Symposium Training Course on Recent Trends in Seismic Networks, Data Processing and Exchange, Hazard and Risk Assessment and Disaster	4 – 17 Oct. 2004	Armenia	1
3.	Training Course on Agrometeorology	1 – 19 Nov. 2004	China	1
4.	The 4th Regional Training Course on Earthquake Vulnerability Reduction for cities (EVRC-4)	29 Nov. – 3 Dec. 2004	Indonesia	1
5.	WMO Training Seminar on Curriculum Development in Aeronautreal Meteorology	7 – 11 Mar. 2005	United Kingdom	1
6.	Regional Training Seminar for National Trainers of RAII and RAV	16 – 27 May. 2005	Malaysia	1
7.	First Combined Modeling and Data Management Training Workshop	4 – 10 Sep 2005	Belgium	1

- 11 -

e. Research Progress

+ The Researches in the Field of Tropical Cyclone done by the staff of the TMD can be listed as below : -
  - The Relation of Tropical Depression and Wind Speeds in the Gulf of Thailand.
  - Tropical Depression Behavior Changes due to Surface Friction.
  - Rainfall Estimation from GMS and TRMM over Thailand.
  - A Study of Behavior of Sea Surface Temperature Relating to Tropical Depression Formation Using TRMM.
  - A Study of Winds and Rain Rates at Sea Surface in Tropical Cyclones Using Remote Sensing Data.
  - Storm Surge Research Using Artificial Neural Network

f. Other Cooperative /RCPIP Progress: Nil

3. Opportunities for Further Enhancement of Regional Cooperation

+ Dr. Tokiyoshi Toya, Director of WMO Voluntary Cooperation Programme : VCP, visited TMD on 18 May 2005 During visit, he gave a brief lecture on VCP and encouraged TMD to take advantage of this project for future cooperation.

+ Exchange of Letters between ASEAN SCMG and KMA was made in August 2005, to strengthen official cooperation among MNHSs of ASEAN countries and KMA in meteorology and related scientific area.

In the United States of America

I. WFO Guam, Micronesia, Western North Pacific

A. Overview

1. Meteorological Assessment - Typical of the year following an El Nino year, tropical cyclone activity in the western North Pacific Ocean area of responsibility (AOR) for the U.S. National Weather Service was below normal, as most storms did not reach severe tropical storm or typhoon intensity until they were north and west of the Micronesian islands. Twenty tropical cyclones transited the WFO Guam AOR during the period from 1 October 2004 to 30 September 2005, and only fifteen had any direct effect on the islands. None produced any extensive

damage during this period.

2. Hydrological Assessment - Due to the below normal tropical cyclone and monsoon activity, rainfall was about 10% below normal over most of Micronesia and 20% below normal over the northern Republic of the Marshall Islands. As a result, there were fewer long-duration heavy rainfall events, and thus, few flash flood and mudslide events on the mountain islands of Micronesia.

3. Socio-economic Assessment - Due to a mild tropical cyclone and monsoon year, extreme wind, storm surge and rainfall events were rare. The drier than normal conditions were not severe enough to seriously impact agriculture or to require fresh water augmentation. As a result, weather had minimal impact on the socio-economic conditions of Micronesia.

B. Meteorology

The 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, watches, warnings and advisories within its AOR (see Figure 1). The Guam WFO AOR encompasses an ocean area of more than four million square miles with more than 2000 Micronesian islands. It includes the CNMI, Republic of Palau (ROP), Federated States of Micronesia (FSM), Republic of the Marshall Islands (RMI), and U.S. Territory of Guam. The FSM includes the States of Chuuk, Yap, Pohnpei, and Kosrae.

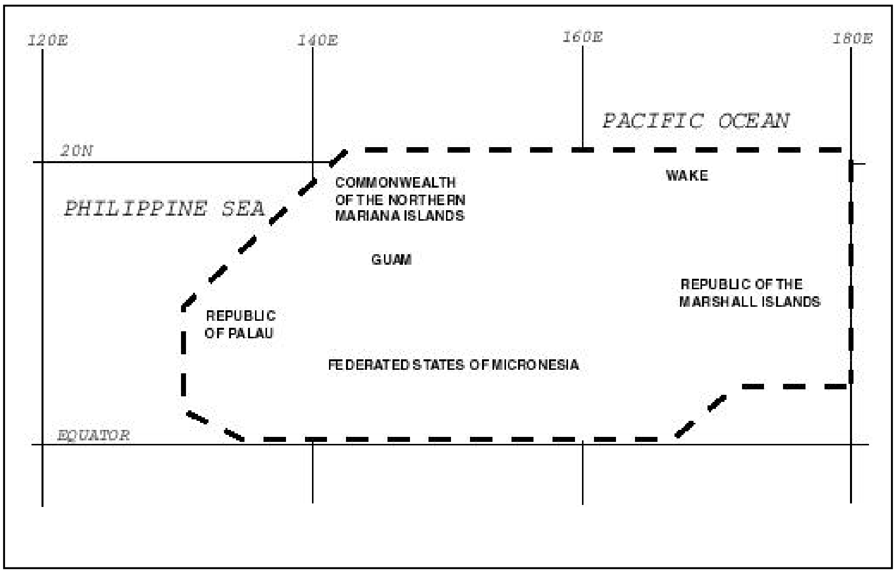


Figure 1. WFO Guam's area of responsibility (AOR). Within this AOR, WFO Guam issues tropical cyclone watch, warning and advisory products based on JTWC tropical cyclone forecasts.

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

a. Hardware and/or Software Progress.
Interactive Forecast Preparation System (IFPS). The WFO Guam IFPS is a system that enables forecasters to produce graphical products from tailored grids. Six products became official—surface temperature, maximum and minimum temperature, dew point, weather, and 12-hour probability of precipitation. Several other "experimental" fields/graphical products are available on the WFO Guam web page.

WFO Guam web site. WFO Guam completely rebuilt its web page to make it simpler to use, faster to load, and standardized and compliant with National Weather Service directives.

A primary benefit is the faster load-time that allows customers with limited band-width to access WFO Guam products, advisories, and warnings much more quickly.

b. Implications to Operational Progress. Nothing to report (NTR).

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

d. Training Progress.

Satellite Interpretation. During annual visits to the Weather Service Offices (WSOs) of Micronesia, the WFO Guam Warning Coordination Meteorologist (WCM) provided satellite interpretation and streamline analysis training. The satellite training included visual, infrared, water vapor, microwave, and scatterometer data.

QuikSCAT. In June 2005, Micronesia WSO Meteorologists and manager were trained by the WFO Guam Science and Operations Officer (SOO) in the use of the QuikSCAT scatterometer and the use of passive microwave imagery to identify tropical cyclone position and intensity.

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). NTR

3. **Opportunities for Further Enhancement of Regional Cooperation**. Training and introduction of the new Saffir-Simpson Tropical Cyclone Scale (STiCkS) around Micronesia continues. STiCkS is a scale that relates maximum tropical cyclone wind speed to potential damage and storm surge as specifically related to tropical regions.
NTR.

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

A. Overview of Meteorological and Hydrological Conditions during the Year.

1. Meteorological Assessment. The tropical cyclone activity in the central Pacific during the 2005 hurricane season was below normal. The normal for the basin is five systems and in 2005 only three occurred: 1 tropical depression and 2 hurricanes. None of the three systems directly struck the Hawaiian Islands. The tropical depression was well south of the islands and lasted only a very short time. Hurricane Jova and Hurricane Kenneth formed in the eastern Pacific and then moved into the central Pacific. Hurricane Jova weakened and turned northward approximately 300 miles to the east of the Hawaiian Islands, thereby causing little impact. Hurricane Kenneth weakened and as it approached the Hawaiian Islands encountered significant wind shear (15-20 meters per second) and became an open wave before reaching the islands.

2. Hydrological Assessment. However, the abundant moisture with the remnants of Kenneth in conjunction with a deep upper level low pressure system over the islands produced flooding in the Hawaiian Islands associated with the very heavy rain and thunderstorms on 30 September to 2 October 2005.

3. Socio-economic Assessment. Because of the tremendous devastation produced by Hurricanes Katrina and Rita on the mainland of the United States of America and the extensive media coverage of these two events, the citizens of Hawaii were well aware of damage and impacts from a hurricane. So when Hurricane Jova approached the islands, the general public began preparedness actions by buying bottled water, stocking up on canned food supplies, filling up their automobiles' gas tanks, and many other related activities.

B. Meteorology

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

a. Hardware and/or Software Progress. NTR.

b. Implications to Operational Progress.
WFO Honolulu provided backup for WFO Guam on 11 January 2005 for almost 12 hours. WFO Guam required this backup to install Advance Weather Information Processing System (AWIPS) Operational Build 4.0. WFO Honolulu downloaded WFO Guam's grids, updated them, and then published them to the National Digital Forecast Database (NDFD) without problems. Also the office provided all of the required services and products to WFO Guam's local customers.

During Hurricane Olaf on 14-16 February 2005 and Hurricane Percy, 24-26 February 2005, RSMC Honolulu provided valuable support to Weather Service Office Pago Pago, American Samoa. During both hurricanes, the office coordinated nationally with the US military Joint Typhoon Warning Center (JTWC) and internationally with the RSMC Nadi Fiji (both of which make track and intensity forecasts for the south Pacific) to provide guidance during 6-hourly conference calls. In addition, RSMC Honolulu provided tropical cyclone satellite-derived Dvorak intensity and location fixes. The office was prepared to backup the WSO if needed. During Hurricane Olaf, WFO Honolulu took over the issuance of WSO Pago Pago's routine products so they could concentrate on the hazardous weather products.

c. Interaction with users, other Members, and/or other components.
Dr. Kimio Uno of Keio University and United Nations University in Japan visited WFO Honolulu on 3 December 2005 to gain an understanding of the meteorological and oceanographic data collected in the Pacific area and used operationally by forecasters. His visit was part of climate partnership building meetings with several U.S. National Oceanic and Atmospheric Administration (NOAA) and University of Hawaii groups.

On 27 January 2005, two members of the Republic of Korea's Assembly, one high level Assembly staffer, and Dr. Lee, Director, Numerical Weather Prediction Division Korea Meteorological Administration, visited WFO/RSMC Honolulu. Their mission was to gather information on the requirements for a tropical cyclone center and also the dissemination of tsunami information through NWS channels. The two Assemblywomen took many notes on the different facets of the office, including the 3 national center functions and the International Pacific Desk Internship.

On 28 January 2005, a Malaysian delegation visited WFO Honolulu. The main focus of their visit was the dissemination of tsunami information and TsunamiReady Program. The office provided the 3-member delegation packets with StormReady/TsunamiReady information along with the NWS Instructions describing the program and a copy of the checklists for each program. In addition, the office explained its role in disseminating tsunami products once they are issued by the Richard H. Hagemeyer (RHH) Pacific Tsunami Warning Center.

On 25 May 2005, Lieutenant Colonel (Lt Col) Devrani, a meteorologist with the Indian Air Force, visited WFO Honolulu to gain a better understanding of how the USA National Weather Service (NWS) prepares, issues, and disseminate forecasts and warnings. Lt Col Devrani had just completed the Tropical Weather Course at Kessler Air Force Base, and the military liaison for his visit wanted to provide Pacific weather operations familiarization training for him. During his 2 hour visit, the Meteorologist in Charge of WFO Honolulu/Director RSMC Honolulu gave him an overview of the office and its broad mission and responsibilities. Then he sat with the forecasters at the 4 shift locations where he was able to learn in more details our gridded forecast process, aviation forecast and advisories, and the marine forecasts, advisories, and warnings.

The NOAA Hurricane Conference was held from 30 November 2004 to 3 December 2004 in Miami, Florida at RSMC Miami. There was a great deal of discussion on the Hurricane

Local Statements, digital wind grids, P-3 availability during the hurricane season, ASOS backup power and communications during hurricane conditions, and a possible new warning for the deadly, destructive winds associated with the eye wall (a team was formed to evaluate all aspects of the issue but there was no consensus for the 2005 Hurricane Season).

d. Training Progress

International Pacific Desk Training Internship. Since the beginning of the WMO Regional Association (RA) V Pacific Desk Internship program in 2001, the Pacific Desk has trained 26 students from 14 different countries in the south Pacific and Southeast Asia. In 2005, 6 students from Cook Islands, Vanuatu, Niue, Samoa, Malaysia, and Tonga.

Hurricane Season Press Conference. RSMC Honolulu hosted a press conference 16 May 2005 to highlight the release of the 2005 Outlook for Tropical Cyclone Activity in the Central Pacific. The Director of RSMC Honolulu, speaking on the theme of Personal Planning: Saving Lives, emphasized the need to be prepared even when minimal activity is expected. The Governor of Hawaii proclaimed the week of 15-21 May as Hurricane Preparedness Week. Media attention was widespread with both major newspapers and all local television outlets attending and reporting on the event.

Hurricane Preparedness and Outreach Presentations. During June 2005, the Director and Warning Coordination Meteorologist of RSMC Honolulu provided hurricane preparedness and outreach presentations to Hawaii (Big Island), Kauai, Maui, and Oahu Counties. The talks were held in the counties Emergency Operations Center and were attended by Federal, State, and county officials including representatives from public works, police, fire, civil defense, Visitors Bureau, Red Cross, water department, Department of Land and Natural Resources (DLNR), forestry, national parks, and others. RSMC Honolulu personnel do this annually in preparation for hurricane season.

Hurricanes in the Pacific - Understanding the Past to Prepare For the Future. On 12 July, the Director of RSMC Honolulu, made a presentation at the US. Army Corps of Engineers “Hurricanes in the Pacific - Understanding the Past to Prepare For the Future.” Jim was part of a panel consisting of Oahu Civil Defense, State Civil Defense, Federal Emergency Management Agency (FEMA), and U.S. Army Corps of Engineer representatives. The event was held at the U.S. Army Corps of Engineers Pacific Regional Visitors Center located near Waikiki, Honolulu, Hawaii. Federal, state, and local government and private agencies and visitors to Hawaii attended.

Outreach. The University of Hawaii at Hilo (Big Island) held the Ellison Onizuka Science Day on 29 January 2005. Personnel from RSMC Honolulu and Data Collection Center Hilo staffed the exhibit. More than 400 students participated in workshops and science exhibits at the event. In addition, RSMC personnel participated in the School Career Day held at Niu Valley Intermediate School in Oahu on 25 January 2005. Over 300 students attended the event and most of them stopped at the NWS exhibit.

e. Research Progress

“Atmospheric Rivers.” WFO Honolulu forecasters assisted NOAA Environmental Technology Lab meteorologists who were conducting an “Atmospheric Rivers” (moisture plumes originating in the tropics and headed towards the west coast of the US mainland) field experiment based out of Honolulu. WFO forecasters participated in daily phone briefings with the project meteorologists in order to determine whether or not a research mission with the NOAA P-3 aircraft should be conducted, and if so, to where should the mission be conducted.

Typhoon Committee Typhoon Research Coordinating Group (TRCG) Workshop on Effective Tropical Cyclone Forecasting. The Director of RSMC Honolulu, made two presentations and chaired 2 sessions at the Typhoon Committee’s TRCG Workshop on Effective Tropical Cyclone Forecasting. He made presentations on the hydrological perspective of effective tropical cyclone forecasting (flash flood aspects) and tropical cyclone warning dissemination and chaired the Warning Dissemination Section and the final session to develop the workshop's findings and recommendation. The results of the workshop will be provided to the 38th Session of the Typhoon Committee in November 2005. His travel was supported by the China Meteorological Agency (CMA).

f. Other Cooperative/RCPIP Progress.

Participation in NWS and National Environmental Satellite and Information Service (NESDIS) Joint Team. Meteorologist in Charge, WFO Honolulu/Director RSMC Honolulu, is the NOAA NWS Pacific Region's representative on a joint NWS and NESDIS team to look at the services NESDIS provides to the NWS. The first item the team is addressing is a proposal by NESDIS to stop producing tropical cyclone satellite-derived Dvorak intensity and location fixes which the Satellite Applications Branch currently does throughout most of the Atlantic and Pacific. The RSMC Miami, RSMC Honolulu, JTWC, RMSC Nadi Fiji and the Tropical Cyclone Warning Center in Brisbane Australia unanimously opposed this proposal.

Presentation to Hawaii State Legislature Joint Committee. On 12 September 2005, the Director of RSMC Honolulu, made a presentation to a joint Hawaii House of Representatives and Senate Committee. The presentation was part of an informational briefing on hurricane preparedness to a joint session of the Hawaii House of Representatives Committee on Public Safety and Military Affairs and the Senate Committee on Education and Military Affairs. At the two hour meeting, the Director and Vice Director of Hawaii State Civil Defense, the Director of the Hawaii Tourism Authority, and Director RSMC Honolulu made presentations. Favorable review by the local newspaper was reported. The Honolulu Advertiser stated in the next day's edition, "Several lawmakers said they were impressed by the presentations and by the confidence of Lee, Teixeira and Jim Weyman, director of the Central Pacific Hurricane Center." "It's pretty obvious that these guys are on it," said state Senator Bob Hogue.

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

Hydrology

In **China**,

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

a. Progress in Hardware and Software Development and Applications

Since the Workshop on Living with Risk: Dealing with Typhoon-related Disasters as part of the Integrated Water Resources Management held in Seoul, Korea, 20-24 September, 2004, China has been taken an active part in the Regional Cooperative Programme Implementation Plan (RCPIP) of hydrological and Disaster Prevention and Preparedness (DPP) components of Typhoon Committee. Now, China is actively pushing forward the two projects led by the Chinese side, namely the project on *the Extension of Flood Forecasting Systems to Selected River Basins*, and the project on the *Evaluation and Improvement of Hydrological Instruments and Telecommunication Equipment.*

◆ **The Projects on the Extension of Flood Forecasting Systems to Selected River Basins**

In accordance with the road map drawn at the Workshop on Living with Risk: Dealing with Typhoon-Related Disasters as Part of the Integrated Water Resources Management held in Seoul, Republic of Korea in September 2004, China made the following progresses in the Project on the Extension of Flood Forecasting Systems to Selected River Basins:

- Reviewed the situation of flood forecasting system establishment and application in members according to the reports provided by members at the Seoul Workshop;
- Prepared an English-version Demo of flood forecasting system of China;
- Drafted the Guidelines for Development of Flood Forecasting System to Selected River Basins. The draft of main contents has been determined.
- Summarized the hydrological forecasting techniques in China as a reference for TC members.

This project would be continued till 2006. At the next workshop, China would submit the final Guidelines on Development of Flood Forecasting Systems.

◆ **The Projects on the Evaluation and Improvement of Hydrological Instruments and Telecommunication Equipment**

Since 2002, this project has been implemented for 3 years. On the basis of the current status of the project and the road map drawn at the Workshop on Living with Risk: Dealing with Typhoon-related Disasters as Part of the Integrated Water Resources Management held in Seoul Korea in September 2004, a draft review report on the Evaluation and Improvement of Hydrological Instruments and Telecommunication Equipment was prepared.

This review was a glancing report because of the very limiting information taken from only three counties' (China, Japan and Malaysia). Nevertheless, it was obvious that Japan was most advanced in hydrological instruments and telecommunication equipments, China and Malaysia need to further promote the development of hydrological instruments and telecommunication equipments though they had their own experience in this aspect. In the connection, the other members all needed to enhance their hydrological instruments and telecommunication equipment.

The final report was submitted at the forthcoming TC session to be held in Viet Nam in November.
For reference, China prepared a report on Application of the Automatic Telemetry System for Hydrological Data Collection in Real-time Flood Forecasting for TC members.

China submitted the Review of report on *the Evaluation and Improvement of Hydrological Instruments and Telecommunication Equipment* and provided a case study entitled the Application of the Automatic Telemetry System for Hydrological Data Collection in Real-time Flood Forecasting in China as an example.

The draft review report was under revision according to the comments. According the suggestions and requirements by the Working Group on Hydrology at the Workshop held in Malaysia, this project would last for the next round of RCPIP.

b. Implications to Operational Progress

Nil

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

China continued her sustained efforts in data exchange with neighboring countries and in undertaking the activities of hydrological and DPP components of Typhoon Committee.

◆ **Project on the Evaluation and Improvement of Operational Flood Forecasting System Focusing on Model Performance**

As a partner of this project, China provided some papers about Chinese hydrological models for the Korea Institute of Construction Technology (KICT), and answered the questionnaire from KICT. At present, the sum and substance of flood forecasting are as following:

- ***Flood Forecasting***

  Mathematical hydrologic models used in operational flood forecasting in China:

  ✧ Watershed hydrological models such as Xinanjing model, Shaanbei model (runoff yield under excess infiltration), API model, Sacramento model, SCLS (Synthesized Constrained Liner System);

  ✧ Channel routing models such as Maskingum routing method, Lag/K routing method, Liner Diffusion Wave routing method, Dynamic Wave routing method;

  ✧ Empirical methods such as P+Pa~R, Relation curve of water level between upstream and downstream, and

  ✧ Commercial model package such as MIKE 11.

  Application of GIS and DEM in hydrological forecasting includes:

  ✧ Delineating basin boundary and estimating basin area,

  ✧ Generating Thiessen polygons of rain-gage network,

  ✧ Calculating areal-mean rainfall,

  ✧ Computing watershed parameters like land slope & river, etc..

China is planning to use the radar rainfall products in real time flood forecasting, and to use more DEM data in dynamic wave modeling and hydrological modeling.

- ***Hydrological data collecting and transmission***

  Currently, there are 7981 hydrometric stations providing real time hydrological information for flood forecasting in China, among which there are 4606 water level and discharge stations, 3275 rain gages. In general, the time interval of flood information provision is 6 hours, while the time interval is 1 hour in the case of major/great floods.

  The telecommunication and computer network used in data transmission in China include: short-wave and ultra-short wave, microwave, PSTN, GPRS, satellite, CHINAPAC, and Wide Area Network (WAN) of real-time flood information.

- ***Hydrological model calibration***

  The calibration of hydrological model parameters can be done manually or through automatic-calibration approach.

  The manual calibration of model parameter is undertaken by a method of trial and error with the help of man-machine interactive interface, while the automatic calibration can be done by using an optimization method like Rosenbrock, simplex or genetic method.

◆ **The Project of Development of Guidelines for Reservoir Operation in Relation to Flood Forecasting**

As a partner of this project, China has completed the questionnaire from KOWACO (Korea Water Resources Corporation). The Main aspects of guidelines for reservoir operation in relation to flood forecasting are as following.

- ***Decision-making procedures of reservoir operation to reduce flood damage***

  At present, the forecasting of reservoir inflow hydrographs is mainly based on the observed rainfall via hydrological models. In addition, China is continuing the efforts in improving the rainfall forecasts, and using rainfall forecasts into operational flood forecasting and prediction in order to increase the lead-time of flood forecasting.

  In flood season every reservoir has their own flood control restricted level, the capacity above this level is flood control capacity, because flood situation is different in different months, so, for different months the level are different. The flood control restricted level is fixed on according to the design flood and the capacity of flood control need.

When floods occur, the reservoir management for flood control is done according to dynamic limiting level during flood season itself.

All the large-sized & medium-sized reservoirs have flood regulation schemes. According to the scale and importance, the flood regulation schemes of reservoirs are developed by the flood control agencies at various levels. The basic principle of the flood regulation scheme of a reservoir lies in fully using its function so as to protect the downstream area given the priority of ensuring the safety of dam. In addition, the flood regulation of a reservoir should be compatible with overall flood management the whole river basin. The scheme design for flood regulation is made out basing on the design flood and the need of flood control.

The design flood is derived on basis of probability theory. In the sake of ensuring the safety of dam, the probability of flood is designed from 1% to 0.01%, depending on the scale of reservoir. For the purpose of protecting the downstream area, the probability of flood is design from 10% to 1%.

In Aug. 2005, a very successful flood regulation of the Dahuofang reservoir was made on the Hunhe River. The Dahuofang reservoir is located in the upstream of the Hunhe River, which is located in Laoning province in Northeast China. When the flood occurred, the Dahuofang reservoir closed all the releasing gates, leading to the reduction of flood peak discharge by 3690m3/s at the Shenyang station, which is located on the outskirt of Shenyang city. If there were no such discharge control at the reservoir, the flood peak of Shenyang would have been 8000m3/s.

A general procedure of real time reservoir operation is shown in the following chart.

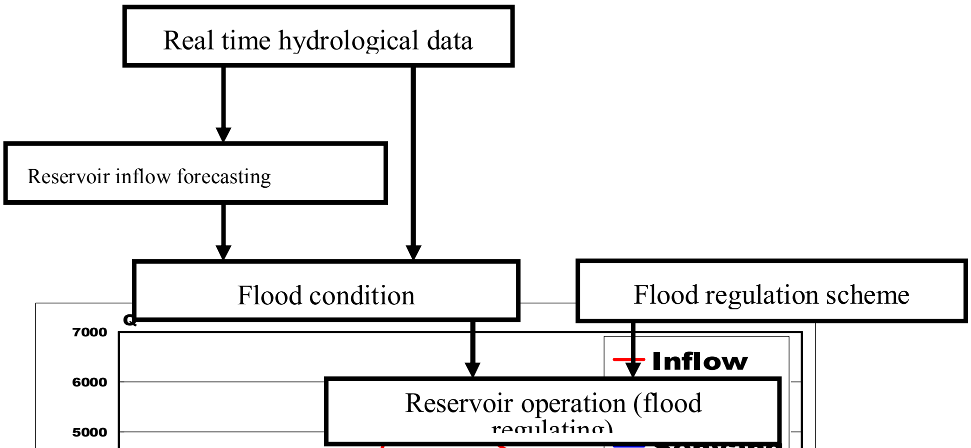


Fig. 3.1 A general procedure of the real time reservoir

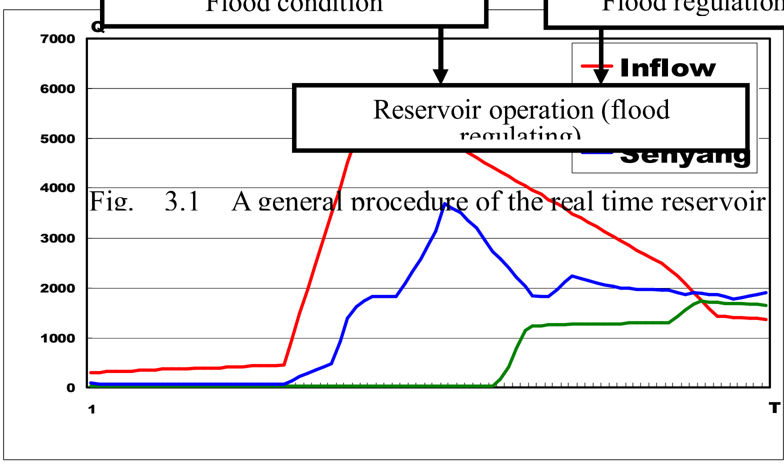


Fig. 3.2 Flood regulation of the Dahuofang reservoir in Aug.

• ***Flood regulation through spillway release and its evaluation***

As soon as the decision of flood release is made, the people and governmental agencies in dangerous area must be warned timely. Before the gates of spillway are opened, the people in the area to be affected by flood must be evacuated, when necessary the dikes and embankment should be reinforced.

When evaluating the flood control effect, the follows factors are taken into account:

✧ Reduction of the down stream discharge & water level as result of dam operation;
✧ Reduction of the flood affected area due to dam operation & dike reinforcement;
✧ Number of people saved or protected, and Reduction of the direct economic losses, etc.

- ***Countermeasure against extreme flood events exceeding design capacity***

Structural measure means that for dam, the safety height of dam is decided by check flood and plus safety height, for large reservoir, the probability of exceeding design criteria is 0.1%, the probability of check flood is 0.01%, the safety height is about 1m above the maximum level. If flood exceed the check flood, in order to release more water to avoid dam break, the spillway can be exploded.
Non-structural measure means that developing flood forecasting and warning system, for get more leading time to evacuate the people from dangerous area, to reinforce the down stream dike. Make emergent plan. In recent year non-structural measure become more and more important.
Moreover, hydrology in China is always positive for international cooperation with neighboring countries and TC members, and it is an active member in international hydrological and meteorological organizations. China has kept on exchanging and sharing data with neighboring countries and international/inter-governmental organizations, such as Russia, Korea, Vietnam, India, Kazakstine and Mekong River Committee.

d. Training Progress

In January, 2005, two Chinese participants attended the training courses on flood hazard mapping held in Tokyo, Japan, among whom, one was from the administrative department of flood hazard maps, the Office of State Flood Control and Drought Relief Headquarters, and the other one was from the Bureau of Hydrology, Ministry of Water Resources. This training event enabled them to further understand the significance of flood hazard mapping in the practice and to learn the technical methods for flood hazard mapping so as to promote the application of flood hazard maps in China.

e. Research Progress

Nil

f. Other Cooperative/RCPIP Progress

In September 2005, China sent 3 persons to participate in the Workshop on Risk Management towards Millennium Development Goals and Socio-Economic Impact Assessment of Typhoon-related Disasters, which was held in Kuala Lumpur, Malaysia.

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

a. Hardware and Software Progress

◆ **Pilot Project on the Establishment of Flash Flood Warning and Forecasting System**

In 2005, China continued undertaking the work under the project on sediment disaster forecasting and warning system.
Mudslide disaster forecasting and warning continued in the pilot area of Xuanhan in Sichuan province. By using the sediment forecasting technique provided by the Japanese colleagues, an event of mudflow and landslide was well detected, which occurred in the Huangjin town in early July of 2005.

Due to its complex topography and vulnerable geology, China is highly susceptible to the sediment-related disasters such as debris/mud flow and landslide caused by torrential rainfalls. With economic growth, urbanization and the subsequent concentration of population and property, the damage caused by sediment-related disaster is becoming more and more remarkable.

Chinese Government has attached great importance to sediment disasters in recent years. The Ministry of Water Resources in liaison with the China Meteorology Administration, the Ministry of Land Resources, the Ministry of Construction and the China State Environmental Protection Administration has developed a plan for technical research on monitoring the debris/mud flow and landslide induced by mountainous floods. The plan was approved by the National Development and Reform Commission in May 2005, and will be implemented soon. The objective of the plan is to establish a national-wide monitoring system of the mudflow, flash flood and landslide, to develop the static model and dynamic model for sediment disaster prediction and to develop a mechanism for reduction of both life and property losses in disaster-prone areas.

The main components of the sediment disaster monitoring system include:

- ✧ Establishment of the monitoring system at five levels such as the state, provinces, counties, townships/villages and sediment sites under the leadership of the State Flood Control and Drought Relief Headquarters;
- ✧ Classification of the sediment disasters into 3 severity levels: extremely dangerous, dangerous and generally dangerous according to the scale and extent of mudflow and landslide;
- ✧ Combination of the national-wide monitoring network with regional monitoring system, and the routine monitoring with hi-tech monitoring such as on-line fully automatic satellite- microwave transmission system;
- ✧ Establishment of a database of sediment disaster; and development an analysis and prediction platform based on GIS.

◆ **Pilot Project on Flood Hazard Mapping**

In recent years, China made continued efforts in fulfilling the tasks scheduled in the implementation plan on the flood hazard mapping, and the satisfactory achievements have been made. Especially, China has finished the revising of the Flood Control Plans for seven major river basins, which established the foundation for the basin-wide flood hazard mapping.

The Office of State Flood Control and Drought Relief Headquarters requested each water resources commission to choose 2~3 conditional provinces (cities or districts) as pilot areas for flood hazard mapping every year, focusing on making flood hazard maps for the key flood-prone/flood-control areas, large-sized reservoirs and flood diversion basins. Up to now, 8 provinces within 7 river basins have started this pilot project.

At present, the *Guide to Flood Hazard Mapping* is under preparation. The guide will include description of the functions and applications of the flood hazard map and the definitions of risks. Various analysis methods and technical approaches will be incorporated to facilitate the preparations o flood hazard maps in accordance to different purposes and applications. Preparation of the flood hazard maps for all major rivers in China has been included in the *Eleventh Five-Year Development Plan of Water Conservancy of China*. It is expected to start the work in China from 2006.

b. Implications to Operational Progress

◆ **Standard Development**

The new '*Standard for Hydrological Information Code* (SHIC)' has been put into application in some pilot areas for flood season. Based on this document, the Standard for Structure and Identifier in Real-time Hydrological Information Database is put into use in September 2005. To adapt to the development of automatic hydrological measurement and reporting system and data transmission technique, the Data Transfer Protocol has been revised and applied.

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

Nil.

d. Training Progress

Nil.

e. Research Progress

Nil.

f. Other Cooperative/RCPIP Progress

Nil.

3. Opportunities for Further Enhancement of Regional Cooperation

◆ As discussed with Malaysia at the Seoul Workshop in September 2004 and Malaysia workshop in September in 2005, China would like to cooperate with Malaysia to combine the project on the Extension of Flood Forecasting Systems to Selected River Basins with the project on on-job training by Malaysia. China hoped that some achievement in combined projects could be made. China would like to provide experts involved in the project with on-job training.

◆ China will continue to participate in the RCPIP projects on Hydrology and DPP and continue to cooperate with TC members. More cooperative activities will be done with TC members advanced in the field of hydrological instruments and telecommunication equipments and flood forecasting system.

◆ TC members are encouraged to conduct further cooperation at regional level, not only in the form of short-term Workshop or TC Session, but also through long-term training and expert exchanges.

In Hong Kong, China,

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

Nil.

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

2a. 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$5.5 billion worth of major river-training works and flood-control projects have been completed in the New Territories (NT). As a result, the flooding situation in NT had improved significantly. The flooding situation in the northern part of NT would be further alleviated upon the completion of the Shenzhen River Regulation Project Stage III as well as other new drainage channels.

To alleviate flooding in low-lying villages, the Hong Kong Special Administrative Region Government had already completed 24 village flood pumping stations to protect 31 villages where the ground topography of the village is so low that river training work cannot improve the drainage condition.

For the rural areas, the construction of 19 km of drainage channels, 3 village flood pumping schemes and 11.6 km of stormwater drains were in progress. Major flood prevention works under planning and design include 33 km of drainage channels, 14 km of stormwater drains and 5 km of drainage tunnel.

For the urban area in West Kowloon, 33 km of stormwater drains had been completed. The construction of another 12 km of stormwater drains was underway. A stormwater diversion scheme comprising 1.5 km of stormwater drainage tunnel, and a 100,000 cubic metres capacity underground floodwater storage tank had been completed in 2004. Plan is also in hand to construct another drainage tunnel of 4 km long in Lai Chi Kok.

For other urban areas, the construction of 5.6 km of stormwater drains started in mid 2005. Further major flood prevention works under planning and design include 19 km of stormwater drains, 10 km of drainage tunnels and a stormwater pumping station in Sheung Wan.

2b. Implications to Operational Progress

Data from raingauges operated by the Drainage Service Department (DSD) and Geotechnical Engineering Office of the Hong Kong Special Administrative Region are relayed to HKO to support the operation of the Rainstorm Warning System and the Special Announcement on Flooding in the Northern New Territories. 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 1,600 km of drains, engineered channels, culverts and watercourses were inspected and 500 km of them were cleansed with 30,000 m3 silt removed. 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. A list of flooding blackspots was also compiled to facilitate the deployment of resources to carry out immediate relief measures during adverse weather situations.

2c. Interaction with Other Users, 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 by DSD's direct 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 were overseen by senior professionals.

2d. Training Progress

Staff of DSD attended various training classes, workshops and conferences (both local and overseas) to acquire the latest advances in knowledge and technologies relating to flood prevention including those 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.

Staff of HKO and DSD attended the Typhoon Committee Workshop on Risk Management towards Millenium Development Goals and Socio-economic Impact Assessment of Typhoon-related Disaster in Kuala Lumpur, Malaysia during 5-9 September 2005. A paper on the risk management of tropical cyclone-induced flooding in Hong Kong was presented.

2e. Research Progress

Computer hydrological and hydraulic models for the drainage systems in Hong Kong was developed to provide quantitative information on the risk of flooding, impacts of development and the performance of various flood loss mitigation options. A computerised stormwater drainage asset inventory and maintenance system was also being developed. In the past year, DSD had completed several research studies including a review on the design of cast iron manhole covers, a sensitivity analysis of rainfall-runoff parameters in drainage modeling and an investigation into variation in flood depths due to actual rainstorm event and the standard design rainstorm profiles. A project to derive the 2-hour Probable Maximum Precipitation (PMP) for Hong Kong to support flood risk assessment was being carried out in collaboration with HKO.

2f. Other Co-operative/RCPIP Progress

Nil.

In Macao, China

1. Progress in Member's Regional Co-operation and Selected RCPIP Goals and Objectives
Meetings and seminars on climate precipitation forecast of southern China during the Rainy Season of 2005 were held with neighboring Meteorological Bureau. Issue on water management was concerned.

2. Progress in Member's Important, High-Priority Goals and Objectives
2a. Hardware and Software Progress
Nil
2b. Implications for Operational Progress
Nil
2c. Interaction with users, other Members, and/or other components
Nil
3. Opportunities for Further Enhancement of Regional Co-operation
Nil

In **Malaysia**,

1.0 Meteorological Component

2.0 Hydrological Component

2.1 Improvement of Facilities

In Malaysia, the Department of Irrigation and Drainage (DID) in the year 2005 has installed about 358 telemetric stations in 38 river basins. 583 manual river gauges and 1076 gauges in flood prone areas are maintained to provide additional information during the flood season. As part of the local flood warning system, about 247 automatic flood warning sirens and 121 flood warning boards are being operated.

Early warning / alarm system has also been installed in 2 hill resort areas, i.e Gunung Ledang and Gunung Pulai, to predict and monitor the occurrence of flash floods, mudflow and landslides. Under the Regional Cooperation Project and Implementation Programme (RCPIP) of working group on hydrology, Typhoon Committee, Malaysia has developed a warning system called Debris and Mudflow Warning System for Cameron Highlands in Pahang State.

2.2 Technical Advancement

The website InfoBanjir (http://infobanjir.water.gov.my) is being operated to display through internet the online data (near real-time) of 283 rainfall stations and 224 river level stations in 38 river basins. The website contains current information as follows:

- Rainfall and water level data
- Flooded areas
- Flooded roads
- Landslide risk
- Debris and Mudflow Warning
- Flood camera pictures
- Drought monitoring
- River forecast
- Satellite imaginary
- Current river and rainfall alarms
- Hotlinks to other useful websites

An automatic alerting system for DID flood managers using Short Message System (SMS) has been operated. Whenever defined rainfall thresholds or critical river levels of telemetric stations are exceeded, alarm signals are sent automatically to their mobile phones for flood operation.

2.3 Flood Forecasting and Warning (basin in operation)

Flood forecasting operations were carried out during the flood seasons by the respective DID state offices with technical assistance from the National Flood Forecasting Centre at DID Headquarter. The river basins provided with forecasting models are summarized as follows:

River Basin	Catchment Area (km^2)	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
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

Malaysia experienced Northeast Monsoon from November 2004 to February 2005 with some flooding occurring. Most river basins mentioned above received relatively less intense rainfall with the forecasting points recorded lower flood levels.

The 2004 monsoon flood in December was as severe as those events in 1988 and 1993 affecting the three coast states in Peninsular Malaysia. In particular, the capital town of Kelantan, Kota Bahru was experiencing the worst flood evr recorded since the record was available in 1926. In addition a number of urban flash floods had occurred causing some damages and social inconvenience, and there there were some occurences of minor landslides. Terengganu, Pahang and Kelantan were hit by annual monsoonal flood in Disember 2004 that resulted a total evacuation of more than 10,000 people and estimated DID structures damaged was in excess of RM 15 million. Sg. Menggatal, Sabah was hit by flash flood due to river overflow of Sg. Menggatal and Sg. Telipok and caused severe localised flood.

The Selangor and Federal States were hit by several flash floods. Sg.Kerayong in Kuala Lumpur with catchment area 60km^2 was hit by localised flood on 22 April 2005 due to very heavy localised rainfall that caused the river to overflow at down stream areas where remedial work was still underway to strengthen the river banks. Similarly, Sg. Buloh and Segambut area in the vicinity of Sg Batu (a major tributary of Sg Klang) experienced localised flood due to localised widespread rainfall on 13 October 2005, a section of the city highway was inundated for a few hours and caused a widespread traffic congestion.

2.4 Comprehensive Flood Loss Prevention and Management (basin on-going)

Besides providing flood forecasting and warning services, Malaysian Government also implemented other non-structural measures and structural measures to mitigate flood impacts. 16 river basin studies were completed with 12 on going. 30 town drainage master plans were prepared. Currently 20 major structural flood mitigation projects are being implemented. The Manual on Urban Storm Water Management has been prepared with a view to control at source the urban runoff quantity and quality. The Manual has been mandatory for use beginning from 1 January 2001. Other flood mitigation strategies included land use planning and control, resettlement of populations in flood prone areas, school education and public awareness programmes.

1. 14 flood programmes (14 states have their own flood programmes)
2. Projek- utama >20 juta = 6 (RTB Kepaal Batas, RTB Sg.Prai, RTB Sg.Muda, Projek Tebatan Banjir KL, SMART (pakej A) , Batu Jinjang Pond & Related Flood Diversion and MSC (pakej B).

2.5 Research

In flood hydrology, on-going research projects are:

(a) Flood mapping for Kelantan river using Radarsat.
(b) Urban hydrology study.
(c) Reduction of flood runoff quantity using roof interception and soil infiltration method.
(d) Impacts of logging on Muda and Pedu Reservoirs.
(e) IRPA Projects - Development of Temporal Pattern for Urban Areas and PMP Derivation for Peninsular Malaysia
- Development of Runoff Characteristics to Validate Manual Saliran Mesra Alam (MASMA)

2.6 Training

During the year, the following Course / Workshop / Seminar related to flood hydrology were organized:

- A course on “Basic Course on Hydrology Forecast” at Kuala Lumpur from 13-15 September 2005.
- A course on “Frequency Analysis of Rainfall and Flood” at Kuala Lumpur from 13 to 15 July 2004.

In the Philippines,

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

From September 2004 to August 2005, the PAGASA issued a total of 232 flood bulletins and 649 daily hydrological forecasts in its monitored major river basins and reservoirs, and 20 general flood advisories for the other ungauged major river basins in the country.

The Flood Forecasting Branch of PAGASA (FFB) also engaged in other activities that would further strengthen its forecasting capability. Relative to this, seminars/workshops and trainings were organized and attended by FFB personnel. Likewise, facilities and equipment were regularly maintained in order to ensure their optimum utilization. The following are the activities undertaken in to meet the FFB’s needs.

- The PAGASA-JICA Technical Cooperation Project (TCP) on the Enhancement of Flood Forecasting and Warning Administration is now in its second and final year. On 18 April 2005, the 2nd Joint Coordination Committee meeting was conducted to present the outputs of the first year including the future activities of the project. The meeting was spearheaded by the Secretary of the Department of Science and Technology (DOST), key officials from PAGASA, JICA, the Embassy of Japan, member agencies of the Joint Operation and Management Committee (JOMC) and heads of the Provincial Disaster Coordinating Councils covering the monitored major river basins. The meeting further strengthened the collaboration of PAGASA with the agencies with their affirmation to help PAGASA secure the installed flood forecasting and warning (FFWS) facilities of PAGASA. The activities of the second year of the TCP will be focused on the Bicol and Cagayan river basins.

- The JOMC of the Flood Forecasting and Warning System for Dam Operation (FFWSDO) had five (5) meetings from September 2004 to August 2005. Three (3) resolution have been passed by the JOMC. The first JOMC Resolution addressed the problem of informal settlers along the river banks of the Angat river. The second resolution was the putting up of a trust fund for the various JOMC activities while the third resolution is in support to the TCP proposal to strengthen the FFWSDO. The three (3) Subcommittees of the JOMC, namely, Hydrology, Telecommunication and Finance and Logistics also met regularly to discuss and settle the problems in their respective fields. For instance, after the unprecedented inflow of Angat dam in November 2004 and hydrological and geomorphological changes in the target areas of the monitored dams, the Subcommittee on Hydrology has started plans to revise the existing Flood Operation Rule, Flood Warning Manual and Dam Discharge Warning Manual of Angat dam.

- Conducted Hydrographic Surveys to update the Flood Assessment levels and the Rating Equations of the forecasting points within the target areas of the monitored river basins.

- Participated as a member in the Technical Working Group on Hazard Assessment & Mapping, a component of the Integrated Reconstruction & Development Plan (IDRP) of the Department of Environment and Natural Resources (DENR) and the National Economic and Development Authority (NEDA).

- Participated in the meeting of the Steering Committee and the Technical Working Group on the Study of the Flood Control Project Implementation System for the Principal Rivers in the Philippines under the Department of Public Works and Highways (DPWH).
- Updated the Operations Manual on the Maintenance of the Telemetry System in collaboration with the JICA Short-term Expert on Telecommunication.

- Assisted the municipalities of Dumangas, Iloilo, Cabanatuan, Nueva Ecija, Sibalom and San Remigio, Antique and Bulacan and Pangasinan provinces in the establishment of a community-based flood monitoring system.

- The PAGASA is streamlining its operations under the rationalization program of the government in order to improve its services. In the process, the Flood Forecasting Branch will be reorganized and renamed as Hydrometeorological Branch. As such, its function will not be limited to floods but also to forecasting low flow events at various spatial scales.

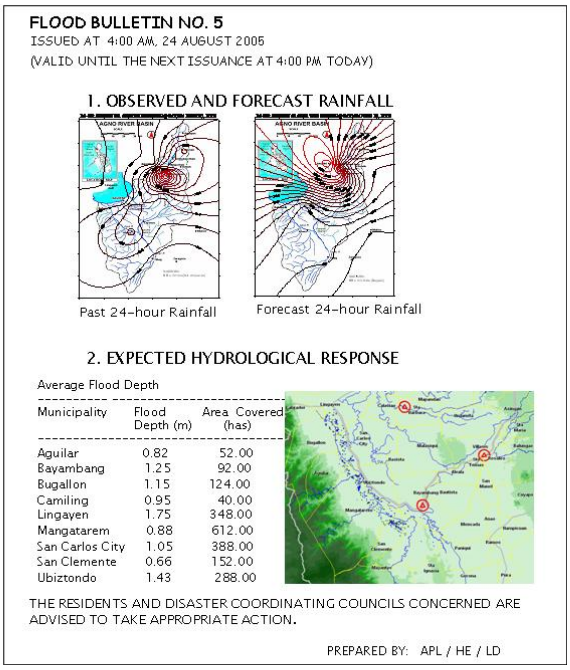
1.1 Hardware and software progress

a. Short Messaging System (SMS) for real-time data transmission

For years, the problem of interference has greatly reduced the percentage of real-time data transmitted from the river basin Field Centers to the PAGASA Flood Forecasting and Warning Center. To address this, SMS was utilized and piloted in the Agno river basin in February 2005. The use of SMS is quite a reliable alternative in the transmission of data to the existing VHF system. One of the advantages of the SMS is the very low cost of maintenance. Budget has been secured for the establishment of SMS in the Cagayan and Bicol river basins.

b. Interactive Hydrologic Model for flood forecasting

An interactive Hydrologic Model has been developed for Pampanga, Agno, Bicol and Cagayan river basins. The outputs of the model are forecast hydrographs of each forecasting station as well as forecast inundation areas of the river basin. To accommodate the software requirement, the existing PCs where these models are run were upgraded. With the help of the JICA short-term Expert, a core group of hydrologists from the monitored river basins have been tasked to calibrate the model parameters. Once in place, the existing flood bulletins will be modified or improved (Figure 7).


FLOOD BULLETIN NO. 5
ISSUED AT 4:00 AM, 24 AUGUST 2005
(VALID UNTIL THE NEXT ISSUANCE AT 4:00 PM TODAY)

1. OBSERVED AND FORECAST RAINFALL

Past 24-hour Rainfall   Forecast 24-hour Rainfall

2. EXPECTED HYDROLOGICAL RESPONSE

Average Flood Depth

Municipality	Flood Depth (m)	Area Covered (has)
Aguilar	0.82	52.00
Bayambang	1.25	92.00
Bugallon	1.15	124.00
Camiling	0.95	40.00
Lingayen	1.75	348.00
Mangatarem	0.88	612.00
San Carlos City	1.05	388.00
San Clemente	0.66	152.00
Ubiztondo	1.43	288.00

THE RESIDENTS AND DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO TAKE APPROPRIATE ACTION.

PREPARED BY: APL / HE / LD

Figure 7. Modified flood bulletin format after TCP

3.1.2 Implications to operational progress

The PAGASA envisions to enhance its hydrological services in the monitored river basins (situated in Luzon island) with the on-going PAGASA-JICA TCP. The best result of the project so far is the closer and more strengthened collaboration between PAGASA and the local government units covering the monitored river basins. But one of the priorities now of PAGASA is to reach out and extend its service to other major river basins and flood prone areas in the country. Focus is now on the promotion of community-based flood monitoring system. The frequent recurrence of floods and the increasing extent of flooded areas has been considered by the local community as an urgent need to address. More and more local government units now seek the technical assistance of PAGASA and willing to invest on non-structural measures such as community-based flood monitoring system. The scheme involves the fabrication of rainfall and water level instruments, training of volunteers and local officials to observe and transmit data, transmission of observed data utilizing existing communication networks and maintenance of the system. The community-based approach is a cost-effective flood mitigation activity that enhances community participation and commitment in disaster mitigation for sustainable economic development.

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

The PAGASA sustained its efforts of interfacing with its clients and the community through public information and education campaigns. PAGASA personnel also attend regular meetings of the Regional and Provincial Disaster Coordinating Councils for Regions I, II, III and V. The FFB personnel were also invited as resource speakers or lecturers in workshops, lectures and seminars conducted by the local government units all over the country. Some of the notable public information activities are as follows:

- A Public Information Drive (PID) was conducted for local officials in the target areas of Pantabangan dam on August 2005. The dam has never operated its spillways since 1972 but with the additional inflow diverted from a nearby river basin through a tunnel, the potential for gate operation is high. As a result of the PID, the Office of the Governor released an amount for the installation of additional rainfall stations within the target area of Pantabangan dam. The PID was conducted in coordination with the National Irrigation Administration (the government agency that manages Pantabangan dam), the Office of the Governor, the Office of Civil Defense (OCD) and the Provincial Disaster Coordinating Council (PDCC) of Nueva Ecija.

- A 4-month long PID was conducted in the province of Bulacan covering all the flood prone municipalities and barangays (smallest administrative unit) of the province. As a result of the PID, the flood prone communities are now more aware of the flooding condition in their locality as well as the flood forecasts and warnings issued by the PAGASA. As a token of their appreciation, the Province of Bulacan awarded PAGASA a citation in the annual awards ceremony of the province.

3.1.4 Training progress

a. Foreign

Name	Title	Date & Venue	Sponsor
Margaret P. Bautista Maximo Peralta	Workshop on Living with Risk: Dealing with Typhoon-related Disasters as part of the Integrated Water Resources Management	20–24 Sep 2004 Korea	Typhoon Committee Trust Fund
Oskar Cruz	International Conference on Disaster Reduction	18–22 Jan 2005 Japan	International Flood Network
Socrates F. Paat, Jr.	Group Training Course on Flood Hazard Mapping	25 Jan – 18 Feb 2005 Japan	JICA
Susan R. Espinueva	Counterpart Training on Flood Forecasting and Warning Administration	24 Jan – 18 Feb 2005	JICA
Oskar D. Cruz	International Workshop on Flash Flood Disaster Mitigation in Asia	27 Feb – 05 Mar 05 Japan	Public Works Research Institute
Margaret P. Bautista	6th Session of the RA V Working Group on Hydrology	17–21 Oct 2005 Fiji	WMO

b. **Local trainings/workshops/seminars**

- Conducted the Training on Observation, Recording and Transmission of Rainfall and Water Level on May 27, 2005. This training was in connection with the establishment of a community-based flood monitoring system in the allied rivers of the Agno river basin. The participants included local government officials in the sites where the observation instruments are installed.
- Conducted the Workshop on Project Cycle Management (PCM) Phase 1: Project Design Matrix and Plan of Operations on May 26-28, 2005. The workshop was attended by key personnel from PAGASA and the member- agencies of the JOMC of FFWSDO such as the National Power Corporation (NPC), National Irrigation Administration (NIA), the Department of Public Works and Highways (DPWH), the Office of Civil Defense (OCD), and the National Water Resources Board (NWRB).
- Conducted the Workshop on Project Cycle Management (PCM) Phase II: Evaluation and Monitoring on August 1-4, 2005. The Phases I and II of the PCM workshop was in connection with the PAGASA-JICA Technical Cooperation Project.
- Conducted in-house training on the troubleshooting of the flood forecasting and warning telecommunication equipment and facilities by the JICA short-term Expert in July 2005.
- Conducted in-house trainings on August 18 - 22, 2005 on the simulation/calibration of flood forecasting models. The participants included PAGASA hydrologists both from the Central Office and from the 4 River Basin Field Centers. The workshop was conducted by the JICA short-term Expert.

3.1. 5 Research Progress

With the acquisition of a PC cluster that will increase the computing speed for numerical modeling, preparations are underway to improve the flood forecasting tools of PAGASA. The operationalization of the HRM that will provide high resolution rainfall forecast will help improve the accuracy of flood forecasts. In addition, hydrological research using remote sensing data are in the incipient stage.

Flood hazard mapping research activities are being conducted in San Juan, Metro Manila, Davao City, Butuan City and in Infanta, Quezon. Infanta was severely affected by the disastrous flashfloods and landslides in November 2004.

Aside from the existing interactive hydrologic model being calibrated for flood forecasting purposes, several research activities are also being carried out on the application of other flood forecasting tools.

3.1.6 Other Cooperative Progress

a. **Collaboration with the Virtual Academy Center of Excellence of Yamanashi University in Kofu, Japan**

Starting June 2005, one Senior Hydrologist of PAGASA was accepted to participate in the second year of the Virtual Academy of Yamanashi University. The Academy offers the use of its Blockwise Topography with Muskingum-Cunge model (BTOPMC) using the data of a Philippine river basin or watershed. The inputs of the BTOPMC model include DEM, land cover, soil, rainfall, discharge and evapotranspiration data. The BTOPMC is a continuous hydrologic model capable of simulating high and low flow events. In the said collaboration, the Angat watershed was used as the initial study area due to its economic importance of providing 97% of raw water to Metro Manila. The model can provide inflow forecasts that are useful not only for flood forecasting but also for water resources management, particularly the allocation of water resource of Angat dam. The initial results of the simulation were presented in the workshop at Yamanashi University on October 26-28, 2005. The development of the BTOPMC, a variant of the TOPMODEL developed in UK, is the initiative of Professor Kuniyoshi Takeuchi, former President of the International Hydrological Program of UNESCO and President of the International Association of Hydrological Sciences.

This collaboration between PAGASA and the University of Yamanashi will continue since the BTOPMC is being promoted to be applied in the various catchments in the Asian Region and eventually used for operational purposes by concerned government institutions. Professor Takeuchi encouraged PAGASA to send more participants in the next courses of the Virtual Academy. This partnership will definitely enhance the operational hydrological activities of PAGASA as well as strengthen the research activities in operational hydrology and water resources.

b. Flood Hazard Mapping Program of JICA

The Flood Hazard Mapping program of JICA which started in January 2005 and will run for five (5) years. Considering the vulnerability of the Philippines on flooding, JICA considers participants from PAGASA. One(1) Hydrologist participated in training course in January 2005 and another hydrologist is currently in Japan attending the same training. The enhancement of the skills of PAGASA personnel in this aspect will be a great help in the on-going hazard mapping activities of PAGASA. The hazard mapping project in the Philippines is a multi-agency collaboration between the National Mapping, Research and Information Agency (NAMRIA), the Philippine Volcanology and Seismology (PHIVOLCS), the Mines and Geoscience Bureau (MGB) and the PAGASA.

With the prevalence of landslides, flashfloods, earthquake, etc., hazard mapping will be an important tool for planners and decision-makers in mitigating the impacts of natural disasters.

c. Climate Forecast Application Project

The PAGASA and the Asian Disaster Preparedness Center (ADPC) in Bangkok are implementing a project geared to provide monthly forecasts for both the agriculture and water resources sectors. The target area for the water resources sector is Angat dam. The inflow forecasts will be the by-product of a downscaled regional rainfall forecast and the local forecast translated into an inflow forecast with the use of a hydrologic model. This will be very useful in planning and allocation of water from the dam for irrigation (for Bulacan) and domestic water supply (for Metro Manila).

In **Thailand,**

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

i. Hardware and Software Progress
(Royal Irrigation Department)

There are three ongoing telemetering projects this year for Ping, LamPao and Chantaburi river basins which are located in the northern, north-eastern and central part of Thailand respectively. The real-time in situ and remotely sensed data collection was planed on hourly basis. These projects employ "NAM-model" to simulate hydrological behavior in the upstream area and created the input to "MIKE II" Model to proceed further in order to produce the channel routing which gives flood forecasting and warning.

b. Implications to Operational Progress
(Royal Irrigation Department)

Since these projects are under installment, no progress could be reported. The remotely sensed data will be collected at the control rooms and disseminated to the concerned agency.

b. Interaction with users, other Members, and/or other components.
(Royal Irrigation Department)

At this moment, the forecasted results from other completed telemetering projects are disseminated to the concerned agencies, and warning is provided via internet, radio and television.

d. Training Progress

(Royal Irrigation Department)

Training programs are set only to the concern local staff and will be provided to the others in the future.

e. Research Progress.

(Royal Irrigation Department)

Last year research was on Pasak river basin, the derived unit hydrograph is applied to compute flood hydrograph this year. The forecasted results are quite satisfied as compared to the measured data. The results give lead time of at least a week to prepare for the flood. This year research is running in the Mae Wang river basin, located in the northern part of Thailand, with a catchment size of 389 sq. km. The unit hydrograph is employed to demonstrate that this technique is also applicable to medium size of catchment. There is no result at this moment, it still need time to verify this methodology. More information will be provided in the future.

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 Software Progress

(Royal Irrigation Department)

Three telemetering systems are under installment and planed to be complete in the near future. Detailed data will be collecting and hopefully in the future some fruitful results can be achieved.

(Department of Water Resources)

Department of Water Resources just develops and sets up a flood and landslide warning system project in mountain and upland area, covered 321 villages. Dealing with the system alerts of heavy rainfall and rising of water levels to monitor at appropriate site, early warning signal was sent to subscribers and communities in advance of the impact of disaster which provides time for people to take actions. Co-ordinate on flood was responded by developing and carrying out risk mitigation plans and planning for emergency response of Department of Disaster Prevention, Department Mineral Resources and the concerning agencies.

b. Implications to Operational Progress

(Royal Irrigation Department)

Exchange of 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.

(Department of Water Resources)

Department of Water Resources has developed and improved in the hydrological and meteorological monitoring network. Real time hydro-meteorological data gathering/ monitoring network had set up into 4 regions which are Northern ; Chiangmai, North Eastern ; Ubon Ratchathani and Khon Kaen, Central; Chachoengsao, and Southern; Nakhonsithammarat and Yala.

The expansion of the appropriate hydrology network in 25 Major Rivers in Thailand are recommended in cooperating with the other concerning department for supporting decisions in planning and policy for making a good water management.

(Department of Water Resources)

Department of Water Resources has cooperated with 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).

(Department of Water Resources)

Real time hydro-meteorological data is collected by the gatherring/monitoring network with high quality and standard operating and maintenance procedures that can provide accurate and reliable data to be used for short term and long term impact assessment of water resources development activities, basin development planning, flood forecasting, navigation and etc.

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

(Royal Irrigation Department)

The interaction among members will be increased which will improve the hydrological products to meet our requirement. The integrated meteorological products and services are essential in better flood forecasting.

d. Training Progress

(Royal Irrigation Department)

The training in flood forecasting has been carried out in the regional center of Irrigation Department, some have proofed to be able to carry out the forecast but need to be trained again. It was planed to launch out the training in the future again.

(Department of Water Resources)

Strongly training on the operation and data handling were provided to the staffs from concerned hydrological centers, and technical staffs from Department of Water Resources, Royal Irrigation Department and Meteorological Department.

e. Research Progress

(Department of Water Resources)

Study on Appropriate Hydrology Network in 25 Major Rivers in Thailand

Hydrological networks stations were established nationwide along side of 25 major rivers in Thailand. The establishment aims to develop hydrological data base of all these 25 major rivers to support decisions in planning and policy for making a good water management. Data from network was published in hydrological yearbooks and made available for research and development activities. The acquired data enables the water potential assessment, water management policy and planning for damage precaution and control of natural disasters including flooding, drought, water pollution and landslide. Moreover, requirement of hydrological data assessed and used to determine how many necessary hydrological stations in each river basin and how many hydrological stations will be distributed in 25 major rivers in order to collect necessary data to support the above mentioned needs. Available resources limited expansion of hydrological stations in these river basins. Therefore, the efficiency came in to determine how and which way this hydrological monitoring network of hydrological stations should collaborate and support each other.

f. Other Cooperative/RCPIP Progress

Nil

3. Opportunity for Further Enhancement of Regional Coopinter

Nil

In the United States of America

I. 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.
   NTR.
c. Interaction with users, other Members, and/or other components.
   Hydrology Workshop. WFO Guam Meteorologist-in-Charge (MIC) and WFO Guam Hydrology Focal Point attended the WMO/ESCAP International Workshop on Risk Management: "Socio-Economic Impact Assessment of Typhoon Related Disasters and Risk Management Towards Millennium Development Goals" held in Kuala Lumpur, Malaysia on 5 September 2005. MIC's presentation on flash flood forecasting in Micronesia included an excerpt on the Flash Flood Monitoring and Predication (FFMP) software soon to be installed at the WFO Guam. Hydrology Focal Point provided the presentation on landslides in Micronesia.

d. Training Progress.

Flash Flood Forecasting. WFO Guam Hydrology Focal Point attended the Flash Flood Forecasting and Quantitative Precipitation Estimation (QPE) course from the Cooperative Program for Operational Meteorology, Education and Training (COMET) in Boulder, Colorado. The course focused on the hydrology of flash floods and the physical processes that control runoff, the science behind Flash Flood Guidance and the latest on flash flood modeling. QPE topics were covered because of their importance in the Flash Flood Monitoring and Prediction software.

Program Management. Hydrology Focal Point also attended the NWS Training Center WFO Hydrology Program Management course. This training focused on a spectrum of topics dealing with the management of a WFO hydrology program. Lessons addressed policy guidance, local training, the duties of a Service Hydrologist and a Hydrology Focal Point, data collection, quality control, hydrologic networks, and establishing forecast Standard Hydrological Exchange Format (SHEF) tutorial (in HTML).

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).
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
American Samoa Automated Flood Warning System. Senior Service Hydrologist at WFO Honolulu held a meeting on 18 August 2005 with three members from the American Samoa Territorial Emergency Management Coordinating Office (TEMCO) and George Wilkins, the president of the Alert Users Group. The meeting focused on developing a proposal to submit to the Department of Commerce Automated Flood Warning Systems (AFWS) grant program. TEMCO wants to deploy an AFWS to help improve flash flood detection and warning capability on the island of Tutuila.

b. Implications to Operational Progress.
Hydrologist in Charge of the Alaska-Pacific River Forecast Center visited Pacific Region Headquarters (PRH) and WFO Honolulu on 18 January 2005 to discuss technical hydrology program support to the Pacific Region. She, PRH, and WFO Honolulu agreed on support for (a) posting stream and rain gage data on WFO Honolulu's Advanced Hydrologic Prediction Service (AHPS) web page, (b) requesting AHPS funds to delineate Flash Flood Monitoring and Prediction basins for Guam, and (c) developing a distributed hydrologic model for a test basin in Hawaii. Hydrologic model development will occur over the next 2 to 3 years and will start with Manoa Stream as a test case.

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

d. Training Progress.
National Flood Awareness Week. During the week of 21-25 March 2005, the Honolulu Forecast Office increased its outreach efforts in support of National Flood Safety Awareness Week. The

office issued daily Public Information Statements (PNS) on various flood safety topics and worked with the local television weather broadcasters on public service announcements. In addition, the front page of the Honolulu Forecast Office's web site included a link to the NWSH Flood Safety Awareness Week web page. Daily PNS topics focused on Flash Flood Monitoring and Prediction system, Turn Around Don't Drown campaign, tropical cyclone flooding, State of Hawaii flood insurance issues, and hiking safety.

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).
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.

Disaster Prevention and Preparedness

In **China**,

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

a. Hardware and/or Software Progress

Currently, the software about impact assessment of typhoon on society and economic are developing in National Climate Center (NMC). In order to provide more useful information to relative departments for disaster mitigating and preventing, Meteorological services strengthen the report system at real time on the impact assessment of typhoon this year.

b. Implications to Operational Progress

Nil

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

The Asian Conference on Disaster Reduction (ACDR) was convened in Beijing, China on 27-29 September 2005 at the invitation of the Government of the People's Republic of China. A total of 385 participants attended the conference, which includes delegations from 42 Asian and South Pacific countries, of which 33 were represented at the ministerial level, and 13 UN agencies and the international organizations. The meeting was organized to facilitate the implementation of the World Conference on Disaster Reduction (ACDR) outcomes (the Hyogo Framework for Action 2005-2015): Building the Resilience of Nations and Communities to Disasters (HFA). The participants developed and presented the Beijing Action for Disaster Risk Reduction in Asia to enhance regional cooperation in the implantation of the Hyogo Framework for Action.

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

(towards the goals and objectives of the Typhoon Committee)

a. Hardware and/or Software Progress

The China Meteorological Administration issued, subject to the approval of the national government, a *Contingency Plan for Significant Meteorological Disaster*, *Procedure for Issuing Unexpected Meteorological Disaster Early Warning Signals* (trial) and the *Guidance on Meteorological Disaster Early Warning Signaling and Preventative Actions; Provisional Rules on News Release of Major Meteorological Information*; and *Rules on Collection, Survey and Evaluation of Meteorological Disasters*. It also worked out a 4-level warning signals and associated rules for issuing, set up regular (monthly) new release system for meteorological information and for disasters, and directly reporting system and evaluating system for meteorological disasters. CMA has prepared *Regulations on Meteorological Disaster Prevention*, which was now going through a legislative procedure.

b. Implications to Operational Progress

From October 1 2004 to 10 October 2005, 10 typhoons landed over China, among which Typhoon Haitang (0505), Metsa (0509), Talim (0513) and Khanun (0515) were most severe, affecting large areas. Typhoon Haitang was the most severe one hitting China's Taiwan over the past 5 years, and it also affected the Fujian and Zhejiang provinces. Due to strong wind at the time of landfall, Metsa caused serious damages and huge losses. It was one of the most severe typhoons affecting east costal areas and East China areas since the No.9711 typhoon 8 years ago. Typhoon Khanun was the most powerful one landed over Mainland China up to now in 2005. The maximum wind speed in the central part of the typhoon reached 50m/s, and its central air pressure was 945 hPa. Typhoon Talim among the typhoons in 2005 caused largest death toll. Typhoon Talim moved steadily towards west and northwest, bringing about 300-400mm rainfall in central part of Anhui and northern part of Jiangxi, even 500mm in some regions. It brought about heavy rainfall to Fujian, Zhejiang, Anhui, Jiangxi and Jiangsu, which led to floods and associated geological disasters, causing serious economic losses and casualties.

Before their landfalls, the Central Meteorological Observatory, CMA had kept the Central Government, including the State Council and the National Headquarters for Flood Control and Drought Relief informed about movements of typhoons in an updated manner. CMA also intensified the technical guidance to local meteorological bureaus. The governments at various levels took preventative measures based on the meteorological forecasts and typhoon-related information, including population evacuations. The meteorological bureaus of the provinces under potential impacts of typhoons kept tracking the approaching typhoons around clock and delivering timely weather information to local governments and customers. In Zhejiang Province alone, 1.158 million people were evacuated from the risky areas, and vessels at sea were managed to call back to seaports, all aimed at minimizing the losses of possible casualties and potential damages.

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

◆ **Improvement in Warning Service System**

Meteorological services at various levels worked closer with various sectors, such as media, communication and urban construction in order to inform wider general public of the tracks and landing information of typhoons as well as relevant warning messages and preventive measures and advices through diversified media including radio, TV, SMS, websites, mobile WAP, hot-line telephone (96121), electronic display screens, and newspaper, etc. Accordingly, the general public would get prepared to protect themselves and other people from possible disasters in a more consciously manner and the causalities were greatly reduced. CMA arranged two groups headed by a Deputy Administrator to visit the affected regions for understanding the situation, showing concern and care about local people, providing guidance for disaster relief and conducting evaluation on typhoons Haitang and Metsa respectively.

◆ **Disaster Prevention and Preparedness Exercise**

A joint nautical exercise was held in the seawater off the Yangshan Port in Shanghai on July 7, 2005. The exercise involves approximately 1,000 people, 30 ships and five aircraft to showcase China's capabilities to cope with any possible emergency situation at sea, search for people missing in mishap on the sea, put out a fire on ship, clear away oil spills and remove explosive devices on ships. Dr. Xu Xiaofeng, Deputy Administrator of CMA, was invited to view the exercise on the spot. Mr. Tang Xu, Director of Shanghai Meteorology Bureau, was in command of the meteorological service for the exercise. As every component of the exercise was closely related to meteorological conditions, it provides a good opportunity to test the ability in providing marine meteorology service in an emergency situation with many precious experiences having been obtained.

d. Training Progress

Nil

e. Research Progress

◆ The researches on TC disaster prevention and preparedness were focused on analysis of disaster characteristic, disaster assessment and the development of warning system for potential TC disasters etc. The evolution of genesis and landfall of typhoon over the Northwest Pacific was studied with 50-year meteorological data. In the same time, the effects of TC disaster were analyzed and estimated quantitatively based on the social and economical data and the possible severity of TC disasters. The risk of a typhoon originated over the Northwest Pacific could be calculated based on typhoon center position and wind speeds. According to the risk evaluations, the distribution pattern and occurrence of excessively strong wind in 10-, 20- and 50-years were given respectively.

◆ Based on intensity, maximum wind speed and maximum rainfall data of 42 TC cases that made landfalls over Guangdong Province from 1950 to 2000, TC disasters were analyzed, based on which an evaluation model was developed. Moreover, TC disaster characteristics were analyzed and the relationship between TC disaster distributions and TC tracks was studied using the disaster data available. Furthermore, a high-resolution numerical storm surge model (ECOM Si) dedicated to the estuary of Yangtze River was developed. The 8 storm surges cased induced by typhoons passing through the estuary of Yangtze River were simulated. It was found that the average error was less than 10 centimeter, comparing the simulated output with observations.

f. Other Cooperative/RCPIP Progress

◆ An academic Seminar on Meteorological Disaster Prevention Science between Taiwan, China and Mainland China in 18-23 February 2005. The Atmospheric Science Department of Taiwan University hosted the Academic Seminar on Meteorological Disaster Prevention between the two sides. Some researchers from Shanghai Typhoon Institute attended the Seminar and delivered presentations.

3. Opportunities for Further Enhancement of Regional Cooperation

Nil

In **Hong Kong, China**

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

1a. Hardware and Software

Nil.

1b. Implications to Operational Progress

Nil.

1c. Interaction with Users, Other Members and/or Other Components

A presentation on the "Dissemination and broadcast of weather warnings in Hong Kong" was made by a HKO officer at the "Regional Workshop on Emergency Information Flow in Disaster Situation" organized by the International Strategy for Disaster Reduction Secretariat and Asia-Pacific Broadcasting Union in Bangkok, Thailand from 13 to 14 June 2005.

1d. Training Progress

Eight meteorologists from Typhoon Committee Members were among the nineteen participants from overseas weather services attending the two WMO Voluntary Co-operation Programme training courses on "Aviation Meteorological Services" held at HKO from 22 to 26 November 2004 and 25 to 29 March 2005 respectively. Experience sharing during the courses included the provision of aviation meteorological services during tropical cyclone situations.

A list of the Observatory's tropical cyclone and disaster prevention related training activities is shown below:

1. Tropical Cyclone Related Training Overseas Attended by HKO Staff

(a) "Typhoon Committee Roving Seminar on Operational Application of Multi-model Ensemble Typhoon Forecasts" in Beijing, China from 22 to 24 November 2004. One officer participated.

(b) "WMO RAII/V Training Workshop on Ensemble Prediction Systems" in Shanghai, China from 18 to 23 April 2005. One officer participated.

(c) "Typhoon Committee Workshop on Risk Management towards Millenium Development Goals and Socio-economic Impact Assessment of Typhoon-related Disaster" in Kuala Lumpur, Malaysia from 5 to 9 September 2005. Two officers (HKO and DSD) participated.

2. Tropical Cyclone Related Training Programmes Organized in Hong Kong, by the Hong Kong Observatory

(a) Pre-rain and typhoon season seminars on 29 March 2005 and 3 June 2005.

(b) Seminar on "Safer Living – Reducing Natural Disasters" on 17 October 2005.

1e. Research Progress

Nil.

1f. Other Cooperative/RCPIP Progress

Nil.

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

2a. Hardware and Software

Nil.

2b. Implications to Operational Progress

As a continuing effort to promote awareness and preparedness of natural disasters, HKO conducted several training courses for members of the public and staff from other government departments. Topics included tropical cyclone warning, public weather information services, weather observation, weather and outdoor work, and violent gusts associated with inclement weather. For the 12-month period ending September 2005, over 1600 participants attended the courses.

On community based disaster training, a year-long public education campaign titled “Safer Living - Reducing Natural Disasters”, was launched in March 2005 to enhance the public’s understanding of natural hazards so that appropriate response action could be taken to reduce natural disasters. Representing a joint effort of HKO, other government departments and NGOs, the campaign comprised of a range of community education programmes, including TV programmes on safer living and meteorological topics, a tropical cyclone name nomination contest, slogan and bookmark design contests, a seminar, popular science lectures and a month-long exhibition as well as rescue drill demonstrations.

The tropical cyclone name nomination contest was successfully completed in May 2005. The contest, open to the pubic, attracted more than 25,000 nominations. The names “TAICHI” and “KAPOK” were finally selected as winners by the judging panel which comprised of the Director of the Hong Kong Observatory and several well-known personalities in the academic and cultural circles in Hong Kong. The winning names would be submitted to the ESCAP/WMO Typhoon Committee to replace two current tropical cyclone names previously provided by Hong Kong, China.

Briefings were held for government departments, transport operators and fishermen to promote the effective use of the forecasting and warning services provided by HKO.

A number of lectures on HKO’s warning services was given to private organizations and the public. HKO’s Weather Service Officers gave talks on tropical cyclones and other aspects of the weather to primary school students.

2c. Interaction with Users, Other Members and/or Other Components

HKO visited relevant government departments and organizations to review disaster preparedness and prevention procedures for the tropical cyclones and the rainy season.

A workshop on meteorology for the media was held for the first time in August 2005. The objective was to enhance media representatives’ understanding of meteorology so as to facilitate their capacity to accurately report weather events, including severe weather associated with tropical cyclone.

2d. Training progress

HKO continued to conduct pre-rain and typhoon season seminars for its staff in March and June 2005 respectively. The aim was to keep them abreast of the latest forecasting techniques and methodologies during severe weather and tropical cyclone conditions. A total of 104 officers attended the seminars.

2e. Research Progress

Nil.

2f. Other Cooperative/RCPIP Progress: Nil.

3. Opportunities for Further Enhancement of Regional Co-operation

Nil.

In **Macao, China**

1. Progress in Member’s Regional Co-operation and Selected RCPIP Goals and Objectives: Nil

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

2a. Hardware and Software Progress A brand new “Sai Van Bridge” has been set up and opened to traffic since January of this year, it greatly facilitate local life and the economy of Macao.
This double-deck design bridge allows six lanes in the upper layer and four lanes in the lower layer which is shaped like a tube.

The lower layer is shut down in common days and opens for emergency and light vehicles to shuttle much more safely between Macao Peninsula and Islands during typhoon hits.

2b. Implications for Operational Progress

The Security Coordination Office held an annual general meeting with the agencies of Civil Defense Operation Centre, in which the exercises related to Tropical Cyclone, heavy rain, traffic accident occurred in the lower layer of “Sai Van Bridge” and other events were discussed. All governmental departments and private sectors involved in the structure of the “Civil Protection Plan of Typhoon” were invited to the annual meeting and discussed about the issues related to the exercises as well as their own contingency plan.

The instructions on Tsunami and Earthquake were included in “Civil Protection Plan of Typhoon”. In addition, a new system to exchange relevant information and messages via e-mail has been set up as well.

Exercise on Typhoon hit was carried out on April 27 in order to test the capability of all departments to deal with a contingency or emergency. Different types of accidents were simulated under the exercise.

As the lower layer of the “Sai Van Bridge” has never been use by the public. Special exercise to test the safety use and rescue management was also carried out on May 20. The testing use for public light vehicles was also arranged for a whole day on May 26.

Special exercise to test the safety use and rescue management of “Sai Van Bridge” Open to public for usage test

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

Several activities were carried out related to public awareness during the year, such as advertisements program on Tropical Cyclone prevention via Macao TV and Radio, as well as leaflets were widespread to Macao citizens to promote the prevention for the occurrence of disasters..

3. Opportunities for further Enhancement of Regional Co-operation

Nil

In **Malaysia,**

1 INTRODUCTION

1.1. For Malaysia, the fact that the December 26, 2004 tsunami had affected us came as a national shock. It is the worst natural catastrophe Malaysia had experienced. Apart from tsunami, recently in the month of August, parts of Malaysia were shrouded in smog caused by open burning and transboundary transport of smoke occurred during the dryer period. The haze was so serious and the level of air pollutant index (API) has reached dangerous level (above level 500). The Government of Malaysia had to declare Haze Emergency in two areas in the state of Selangor.

1.2. Though most natural hazards may be inevitable, their effects can be prevented or mitigated. The Government is very concerned about occurrences of such disasters that adversely affect its people. Emphasis is being given to disaster risks reduction and development of disaster management capabilities in various areas of disaster prevention, mitigation, response and recovery.

2. ACTIVITIES

For the period between November 2004 to September 2005, several programs and activities are being carried out by National Security Division, Prime Minister's Department. Among others are as follows:

2. **Exercise on Disaster Management**

The exercises are carried out to ensure the high level of alertness among those relevant agencies involved in enhancing and promoting the culture of teamwork and cooperation in response to disasters. Among the exercises are as follows:

a. The Drill On Mass Evacuation At The High Risk Residential Areas During The Earth Quake;

b. KL Twin Tower Evacuation Exercise;
c. The Exercise Of Handling Crisis And Disaster Involving Light Rail Transit (LRT);
d. Counter-Terrorist Crisis Management Training And Assistant;
e. Management of CBRN and TIC incident; and
f. ASEAN Regional Disaster Exercise (ARDEX '05) participated by Malaysia, Singapore and Brunei.

3. **Upgrading of Equipment and Communication Facilities for the Disaster Management Operation Centre (OPS Room)**

The Operation Rooms at the Federal, State and District levels are being equipped with the up to date and appropriate equipment and communication facilities for the efficiency in communication, response coordination and monitoring of disasters.

4. **Implementation of Disaster Prevention and Preparedness Programmes**

i. The Government of Malaysia is committed to develop programmes to enhance public awareness in the society especially the knowledge on Tsunami and earthquake hence it helps to equip theirs self protecting capability against those disasters;

ii. In regard to tsunami awareness programme, National Security Division, Prime Minister's Department is currently spearheading and coordinating public awareness campaign though an array of seminars involving responding agencies at state level as well as disaster exercises and earthquake disseminating information via mass media. Pamphlets on tsunami early warning and evacuation will be distributed to hotels and high risk residential places. It is a continuous programme for the awareness campaign. In addition, the up-to-date information and alert on tsunami warning and educational write up on the matter were published in Malaysia daily newspapers.

iii. The Government also committed in reconstruction infrastructure as well as rehabilitating the livelihood of tsunami victims through the construction of permanent houses for them and to resettle them in a safer place a distance away from the tsunami affected areas.

5. Integration of disaster reduction concepts into development planning

i. The message from the December 26, 2004 earthquake and tsunami is clear that conventional approaches based on providing medicines, food, and blankets after a disaster occurs are insufficient though indispensable. Disaster preparedness, prevention and mitigation measures must be integrated into the massive reconstruction effort confronting the region in the short term, and into development planning and programming in the medium to longer term.

ii. Malaysian Government indeed has taken integrated development strategies especially for managing disaster risks, based on the development policy which emphasizes on socio-economic and environmental approach. For example, in order to control and reduce the impact of landslides in urban areas, the Government has undertaken legislative and non-legislative measures such as:

b.identification and mapping of landslide prone areas;

c. development of design and building codes that will ensure the construction practices appropriate to the maintenance or enhancement of slope stability. Kuala Lumpur City Centre (KLCC) is one of the example of building complex which complies to building codes of earthquake resistance;

d. amendments to Land Conservation Act 1960 to enable the Government to have a comprehensive monitoring of development activities on hill slopes; and

e. amendments to Environmental Impact Assessment (EIA) Rules 1987. This is to enable the Government to have a closer monitoring and enforcement over development projects on hilly areas, particularly in urban, for the construction of roads, buildings and recreational facilities.

6. CONCLUSION

Effective disaster management could reduce the impacts of disasters. NSD as the national focal point for disaster is being tasked to plan and build up disaster management capability towards prevention, preparedness, response as well relief and recovery with the cooperation and involvement of relevant agencies. Malaysia is also in the process of upgrading its capacity building in disaster management and response pertaining to the new emerging trends of disasters such as earthquake and tsunami. In this regard, we are building up our tools of disaster management in areas pertaining to communication networking, data transmission, mapping, research and study as well as developing procedures and plans to face those potential disasters.

In the **Philippines**,

1 Progress in member's Regional Cooperation and Selected RCPIP Goals and Objectives

1.1 Hardware and/or Software Progress

a. Establishment of a Community-Based Rainfall Observation Network (CBRON)

A network of raingauges will be provided in the establishment of CBRON in Regions 2, 3, 4, 5 and 8, which are flood and landslide-prone areas in the country. The data from these raingauges will be used in local forecasting and early warning of the above-mentioned hazards.

b. Strengthening Weather Observational Capability for Natural Disaster Preparedness and Mitigation

The project aims to strengthen the agency's observational capability for natural disaster preparedness and mitigation by rehabilitating, upgrading and installing weather instruments to the country's selected synoptic and agromet stations. The project will greatly improve the data collection leading to near real-time weather forecasting and improved weather predictions.

d. Climate Forecast Applications for Disaster Mitigation

The program seek to develop locally-appropriate climate information tools and capacity to apply and use them in real-time during the occurrence of extreme climatic events such as El Niño and La Niña phenomena.

1.2 Implication to Operational Progress

- Flood and landslide forecasting and early warning could be made through the establishment of CBRON.

- The project on strengthening of observational systems will enhance collection of meteorological and hydrological data for forecasting and warning purposes.
- The rehabilitation of the 5 radars in the eastern seaboard of the country which is frequently affected by tropical cyclones will greatly help in weather monitoring, forecasting and warning.

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

- The above-mentioned projects are implemented in close coordination with the Local Government Units (LGU's). The LGU's will be responsible in undertaking rainfall and water level measurements in community-based early warning systems such as CBRON.

1.4 Training Progress

- The Establishment of a Community-Based Rainfall Observation Network (CBRON) includes training of LGU personnel on how to undertake observations including transmission of data as well as on early warning system for floods and landslides.
- The project entitled Strengthening Weather Observational Capability for Natural Disaster Preparedness and Mitigation includes training activities for field personnel especially Chief Meteorological Officers (CMO) on the proper maintenance and effective management of field stations.

a. Foreign

Name	Title	Date & Venue	Sponsor
Graciano P. Yumul, Jr. Prisco D. Nilo	Asian Conference on Disaster Reduction	27 – 29 Sep 05 China	People's Republic of China
Nathaniel T. Servando	Asia Pacific All Hazards Workshop	06 – 10 Jun 05 Hawaii	US Trade and Development Agency & the NOAA
Lucrecio O. About, Jr.	International Training Symposium for Typhoon & Flood Disaster Reduction 2005	21 – 25 Mar 05 Taiwan	National Science & Technology Center for Disaster Reduction
Romeo Pelagio	Training Program on Geographic Information System and Remote Sensing for Disaster Risk Assessment	13 – 24 Sep 04 Thailand	Japan Aerospace Exploration Agency (JAXA)

1.4.1 Research Progress

- Most of the above-mentioned activities include research activities which will lead to the establishment of early warning system for floods and landslides, result of the impact of climate events to certain sectors and research on the development of software and interactive web-based weather related information system.

a. Other Cooperative/RCPIP Progress

- Several proposed cooperative/RCPIP activities are being reviewed for approval by research committee of PAGASA for possible funding to sustain and continue the Agencies commitment to international cooperation.

In **Thailand,**

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

Nil

d. Training Progress

Nil

In the **United States of America**,

I. 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.

Satellite telephone progress. While providing tropical cyclone support to Yap, Federated States of Micronesia for Tropical Storm Kulap, a malfunction on the commercial "Intelsat" satellite caused a communication outage throughout Micronesia, except for Guam and the Commonwealth of the Northern Marianas Islands (CNMI). Contact to the islands was possible only through High Frequency radio and satellite telephone. However, satellite telephone reception and transmission was difficult within the station buildings. As part of the lessons learned, external antennas were installed at each Micronesia Weather Service Office to harden their backup communications.

Hurricane Evacuation (HURREVAC) software. During his annual training visit, the WFO Guam WCM implemented HURREVAC typhoon tracking and evacuation management software at the National Emergency Management Office in Palau. He also provided training on its use to the Emergency Management staff. In addition, the WCM loaded the latest version of HURREVAC and provided refresher training at the other Micronesian Weather Service and Disaster Management offices. This software will allow 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.

b. Implications to Operational Progress.

NTR.

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

Media Workshop. Important for interfacing with population regarding tropical cyclone warning and watch information, WFO Guam WCM held the first National Weather Service Media Workshop in Saipan, CNMI in October 2004. Similar to the Media Workshop given a month earlier on Guam, the Saipan media were given a PowerPoint presentation on WFO Guam operations and products, and were provided a comprehensive 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. 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 islands; other meteorological and ocean hazards; rip currents, volcanoes and tsunamis; tropical cyclone plotting and speed-distance-time computations; climate and climate change; ENSO and its impacts, status and rainfall and tropical cyclone forecasts; the Saffir-Simpson Tropical Cyclone Scale; an Assessment of Typhoon Chaba (August 2004); and tropical cyclone decision making.

Typhoon Exercise. On 4 August 2005, WFO Guam and Guam Civil Defense held an annual typhoon exercise that involved key Government agencies, military and Non-Governmental Organization representatives, and emergency managers. The exercise was targeted at testing procedures in a new Disaster Plan. The scenario included a direct hit of a strong typhoon on Guam, and tested preparation, response and recovery actions. The exercise lasted all day.

Ambassador visit. WFO Guam hosted the U.S Ambassador to the Federated States of Micronesia (FSM), Ms. Suzanne K. Hale. The Ambassador was on Guam for the change of command at the Commander, Naval Forces Marianas (COMNAVMAR), and accepted an invitation for a visit to WFO Guam. She was very impressed, and gained a comprehensive understanding of the scope of the WFO Guam support to the FSM and all of Micronesia. In turn, she requested that the Guam WCM give seminars at the five campuses of the College of the FSM. Seminars were conducted at the College campuses on the topic of Tsunamis: Their Behavior and Risk to the Micronesian Islands.

Tropical cyclone forecasting training. The WCM and the JTWC Meteorological Coordinator provided a joint workshop on tropical cyclone forecasting and warning to the weather people and disaster managers at Kwajalein Atoll. The Meteorologists in Charge (MIC) from the Micronesian WSOs also attended the workshop. The MIC from Majuro, the WCM, the JTWC representative, and the weather operations officer from Kwajalein visited the Mayor of Ebeye to coordinate tropical cyclone and tsunami warning support.

d. Training Progress.

Teacher training. WFO Guam conducted a one-month continuing education course with 10 teachers of the Guam Public School System. The purpose of the course was to teach the teachers to the point that they could develop a curriculum for Guam public middle schools. The course consisted of 2-3 hours of daily lectures for 15 days on: all aspects of Micronesia's weather and climate; ocean climate; and geophysical aspects such as tropical cyclones, earthquakes, volcanoes and tsunamis. WFO Guam taught most courses, with some assistance from United States Geological Survey and Guam Civil Defense. WFO Guam will now work with the teachers to fine-tune the curriculum and tests. Several WFO Guam people volunteered to be technical advisors for the various segments of the curriculum development. After implementation in Guam public schools, the curriculum will be disseminated across Micronesia.

Spotter training. The WCM provided spotter training for the mayors of Guam and their staffs, and for members of the Homeland Security/Office of Civil Defense. Five Micronesian Meteorologists in Charge from Guam, Palau, Chuuk, Yap, and Pohnpei also attended. The training included tsunamis, tropical cyclones, lightning, waterspouts and funnel clouds, hazardous surf, and volcanic ash/haze. A total of 53 people attended the training. In addition, the WCM provided surf observation training to eight observers in the CNMI and the Republic of the Marshall Islands during the year.

HURREVAC Tropical Cyclone plotting software. WFO Guam hosted a workshop for Guam emergency coordinators on the use of the latest HURREVAC software. Training was arranged by the US Army Corps of Engineers, Honolulu Engineer District. This computer program allows emergency planners the ability to view current and various alternate TC scenarios for their area. These can be used in both real time situations and for workshop scenarios

e. Research Progress.

Dvorak Paper. Submission of Bulletin of the American Meteorological Society on "The Dvorak Tropical Cyclone Intensity Estimation Technique: A Satellite-Based Method that has Endured for over 30 Years". The WFO Guam WCM and SOO are among the co-authors to this paper.

Global Microwave Tropical Cyclone Database. The WFO Guam SOO is developing a global tropical cyclone data base containing microwave data which includes simultaneous microwave imagery, scatterometer data (winds, ambiguities, and normalized radar cross-sections (NRCS)) and the more standard visual and infrared imagery for comparison. The goal of this project is to develop combined, integrated operational techniques for using all satellite-based reconnaissance sensors. Current

dependence upon traditional sources such as infrared and visual imagery is inadequate to thoroughly diagnose many tropical cyclone scenarios such as during the genesis and extratropical transition. This research hopes to address methods to improve near real-time intensity analysis and forecasting, and positioning techniques.

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.
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 1996 through 2004 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 to augment them for research and reassessment purposes. The inputs included 531 lines of data and 2130 individual pieces of data.

JTWC Customer visits. JTWC Technical Adviser and the JTWC Deputy Director provided a presentation on 13 April of the mission and operations of the JTWC, and a summary of the 2004 tropical cyclone-season forecast performance. Members of the WFO Guam staff and Guam Civil Defense attended.

d. Training Progress.
NTR.

e. Research Progress.
NTR.

f. Other Cooperative/RCPIP Progress.
NTR.

3. Opportunities for Further Enhancement of Regional Cooperation. Training and introduction of the new Saffir-Simpson Tropical Cyclone Scale (STiCkS) around Micronesia continues. STiCkS is a scale that relates maximum tropical cyclone wind speed to potential damage and storm surge as specifically related to tropical regions.
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/or Software Progress.
Pacific Disaster Center (PDC) Project Using WFO Honolulu Forecast Grids. Personnel from WFO Honolulu/RSMC Honolulu met with PDC staff for an update on a project WFO Honolulu is collaborating on with PDC. The project involves the PDC, which is based in Maui, ingesting the National Digital Forecast Database (NDFD) high resolution gridded forecasts for Hawaii and then convert them into GIS format for inclusion into a large database of information aimed primarily at Emergency Management community. This database, available via a web-based interface, will allow a user to easily overlay information from various sources. For example, the wind speed forecasts during a hurricane threat can be combined with GIS

layers indicating locations of storm shelters and quality of building structures. The project will be officially unveiled in early May 2006.

b. Implications to Operational Progress.

Award Presented to WFO Honolulu. On 15 December 2004, Hawaii State Civil Defense presented an award to Central Pacific Hurricane Center/WFO Honolulu "For outstanding support of Hawaii Emergency Preparedness and Homeland Security." The Governor, State of Hawaii, and the Vice-Director of State Civil Defense presented the award in recognition of the outstanding service and support provided by WFO Honolulu during strong winds, flooding, severe thunderstorms, tornadoes, high surf, winter storms, and hurricane events which have occurred during the past year. This award was the direct result of the dedicated, professional, outstanding team at RSMC Honolulu/WFO Honolulu who value service above self and value commitment to integrity, teamwork, self-improvement, high standards, and the scientific approach to our mission.

Hurricane Jova and Hurricane Kenneth. RSMC Honolulu was very active in providing forecasts/advisories, coordination calls, and media interviews as Hurricanes Jova and Kenneth threatened the Hawaiian Islands. RSMC Honolulu personnel provided daily conference coordination calls hosted by state civil defense for 15 continuous days. Personnel on the call included all 4 counties civil defense agencies, representatives of the Governor for tourism and communications, State departments of education and transportation, National Guard, American Red Cross, FEMA, Energy Council, and other Federal, State, and county government agencies. In addition, several military coordination calls were done for these two hurricanes. During this period when the hurricanes were potential threats to the islands, the media interviewed members of RSMC Honolulu daily for newspaper articles and television news segments.

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

Hawaii State Hurricane Advisory Committee (HSHAC). HSHAC exists to advise and assist the State Civil Defense relating to hurricane impacts, mitigation, preparation, building code, and structural design. The Committee is composed of two meteorologists, 4 structural engineers, a Red Cross representative, a State Department of Education person (shelters), a coastal zone engineer, and the Director of Public Works, Department of Accounting and General Services. The Committee meets quarterly to discuss the preparation of a Strategic Plan for HSHAC; the Committee’s education and outreach program; workshops for various groups of architects, building contractors, building inspectors, and engineers; and preparation of a Hurricane Atlas for the Central North Pacific. Director RSMC Honolulu chairs the HSHAC and was reelected as Chairperson for 2005.

Transportation Issues in Disaster Management Workshop. RSMC personnel attended and made a presentation at Hawaii’s first workshop entirely devoted to transportation issues in disaster management. The workshop included a wide array of Federal, State, and local government agencies and many private transportation industry representatives. The workshop focused on airports, harbors, roads, and the general public, especially those with special needs. Subgroups were formed in each of these areas and then reported their findings back to the total forum. It was an excellent opportunity to better understand the transportation industry’s needs and requirements during a disaster and what type of actions/ activities they have to consider in an emergency.

State Warning Point Coordination. Key staff from the State Warning Point in Hawaii visited RSMC Honolulu/WFO Honolulu on 29 September 2005 to familiarize themselves with severe weather operations. Managers and forecasters from RSMC/WFO Honolulu presented information on NWS products and services, and participated in a discussion related to decision-making strategies in threatening weather events. The group toured the forecast office and observed a demonstration of the WarnGen warning creation process. They also provided information on their actions at each step of the watch/warning/advisory process.

d. Training Progress.

StormReady/TsunamiReady. StormReady/TsunamiReady are programs of the US 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. Once the community or county meets all of these requirements, the NWS recognize the community as StormReady, TsunamiReady, or both and presents them with a certificate and signage signifying their achievement. Currently there are more than 910 StormReady and 22 TsunamiReady communities in 47 states. Hawaii was the first state in the United States to be StormReady and TsunamiReady statewide. However, TsunamiReady or StormReady doesn't mean tsunami or storm proof. TsunamiReady criteria serve as a baseline for tsunami preparation and even after certification, there is still a great deal of work and planning required to meet worse case scenarios. The tsunami warning process is like the links of a chain, they all must remain connected and each has to be held responsible for performing their assigned part.

Hurricane Makani Pahili Preparedness Exercise. The annual Hawaii state-wide hurricane preparedness exercise, Makani Pahili, began 10 May and continued through 20 May. RSMC Honolulu designed and structured a tropical cyclone scenario for local, state, and federal agencies to exercise their disaster plans in response to a hurricane affecting the major islands in the state. Tropical cyclone bulletins were disseminated to planners and players in real time as the virtual cyclone moved across the state. RSMC/WFO Honolulu participated in the exercise in two ways. WFO operational staff prepared Hurricane Local Statements in real-time in parallel with the exercise. In addition, all staff was asked to review their personal preparedness plans for tropical cyclone events and make adjustments as needed.

Tsunami Exercise. WFO Honolulu participated in a state-wide tsunami preparedness exercise 1 April 2005, simulating operational procedures in the event of a tsunami threatening the state of Hawaii. WFO Honolulu asked each employee to review their personal preparedness plans for weather disasters in light of anticipated work-related requirements. In addition, WFO Honolulu provided information and references for tsunamis in Hawaii to other NOAA offices across the state and invited these offices to exercise their own operational and personal preparedness plans during Tsunami Awareness Month in Hawaii.

e. Research Progress.
NTR.

f. Other Cooperative/RCPIP Progress.
Hurricane Outreach. RSMC Honolulu personnel spoke to a class of international business students at the Intercultural Communications College in Honolulu regarding hurricane activity and impacts in the Central Pacific basin. The students, who are in Hawaii studying English, came from Japan, Germany, and Switzerland. The seminar covered tropical cyclone vocabulary, storm structure, preparedness and safety information, as well as general weather regimes and tsunamis in the Pacific Ocean basin.

Personal Planning and Emergency Preparedness. RSMC Honolulu talked about the need for personal planning for weather-related emergencies at the quarterly meeting of the Hawaii Emergency Preparedness Executive Committee meeting 29 June. RSMC personnel emphasized the importance of personal and family planning for civil service and emergency responders to the success of emergency operations plans for government, business, and emergency managers.

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

Pacific All Hazards Workshop. On 6-10 June 2005, NOAA, the U.S. Trade and Development Agency in partnership with the Asia-Pacific Economic Cooperation held an all hazards workshop in Honolulu Hawaii. Director RSMC Honolulu, addressed the delegates at the East-West Center Conference Center and described the operations of WFO Honolulu, RSMC, Pacific ENSO Application Center, International Pacific Desk Training Internship program, and the office's extensive collaboration with both U.S. and international agencies. Three groups totaling about 60 of the participants visited the forecast office.

Personal Planning and Emergency Preparedness. RSMC Honolulu's Warning Coordination Meteorologist addressed a group at Lanakila, Hawaii, an independent living support facility for adults with physical and cognitive disabilities, on weather hazards in Hawaii. This was a unique opportunity to work with an underserved population in the area of preparedness and mitigation. An audience of more than 80 staff and clients learned about tsunami and seasonal weather threats in Hawaii and discussed preparedness and mitigation options for the center and for individual clients.

APPENDIX V

REPORT OF THE WORKING GROUP ON METEOROLOGY (WGM)

1. The meeting of the WGM was convened by Mr Wang Bangzhong (China) at 1045 in Function Room 1 and 2 of the Melia Hanoi Hotel. The Members of the working group re-elected Mr Wang Bangzhong as Chair and elected Ms Duong Lien Chau as vice-chair. The meeting was attended by 28 participants from twelve Members of the Committee.

2. The Chairman of WGM provided a briefing on the outcome of the WCDR and ACDR on the following points:

For the WCDR,

- The importance of disaster reduction has grown on the international agenda. Hazards, including floods, drought, storms, landslides, locust and grasshopper infestations, earthquakes, tsunamis and epidemics are having an increasing impact on humans, due to population growth, urbanization, rising poverty and the onset of global environmental changes, including climate change, desertification and biodiversity loss. Most policymakers and academics acknowledge that poor planning, poverty and a range of other underlying factors create conditions of vulnerability that result in insufficient capacity or measures to reduce the potential negative consequences of risk. Consequently, vulnerability contributes as much to the magnitude of the disaster risk as do the natural hazards themselves. Thus, hazards only result in disasters if high risk conditions are present. Action to reduce risk is now essential in order to achieve the Millennium Development Goals (MDGs).
- Disaster risk reduction is not an additional expense, but an essential investment and a moral imperative, and a portion of emergency relief spending is earmarked for disaster risk reduction.
- A fundamental condition for disaster preparedness is the availability of risk assessments and well functioning early warning system that deliver accurate and useful information in a timely and dependable manner to decision-,makers and the population at risk,
- A dollar spent on disaster preparedness can prevent seven dollars in disaster-related economic losses- a very considerable return to investment. The return is far higher when prevention on social and ecological losses is also taken account.
- Beyond availability and timely dissemination of reliable information, a critical component of preventive strategy is to ensure that government authorities, risk manager and the public at risk can understand and utilize the information.
- About 90% of all natural disasters are of meteorological or hydrological origin. Losses from natural disaster, while already high, would have been much higher with early warning systems and risk assessments.
- Awareness raising on all types of natural hazards is essential, particularly where the warning period is short. Education of communities at large, in involvement of media and continuous interaction between scientists and the decision makers are critical.

For the ACDR,

- Importance of cooperation among countries and regions, regional organizations, disciplines, platforms and systems should be emphasized
- Importance of capacity building as an important integral element for effective disaster reduction
- The warning system should be integrated to cover all hazards
- Real time data acquisition, processing and dissemination are integral parts of the an effective disaster reduction system

- Remote sensing using space technology is an emerging and effective tool for disaster management

3. The WGM took note of following recommendations of the Workshop on Effective Tropical Cyclone Warning in term of Meteorology (Shanghai, April 2005):

- Obtain and utilize meteorological data such as raingauge and radar data observed by organizations other than NHMSs in order to effectively monitor the weather and further improve weather forecasts.
- JMA to assist Members in storm surge forecasting by giving them PC storm surge model if requested. Recommend JMA to provide training at future storm surge workshops of the Committee.
- Promote the development of mesoscale models and shared of these models among Members through collaboration and workshops
- Encourage the continued interaction through workshops and advanced forecaster training sessions to develop national TC forecasting capability.
- Specify the objectives, targeted trainees and interactive sessions of future workshops.
- Request WMO to request to NWP centers to make available EPS outputs to NMHSs for TC forecasting.
- Develop techniques to make EPSs applicable to TC forecasting. Develop methods for calibration of TC intensity, utilization of an ensemble of EPSs, interpretation techniques of probabilistic forecasts for decision makers, and downscaling techniques.
- Encourage collaboration among meteorologists and various users to realize the potential benefits of EPS
- To organize, seminars and workshops to train forecasters on EPS, as soon as EPS is proven to be operationally useful
- Accelerate, through regional cooperation, the ongoing projects under Asian THORPEX and WMO demonstration projects.
- To organize at least two demonstration projects for the application of EPS in storm surge, landslide, wave model, and flood forecasting.

4. With regarding the assistance to Cambodia, DPR of Korea and Lao PDR to strengthen the NMHSs of the said Members in particular in communication and human resource development,, the Chairman of WGM briefed latest information, based on the information from the TC Workshop on Effective Early Warning for Typhoons (Shanghai, April 2005) and other sources. The meeting with satisfactory noted that Viet Nam provided the assistance to Lao PDR in 2005.

5. The meeting of WGM noted the importance of the Third Conference on Early Warning (EWCIII), in Bonn, Germany, in March 2006, as an opportunity to enhance visibility of TC and expressed its appreciation to UNESCAP, WMO and TCS for the assistance aiming at mobilizing resources to enable TC Members to participate in EWCIII, and encourage the interested Members attend the conference with their proposal and/or Presentation.

6. The WGM proposed and primarily discussed the issue of nameless tropical cyclones at the regional and international level.

7. The meeting of WGM made the necessary updates and revisions on the Committee's RCPIP related to meteorology. The updates are available in Appendix ??.

8. The following recommendations were made by the Meeting of WGM, on the basis of the information provided:

- Encourage participation of Committee Members at the ASIA/THORPEX (mainly on NWP and EPS issues).
- Initiate the process to address the issue of naming tropical depressions.
- Organize a workshop, namely, “Inter-comparison between Members’ Typhoon Monitoring, Forecasting Information Comprehensive Processing Systems” in 2006, with an aim to exchange good practice among Members and improve the typhoon forecaster’s platforms of the Members.
- Organize a workshop on EPS in 2007.
- Organize a training course on the application of radar and satellite data to monitor tropical cyclones.
- Adopt the revision of the RCPIP proposed by WGM as contained in Appendix ??.
- Implement the targeted activities for 2006 under the meteorological component of the RCPIP.

APPENDIX VI

RSMC Activities in 2005 and Implementation Plan for 2005-2010

1. Provision of RSMC Products

The RSMC Tokyo-Typhoon Center (hereafter refered to as the Center) has been providing the Typhoon Committee Members with various kinds of products on tropical cyclones in the western North Pacific and the South China Sea through the GTS and the AFTN. Table 1 shows the total numbers of the products provided by the Center in 2005 (as of 30 September).

2. Track Forecast

Operational track forecasts for 19 tropical cyclones which attained TS intensity or higher in 2005 (as of 30 September) were verified against best track data of the Center. Figure 1 shows annual mean errors of 24-hour (from 1982), 48-hour (from 1988) and 72-hour (from 1997) forecasts of center positions. The annual mean position errors for this year are approximately 100 km (125 km in 2004) for 24-hour forecast, 174 km (243 km) for 48-hour forecast and 278 km (355 km) for 72-hour forecast. The annual mean position errors for 24-hour forecast in 2005 are smallest after each forecast started operationally. The annual mean ratios of EO (position errors of operational forecasts) to EP (position errors of PER-method forecasts) are 51 % (54 % in 2004) for 24-hour forecast, 37% (47 %) for 48-hour forecast and 37% (45%) for 72-hour forecast, which are also lowest after inauguration of each operational forecast. Position error statistics of 24-, 48- and 72-hour forecasts for each tropical cyclone are shown in Table 2.

3. Intensity Forecast

Table 3 gives root mean square errors (RMSEs) of 24-, 48- and 72-hour intensity forecasts for each tropical cyclone in 2005 (as of 30 September). The annual mean RMSEs of central pressure forecasts were 12.2 hPa (11.4 hPa in 2004), 16.4 hPa (16.1 hPa), and 19.4 hPa (18.6 hPa) for 24-, 48- and 72-hours, respectively, while those of maximum wind speed forecasts for 24 hours were 5.5 m/s (5.1 m/s in 2004), 7.5 m/s (7.1 m/s) and 10.4 m/s (8.1 m/s), respectively. The overall performance of intensity forecasts in 2005 was a little worse than in 2004.

4. RSMC Data Serving System

The Center operates the RSMC Data Serving System (RSMC-DSS) to allow TC Members to retrieve NWP products such as GPVs and observational data through the Internet. RSMC-DSS is serving nine user countries/territories as of 30 September. The products and data being provided through the system are listed in Table 4.

5. JMA Numerical Typhoon Prediction (NTP) Website

The Center has officially operated the Numerical Typhoon Prediction (NTP) Website with cooperation of eight NWP centers; BOM (Australia), CMC (Canada), DWD (Germany), ECMWF, KMA (Republic of Korea), NCEP (USA), UKMO (UK) and JMA since October 2004.

The NTP Website offers predictions of tropical cyclone tracks performed by the models of major NWP centers in the world to assist the NMHSs of the Typhoon Committee (TC) Members in better tropical cyclone forecasting and warning services.

The contents of the NTP Website includes:

1) a data table and a chart of the latest predicted positional data of the participating NWP centers with analysis data of JMA, which have several useful functions such as deriving an ensemble mean from any combination of the centers' predictions of a user's choosing, and
2) maps of the NWP models of the participating NWP centers.

Ten TC Members except Japan have already registered for users of the NTP Website as of 30 September.

6. Migration of SAREP and RADOB to BUFR

The World Meteorological Organization (WMO) is now implementing the migration from Traditional Alphanumeric codes (TACs) to Table Driven Code Forms (TDCFs) based on the migration plan which was designated by the Commission for Basic Systems (CBS) and endorsed at the World Meteorological Congress.

The migration plan includes SAREP and RADOB which are widely used by the Members of the Typhoon Committee for exchanging information regarding tropical cyclones. Since the plan calls for migration of SAREP and RADOB by 2006 and 2008, respectively, the Members concerned are urged to take necessary actions according to their national migration plan.

The Center proposed a template and descriptors of the SAREP report in BUFR format, and ECMWF reported that there was no problem in them. Therefore, the template and descriptors were registered as formal ones by WMO. Prior to the dissemination of the SAREP report in BUFR format, the Center asked HKO to cross-check the sample reports in July 2005, and HKO kindly examined and decoded them correctly.

The Center plans to start disseminating SAREP report in BUFR format in November 2005, while it will continue disseminating SAREP in the present TAC format. One year after the dual exchange started, the Center will discontinue disseminating the SAREP report in TAC format in November 2006 if Members are ready in receiving and decoding the SAREP report in BUFR format.

The Center will implement the migration of RADOB and SAREP to BUFR with sufficient coordination and collaboration with the Members.

7. Expanded Best Track Data Set for the Western North Pacific and the South China Sea

At the thirty-sixth session of the Typhoon Committee held in Kuala Lumpur, Malaysia in December 2003, a plan to produce an "Expanded Best Track Data Set for the Western North Pacific and the South China Sea" (hereafter EBT) was approved. Each Member should send observational data, data related to disaster and so on to be included in EBT to the Center, and the Center would put the data into EBT after basic screening.

TCS requested all Members to provide the data from 1996 to 2004 by March 2005. Seven Members provided the data for the Center as of 31 October 2005. The Center is screening the data before putting the data into EBT.

Considering that EBT would contribute to the disaster preparedness as an important database for each Member, the Members that did not provide the relevant data for the Center are requested to provide the data.

8. Publication

The Center published:

1) "Annual Report on Activities of the RSMC Tokyo-Typhoon Center in 2004" in October 2005. It is now available at the website of the Center (http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm).
2) "Technical Review (No.8)" in November 2005 (now editing) that contains the following papers:
   - Verification of the guidances during the period of typhoon Songda (0418)
   - Estimation of the Radius of Probability Circle in Typhoon Track Forecast.

   It will be published by the end of this year.

9. Training

1) International seminar

The "International Training Seminar on Typhoon Monitoring and Forecasting in the Western North Pacific" was held from 17 February to 4 March 2005 in Tokyo with participation of four experts from four countries; Cambodia, Laos, Micronesia, and Philippines. The purpose of the seminar is to share recent knowledge and techniques of typhoon monitoring and forecasting with forecasters of NMHSs in the region through lectures, on-the-job training and discussions. The seminar included lectures on typhoon analysis/forecasting and NWP and its products, and practical training on typhoon analysis/forecasting, etc.

2) Attachment to RSMC

Two forecasters from Macao, China and Singapore visited at the Center from 20 to 29 July 2005 for the on-the-job training for typhoon operations. The training was carried out with the support of WMO in response to the proposal presented at the thirty-third session of the Typhoon Committee. During the two weeks the two forecasters experienced the analysis and forecasts for Dianmu (0406) in reference to the operational procedures of the Center.

3) Training Course on Typhoon Forecast by using NWP Technique

"Training Course on Typhoon Forecast by using Numerical Weather Prediction (NWP) Technique" was held at Thailand Meteorological Department (TMD) in Bangkok, Thailand from 22 to 31 August 2005. The purpose of the training course is for the staff of TMD to understand the fundamental knowledge essential for operation, development and improvement of NWP system as well as application of NWP to typhoon forecast. TMD invited Head of the Center who gave lectures on the overview of typhoon, analysis and forecast method of typhoon at the Center, the overview of NWP system, quality control, data assimilation, physical processes of NWP model, verification, application of NWP, and finite difference method.

10. Implementation Plan

Table 5 shows the implementation plan of the Center for the period from 2005 to 2009.

Table 1 Monthly and annual total numbers of products issued by the RSMC Tokyo - Typhoon Center in 2005 (as of 30 September)

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TCNA20	15	0	11	18	0	41	85	108	122				**400**
TCNA21	19	0	18	22	4	42	95	125	144				**469**
WTPQ20-25	37	0	37	45	10	67	197	254	294				**941**
WTPQ30-35	9	0	9	12	2	21	49	67	88				**257**
FXPQ20-25	29	0	25	33	7	62	141	185	213				**695**
FKPQ30-35	19	0	19	22	5	38	97	124	145				**469**
AXPQ20	0	1	1	0	1	0	1	3	7				**14**

Notes:

- via the GTS or the AFTN -

SAREP	TCNA20/21 RJTD
RSMC Tropical Cyclone Advisory	WTPQ20-25 RJTD
RSMC Prognostic Reasoning	WTPQ30-35 RJTD
RSMC Guidance for Forecast	FXPQ20-25 RJTD
Tropical Cyclone Advisory for SIGMET	FKPQ30-35 RJTD
RSMC Tropical Cyclone Best Track	AXPQ20 RJTD

Table 2 Mean Position Errors of 24-, 48- and 72-hour Operational Forecasts in 2005 (as of 30 September)

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast			
			Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num.	EO/EP (%)
STS	KULAP	(0501)	138	87	11	46	332	153	7	49	706	299	3	95
STS	ROKE	(0502)	178	107	6	104	98	21	2	0	0	0	0	0
TY	SONCA	(0503)	108	83	14	37	225	128	10	27	505	53	6	29
TY	NESAT	(0504)	74	41	38	42	120	81	33	29	225	129	28	32
TY	HAITANG	(0505)	95	45	25	47	122	67	21	22	142	69	17	14
TS	NALGAE	(0506)	140	86	12	78	144	110	8	26	200	76	4	19
STS	BANYAN	(0507)	138	56	21	51	324	123	17	56	573	193	13	71
TS	WASHI	(0508)	78	22	5	63	278	0	1	0	0	0	0	0
TY	MATSA	(0509)	75	50	24	56	91	54	20	36	188	122	16	52
STS	SANVU	(0510)	117	48	6	43	274	29	2	0	0	0	0	0
TY	MAWAR	(0511)	74	43	13	27	210	72	9	20	355	212	5	13
STS	GUCHOL	(0512)	107	82	29	68	188	112	25	44	318	185	21	43
TY	TALIM	(0513)	92	43	35	47	129	86	31	29	158	66	27	23
TY	NABI	(0514)	75	33	21	57	136	61	17	40	193	92	13	32
TY	KHANUN	(0515)	105	67	20	65	157	87	16	40	285	165	12	53
TS	VICENTE	(0516)	83	43	5	10	262	0	1	0	0	0	0	0
TY	SAOLA	(0517)	129	73	19	42	263	83	15	33	278	165	11	19
TY	DAMREY	(0518)	115	81	23	72	241	153	19	77	468	257	15	101
TY	LONGWAN(	(0519)	78	37	24	61	145	61	20	42	226	84	16	42
Mean(Total)			100	65	351	51	174	116	274	37	278	198	207	37

EO/EP indicates the ratio of EO (mean position error of operational forecasts) to EP (mean pos
forecasts by the persistency method)

Table 3 Root Mean Square Errors (RMSEs) of 24-, 48- and 72-hour intensity forecasts For each tropical cyclone in 2005 (as of 30 September)

Tropical Cyclone			RMSE of 24-hour Forecast			RMSE of 48-hour Forecast			RMSE of 72-hour Forecast		
			Central pressure (hPa)	Maximum Winds (m/s)	Number	Central pressure (hPa)	Maximum Winds (m/s)	Number	Central pressure (hPa)	Maximum Winds (m/s)	Number
STS	KULAP	(0501)	2.7	1.3	11	7.1	4.1	7	7.2	5.4	3
STS	ROKE	(0502)	8.4	5.3	6	2.8	1.8	2	0.0	0	0
TY	SONCA	(0503)	25.2	10.8	14	29.6	11.9	10	28.6	12.4	6
TY	NESAT	(0504)	14.4	5.4	38	16.4	6.4	33	12.7	5	28
TY	HAITANG	(0505)	10.5	4.2	25	10.9	5.4	21	22.6	9.3	17
TS	NALGAE	(0506)	7.3	4.3	12	9.3	6	8	11.5	7.6	4
STS	BANYAN	(0507)	7.9	6	21	14.9	10.9	17	20.3	14.4	13
TS	WASHI	(0508)	3.6	2.3	5	6.0	18	1	0.0	0	0
TY	MATSA	(0509)	9.1	2.9	24	12.3	5.6	20	18.5	8.1	16
STS	SANVU	(0510)	3.1	1.8	6	7.0	6.6	2	0.0	0	0
TY	MAWAR	(0511)	6.5	3.3	13	5.8	2.8	9	8.0	3.8	5
STS	GUCHOL	(0512)	17.0	7.1	29	20.3	7.9	25	20.2	7.1	21
TY	TALIM	(0513)	12.7	4.7	35	17.7	6.9	31	16.4	6.9	27
TY	NABI	(0514)	11.5	6.3	21	20.3	7.1	17	29.1	10.7	13
TY	KHANUN	(0515)	6.8	3.9	20	13.4	6.5	16	18.0	7.8	12
TS	VICENTE	(0516)	7.5	5	5	14.0	7.7	1	0.0	0	0
TY	SAOLA	(0517)	6.8	3.6	19	13.1	5.4	15	15.4	6.8	11
TY	DAMREY	(0518)	11.5	5.9	23	19.6	11.1	19	22.6	24	15
TY	LONGWANG	(0519)	15.3	7.3	24	16.3	7.4	20	21.0	9.9	16
Mean(Total)			12.2	5.5	351	16.4	7.5	274	19.4	10.4	207

Table 4 List of GPV products and data on the RSMC Data Serving System

Area	20S-60N, 80E-160W	20S-60N, 60E-160W
Resolution	2.5×2.5 degrees	1.25×1.25 degrees
Levels and elements	Surface (P,U,V,T,TTd,R) 850hPa (Z,U,V,T,TTd,ω) 700hPa (Z,U,V,T,TTd,ω) 500hPa (Z,U,V,T,TTd,ξ) 300hPa (Z,U,V,T) 250hPa (Z,U,V,T) 200hPa (Z,U,V,T) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T)	Surface (P,U,V,T,TTd,R)** 1000hPa (Z,U,V,T,TTd) 925hPa (Z,U,V,T,TTd,ω) 850hPa (Z*,U*,V*,T*,TTd*,ω,ψ,χ) 700hPa (Z*,U*,V*,T*,TTd*,ω) 500hPa (Z*,U*,V*,T*,TTd*,ξ) 400hPa (Z,U,V,T,TTd) 300hPa (Z,U,V,T,TTd) 250hPa (Z,U,V,T) 200hPa (Z*,U*,V*,T*,ψ,χ) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T) 70hPa (Z,U,V,T) 50hPa (Z,U,V,T) 30hPa (Z,U,V,T) 20hPa (Z,U,V,T) 10hPa (Z,U,V,T)
Forecast hours	(00 and 12 UTC) 0, 6, 12, 18, 24, 30, 36, 48, 60 and 72 hours	(00 and 12 UTC) 0 – 84 every 6 hours In addition (12 UTC), * 96, 120, 144, 168 and 192 hours ** 90 – 192 every 6 hours
Frequency (initial times)	Twice a day (00 and 12 UTC)	Twice a day (00 and 12 UTC)

Area	Whole globe		Whole globe
Resolution	2.5×2.5 degrees		1.25×1.25 degrees
Levels and elements	Surface(P,R,U,V,T) 1000hPa(Z) 850hPa(Z,U,V,T,TTd) 700hPa(Z,U,V,T,TTd) 500hPa(Z,U,V,T) 300hPa(Z,U,V,T) 250hPa(Z,U,V,T)* 200hPa(Z,U,V,T) 100hPa(Z,U,V,T)* 70hPa(Z,U,V,T)* 50hPa(Z,U,V,T)* 30hPa(Z,U,V,T)*	Surface (P,U,V,T,TTd*) 1000hPa (Z,U,V,T,TTd*) 850hPa (Z,U,V,T,TTd) 700hPa (Z,U,V,T,TTd) 500hPa (Z,U,V,T,TTd*) 400hPa (Z,U,V,T,TTd*) 300hPa (Z,U,V,T,TTd*) 250hPa (Z,U,V,T) 200hPa (Z,U,V,T) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T) 70hPa (Z,U,V,T) 50hPa (Z,U,V,T) 30hPa (Z,U,V,T) 20hPa (Z,U,V,T) 10hPa (Z,U,V,T)	Surface (P,U,V,T,RH,R) 1000hPa (Z,U,V,T,RH,ω) 925hPa (Z,U,V,T,RH,ω) 850hPa (Z,U,V,T,RH,ω,ψ,χ) 700hPa (Z,U,V,T,RH,ω) 600hPa (Z,U,V,T,RH,ω) 500hPa (Z,U,V,T,RH,ω,ξ) 400hPa (Z,U,V,T,RH,ω) 300hPa (Z,U,V,T,RH,ω) 250hPa (Z,U,V,T) 200hPa (Z,U,V,T,ψ,χ) 150hPa (Z,U,V,T) 100hPa (Z,U,V,T) 70hPa (Z,U,V,T) 50hPa (Z,U,V,T) 30hPa (Z,U,V,T) 20hPa (Z,U,V,T) 10hPa (Z,U,V,T)
Forecast hours	(00 and 12 UTC) 24, 48 and 72 hours In addition (12 UTC), 96 – 192 every 24 hours * 96 and 120 only	(00 and 12 UTC) 0 hours * 00UTC only	(00 and 12 UTC) 0 – 84 every 6 hours In addition (12 UTC), 96 – 192 every 12 hours

Frequency (initial times)	twice a day (00 and 12 UTC)	twice a day (00 and 12 UTC)

Area	Whole globe
Resolution	2.5×2.5 degrees
Levels and elements	Surface (P) 1000hPa(Z) 850hPa (T,U,V) 500hPa (Z) 250hPa (U,V) *Above GPVs are ensemble mean and standard deviation of ensemble forecast memers.
Forecast hours	Every 12 hours from 0 192 hours
Frequency (initial times)	Once a day (12 UTC)

Notes: P : pressure reduced to MSL R : total precipitation RH :relative humidity
T : temperature TTd: dew point depression U : u-component of wind
V : v-component of wind Z : geopotential height ξ : relative vorticity
χ : velocity potential ψ : stream function ω : vertical velocity

Products/ Data	Satellite data	Typhoon Information	Global Wave Model (GRIB)	Observational data
Contents	MTSAT-1R data (GRIB) ・Equivalent blackbody temperature	Tropical cyclone related information (BUFR) ・Position, etc.	・Significant wave height ・Prevailing wave period ・Prevailing wave direction Forecast hours: 0, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84 (00 and 12 UTC); 96, 108, 120, 132, 144, 156, 168 ,180 and 192 hours (12 UTC)	(a) Surface data (SYNOP, SHIP) (b) Upper-air data (TEMP, parts A-D) (PILOT, parts A-D)
Frequency (initial times)	4 times a day (00, 06, 12 and 18 UTC)	4 times a day (00, 06, 12 and 18 UTC)	Twice a day (00 and 12 UTC)	(a) Mainly 4 times a day (b) Mainly 2 times a day

Table 5 Implementation Plan of the RSMC Tokyo-Typhoon Center (2005-2009)

PRODUCT	2005	2006	2007	2008	2009	REMARKS
Satellite Observation						
GMS S-VISSR*	——					24 times/day (full-disk)
MTSAT HiRID	···——	——	——			All observed cloud images (full or half-disk)
MTSAT HRIT	···——	——	——	——	——	All observed cloud images (full or half-disk)
GMS/MTSAT WEFAX*	——	——	——			8 times/day (4-sector), 24 times/day (Image H), 24 times/day (Image I or J)
MTSAT LRIT	···——	——	——	——	——	24 times/day (full-disk), 24 times/day (polar-stereo East Asia)
Cloud motion wind (SATOB)	——	——	——			4 times/day
Cloud motion wind (BUFR)	——	——	——	——	——	4 times/day
Analysis						
SAREP (for tropical cyclones, TACs)	——	——	····			4-8 times/day Dvorak intensity*** (estimation included)
SAREP (for tropical cyclones, BUFR)	····	······——	——	——	——	
Report of typhoon analysis**	——	——	——	——	——	8 times/day
Sea Surface Temperature	——	——	——	——	——	
Objective analysis						
pressure pattern, etc	——	——	——	——	——	FAX
stream lines	——	——	——	——	——	FAX****
Cloud distribution	——	——	——	——	——	GPV****
Forecast						
RSMC Prognostic Reasoning	——	——	——	——	——	2 times/day
RSMC Guidance for Forecast	——	——	——	——	——	TYM up to 84 hours 4 times/day GSM up to 90 hours 2 times/day
NWP products						
pressure pattern, etc	——	——	——	——	——	FAX, GPV (GSM)
stream line	——	——	——	——	——	FAX****
Numerical Typhoon Prediction Web Site						
tracks and prediction fields, etc	——	——	——	——	——	mostly updated 2 times/day up to 84 hrs
RSMC Tropical Cyclone Advisory**	——	——	——	——	——	4 times/day up to 72 hrs 8 times/day up to 24 hrs
Others						
RSMC Tropical Cyclone Best Track	——	——	——	——	——	GTS
Annual Report	——	——	——	——	——	
Technical Review	····	····	····	····	····	(as necessary)

SUPPORTING ACTIVITY	2005	2006	2007	2008	2009	REMARKS
Data archive	——	——	——	——	——	
Monitoring of data exchange	——	——	——	——	——	
Dissemination of products	——	——	——	——	——	RSMC Data Serving System

* WEFAX from GOES-9 GVAR is disseminated via GMS-5 and S-VISSR from GOES-9 GVAR is disseminated to registered NMHSs through the Internet in place of S-VISSR via GMS-5.

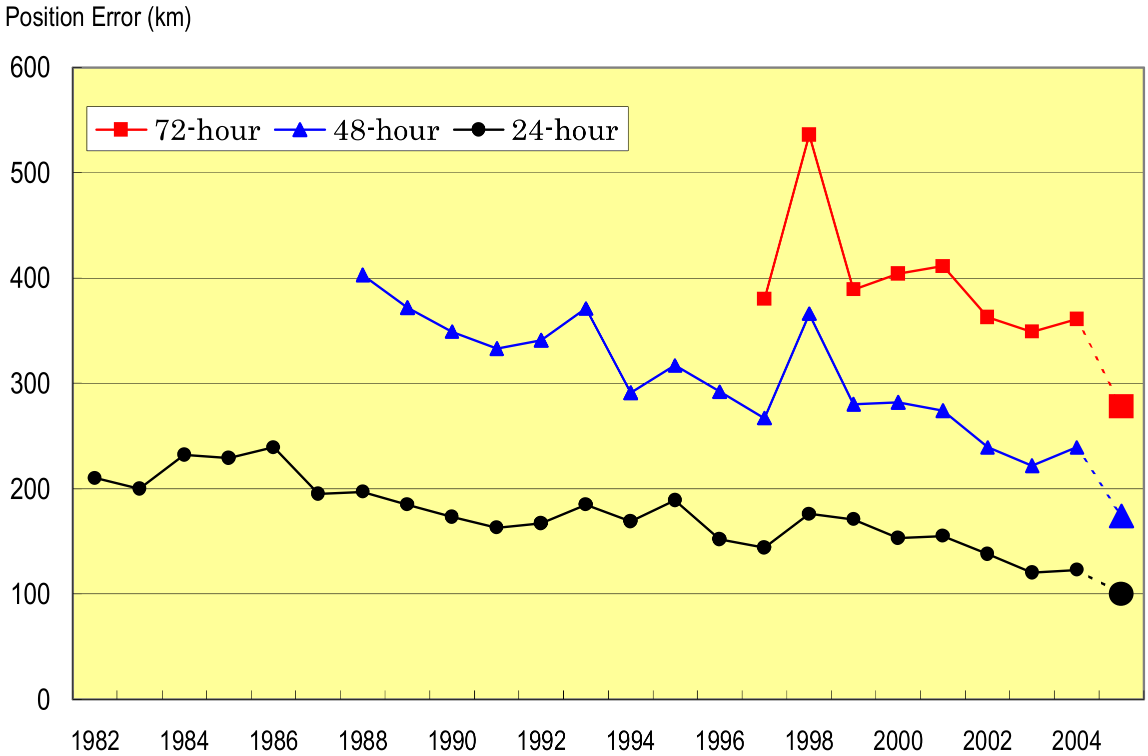
** "RSMC Tropical Cyclone Advisory" involves "Report of typhoon analysis"

*** 8 times a day for CSC (Cloud System Center) position, system size and moving.

**** Some of these products will be disseminated within the capacity of traffic of the GTS and JMH.

Figure 1 Annual means of position errors of 24-, 48- and 72-hour operational track forecasts

(as of 30 September)



APPENDIX VII

PROPOSED AMENDMENTS TO THE TYPHOON OPERATIONAL MANUAL (TOM)

Introduction

1. The Typhoon Committee Operational Manual - Meteorological Component (TOM) has been reviewed and updated every year since the first issue in 1987. The 2005 edition of TOM was published in February 2005 in accordance with the approval of amendments to the previous issue of TOM at the thirty-seventh session of the Typhoon Committee (15 to 20 November 2004, Shanghai, China) as proposed by the rapporteur.

2. At the thirty-seventh session, the Committee decided that a rapporteur of the Japan Meteorological Agency (JMA) would continue the services for updating TOM. On 8 June 2005, the rapporteur, Mr. Nobutaka Mannoji, Head of the RSMC Tokyo - Typhoon Center, invited the individual focal points of the meteorological component of the Members to provide him with proposals on the further update of TOM.

3. As of the end of October 2005, proposals were submitted by the seven focal points of Hong Kong/China, Japan, Macao/China, Malaysia, Republic of Korea, Singapore, and Thailand.

4. Major points of the proposed amendments are as follows:

- Amendment to Chapter 2 to add information on the migration of SAREP to BUFR.

- Amendment to Appendix 2-A and 2-B to add a surface observing station and upper-air observing stations in Malaysia.

- Amendment to Appendix 2-D to update information on radar stations in Macao/China, Malaysia, Republic of Korea and Thailand.

- Amendment to Appendix 2-E to update the schedule of MTSAT observations and disseminations.

- Amendment to Appendix 2-F to update satellite imagery receiving facilities in Republic of Korea, Hong Kong/China, and Singapore.

- Amendment to Appendix 3-A to update information of tropical cyclone prediction models improved by Japan.

- Amendment to Appendix 4-B to update weather forecast areas for the high seas fixed by Republic of Korea.

- Amendment to Appendix 5-C to add tropical cyclone forecasts by Hong Kong/China, and to update items on tropical cyclone related information distributed to or through Bangkok.

Action Proposed

5. The Committee is invited to:

(a) Note the information given in this document; and
(b) Review and approve the proposed amendments to TOM with modifications as necessary.

Proposed Amendments to
the Typhoon Committee Operational Manual - Meteorological Component (TOM)

Page	Line	Present Description		Proposed Amendment

CHAPTER 2

Page	Line	Present Description		Proposed Amendment
9	24	1, FM85-IX (WMO Publication No.306).	→	*<< to be added after this line.>>* 1, FM85-IX (WMO Publication No.306). Regarding a WMO plan for migration to table driven code forms, SAREP reports in BUFR FM-95 (IUCC10 RJTD) has been disseminated since November 2005 as transition measures for users. WMO codes and representation forms, guide to WMO table driven code form FM 94 BUFR, and BUFR/CREX templates to transmit in table driven code forms are given in the WMO webpage (http://www.wmo.ch /web/www/WMOCodes.html).

CHAPTER 3

Page	Line	Present Description		Proposed Amendment
13	12	*Table 3.2* Whole globe 1.25x1.25 degrees Surface(P,U,V,T,RH,R,**CI**)	→	*<< to be deleted.>>* Satellite data 1.25x1.25 degrees Surface(P,U,V,T,RH,R)
14	12	*Table 3.2 Notes:* Notes: **CI: cloud cover (total)** P: pressure 갱	→	*<< to be deleted.>>* Notes: P: pressure갱 갱 갱 .

CHAPTER 5

Page	Line	Present Description		Proposed Amendment
25	4	*Table 5.1* Tokyo - Manila Cable, 16kbit 갱 갱 갱 갱 .	→	*<< to be added.>>* Tokyo - Manila Cable **(F/R)**, 16kbit 갱 갱 갱 갱 .

Appendix 2-A

Page	Line	Present Description		Proposed Amendment
		Malaysia (48): 601, 615, 620, 647, 657, 665	→	*<< to be added.>>* (48): 601, 615, 620, 647, **650**, 657, 665

Appendix 2-B

Page	Line	Present Description		Proposed Amendment
		Malaysia (48): 601, 615, 647, 657	→	*<< to be added.>>* (48): 601, 615, 647, **648, 649, 650**, 657

Appendix 2-D

Page	Line	Present Description		Proposed Amendment
8		*Macao, China (OPERATIONAL MODE)* Every **15** minutes	→	*<< to be replaced.>>* Every **12** minutes
9		*Malaysia*	→	*<< to be replaced.>>* *new document (see **Attachment A2D1**)*
14		*Republic of Korea*	→	*<< to be replaced.>>* *new document (see **Attachment A2D2**)*
17		*Thailand*	→	*<< to be replaced.>>* *new document (see **Attachment A2D3**)*

Page Line	Present Description		Proposed Amendment
Appendix 2-E			
		→	*<< to be replaced.>>* *new document (see **Attachment A2E**)*
Appendix 2-F			
		→	*<< to be replaced.>>* *new document (see **Attachment A2F**)*
Appendix 3-A			
		→	*<< to be replaced.>>* *new document (see **Attachment A3A**)*
Appendix 4-B			
	Republic of Korea	→	*<< to be replaced.>>* *new document (see **Attachment A4B**)*
Appendix 4-C			
	Station: Hong Kong, Area covered 30N 125E to 10N 125E, **to 10N 125E,** to 10N	→	*<< to be deleted.>>* 30N 125E, to 10N 125E, to 10N
Appendix 5-A			
	Republic of Korea	→	*<< to be replaced.>>* Daejeon Regional Meteorological Office Korea Meteorological Adm. (Chief Executive: W.J. Lee) 22, Guseong-dong, Yuseong-gu, Daejeon Korea 305-338 Tel.: (+82)(41) 862 8144 Fax: (+82)(41) 862 8141
	Thai Meteorological Department	→	*<< to be replaced.>>* (Director-General: Mr. Suparerk Tansriratanawong) Tel.: (+66)(2)399 1425 Fax: (+66)(2) 399 1426 E-mail: suparerk@metnet.tmd.go.th
	Weather Forecast Bureau *Thai Meteorological Department*	→	*<< to be replaced.>>* (Director: Mr. Amorn Chantanavivate) Tel.: (+66)(2)398 9801 Fax: (+66)(2)398 9830 Tel.& Fax: (+66)(2)399 4012-4 E-mail: weatherman@metnet.tmd.go.th
	Meteorological Telecommunication and Information Division *Thai Meteorological Department*	→	*<< to be added.>>* E-mail: kumpol@metnet.tmd.go.th
Appendix 5-B			
	Singapore	→	*<< to be added.>>* Singapore **WTSR20 WSSS**
Appendix 5-C			
		→	*<< to be replaced.>>* *new document (see **Attachment A5C**)*

Appendix VIII

Report of the Working Group on Hydrology

The pre-session meeting of WGH was held at Ballroom on 14 November 2005. The meeting was chaired by Mr. Katsuhito Miyake, chair of the WGH, with (how many?) participants from (how many) countries.

Firstly, the agenda of election of officers for the next term was conducted. As a result, Mr. Katsuhito Miyake was proposed to serve as chair of the WG, and Dr. Hong Il-Pyo was proposed as vice-chair of the WG. In addition, considering the increasing activities of the WG, it was also proposed that Dr. Liu Jimping would serve for the WG as Secretary.

Next, Mr. Miyake introduced by presentation style the discussions and results of the Workshop of WGH held from 5 to 8 September 2005 in Kuala Lumpur, hosted by the Ministry of Natural Resources and Environment, Malaysia.

Most of the activities taken during the past inter-sessional period by each members were reviewed during the said WS. Therefore the discussion was focused on future works rather than sharing information of each members' activities.

Among some issues discussed in the session are as below.

1. The WG's willingness to take up a new project on socio-economic impact assessment was reaffirmed.
2. The WG's willingness to further deepen the level of collaboration with two other WGs was reaffirmed.
3. Participation in WWF4 to disseminate the activities of WGH and to raise visibility of TC was agreed.
4. The idea of making the best use of the external funds to proceed the activities attached to RCPIPs was reconfirmed.

APPENDIX IX
Report of the TRCG

Agenda for TRCG meeting in 38th session

1. Review of summary for inclusion in the final report of TRCG
2. Roving seminar at Vietnam in 2006
    a. Period: 3-4 days in 2006 (depending on the host)
    b. Fund support: approx. USD 10,000~15,000 (for the invitation of two lecturers and for the support of 5-7 attendents in the neighboring countries)
    c. Subject: the decisive factors to determine tropical cyclone intensification, its movement, and associated heavy rainfalls and/or other subjects at locality
    d. Lecturers to be invited ?
    e. Participants to be supported ?
3. Research subjects in the future, including update of RCPIP

Summary for inclusion (38th session)

Wide ranges of research activities has been carried out by Members during the intersession period, including topics associated with

- 3d/4d-Var data assimilation and bogusing with satellite drift wind and AMSU radiance,
- conceptual models on formation probability, twin typhoon interaction, structural change at landfall, vertical wind shear and rain asymmetry, intensity measures with microwave channels,
- application of ensemble prediction system guidance; calibration and bias correction, downscaling to high winds,
- statistical models for intensity forecasting, continued improvement of STIPS and CLIPER,
- development of high resolution model for interaction with ocean, inner core structure, various verification studies,
- long-range forecasting to understand the influence of MJO on storm intensity

At the kind invitation of the China Meteorological Administration (CMA), the second regional workshop entitled “Effective tropical cyclone warning” was hosted at the Shanghai Meteorological Bureau (SMB) from 24 to 28 April 2005, and the SMB made excellent arrangements for the workshop. The workshop was particularly focused on cross collaboration among the three components. The workshop was supported from the Typhoon Committee Trust Fund (TCTF) of USD 27,400 for the invitation of five resource persons, two lecturers for EPS, and fourteen participants. WMO supported the expenses for the representative of WMO to provide a special lecture. The CMA kindly provided financial support for the two resource persons from USA and Australia respectively in addition to the expenses including the venue, facilities, and working arrangements. The Hong Kong Observatory, JMA, KMA, Macao China supported the expenses for the national representative to attend the workshop. Major findings and recommendation of the workshop can be found in ANNEX I.

A research project completed, and two research projects are going on under the Typhoon Committee research fellowship scheme during the intersession period.

- Effect of tropical cyclone bogusing on model analysis and forecasts by Ms. Wang Dongliang, Shanghai Typhoon Institute , hosted by Hong Kong Observatory, China during 11 Oct. – 10 Dec. 2004
- Evaluation of the model performance in typhoon prediction in the high-resolution global model (T426L40) by Ms Sugunyanee Yavinchan, Thai Meteorological Department , hosted by Typhoon Research Center, Kongju Nat'l University, Republic of Korea during 1 Aug. – 30 Oct. 2005
- Impact study of Moisture Data on TC Forecasting in South China Sea and Western North Pacific by Dr. Vicente B. Malano, PAGASA , hosted by Hong Kong Observatory, China during 20 Sept. – 19 Nov. 2005

It is noted that the paper from the research by Dr. Peng Taoyong (China), hosted by Korea Meteorological Administration during 15 JUN- 15 NOV 2001 (5 months) on TC track forecasting with use of superensemble, has been recently published in Int'l J. Systems & Cybernetics (2005).

Two roving seminars on the application of multi-model ensemble typhoon forecasts were held during the intersession period with the financial support of 10,000 USD from the Typhoon committee Trust Fund (TCTF), and the kind arrangements of the local hosts.

- Beijing, China, 22-24 Nov. 2004
- Petaling Jaya, Malaysia, 25-27 Nov. 2004

More than 40 participants attended for the two roving seminars. The roving seminars were well recognized, in which a host of knowledge on ensemble forecast theories and applications were lectured, experiences of TC numerical model developing and operational TC forecasting were fully exchanged. All the participants expressed their appreciation of the significance and helpfulness of the seminar. The participants expressed their thanks to the lecturers Dr. Chan and Dr. Mannoji for the high standards and providing excellent notes which had enhanced their knowledge on tropical cyclones and in the ensuing discussions during and after the lectures the participants learned a lot about the short comings, current status and progress made in tropical cyclone formation and prediction. The TRCG noted that JMA provide workshop on numerical weather prediction at Thai meteorological department in 2005, which contribute to the capacity building of members. The TRCG recommend that similar workshop could be held frequently with the voluntary support of Members.

Regarding to the activities of TRCG for 2006, TRCG propose to hold a roving seminar as shown in Annex II. The TRCG also propose to continue the Typhoon Committee research fellowship scheme in 2005, in parallel with review on its progress and direction for the improvement.

The TRCG recommend for the consideration of the committee 38th session to:

- Allocate TC Trust Fund of USD 15,000 for the aforementioned roving seminar in 2006
- Encourage members to promote research under the TC research fellowship scheme with possible extension to hydrology and DPP components, and request TCS to make necessary arrangements to implement the scheme for 2006
- Update the research plan under RCPIP as proposed in Annex III, considering the outcome of the workshop on effective tropical cyclone warning (Shanghai, 24-28 April 2005).
- Support the joint regional workshop every 1-2 years

Research Plan under Regional Cooperation Programme Implementation Plan

* Following contents are duplicated from the final report of 36th session of Typhoon Committee, and partially updated in red color with the recommendation from the workshop on effective tropical cyclone warning (24-28 April 2005, Shanghai, Appendix II).

Broad Goal. To effectively collaborate among Members on research activities applicable to more than one Member and to facilitate the transfer of technology and relevant research to all Members and into operational use.

5.1 Objective 1: To increase the knowledge and understanding of tropical cyclones through observational programme to improve tropical cyclone forecasting, considering the newly developed GEOSS commitments.		
Action	**Completion Date**	**Success**
5.1.1 Organize an International Intensive Observing Experiment.	Before 2006	Completion of experiment.
5.1.2 Use the International Intensive Observing Experiment data set in numerical modeling of tropical cyclones. Improved boundary layer representation for coupled air/sea/land models by, for example, exploiting results from field experiments/projects (e.g., improved parameterization of surface fluxes in high wind regimes and effects of seas spray on transfer coefficients).	2006	Demonstrate and present an improvement in tropical cyclone forecasting in regional workshop/seminar for all Members.
Action	**Completion Date**	**Success**
5.1.3 Conduct additional research into use of current and future remote sensing data to ensure provision of real-time nowcasts to decision-makers including emergency managers.	Continuing through 2006	Incorporation of additional remote sensing data with demonstrable improvement in tropical cyclone forecasting accuracy.

5.2 Objective 2: To improve techniques for tropical cyclone track, intensity, storm surge, destructive winds, rainfall, and flood forecasting.

Action	Completion Date	Success
5.2.1 Improve Dvorak technique for the diagnosis of position and intensity of a tropical cyclone, toward an objective technique blending with microwave imagery, which should be operationally feasible for application.	2006	Operationally implement an objective met hod to determine position and intensity available to all Members.
5.2.2 Improve utilization of multi-model ensemble through the application of available methodology from TIGGE/THORPEX international project for both track and intensity forecasting for the extended period beyond 48 hours. Enhance methods for identification and reduction of the occurrence of guidance and official track outliers, focusing on both large speed errors (e.g., accelerating “re-curvers” and stalling storms) and large direction errors (e.g., loops and unusual tropical cyclone tracks).	2006	Reduce track and intensity error by 1 2%.
5.2.3 Improve operational procedures based on the latest findings associated with vertical shear, interaction with upper level trough, multi-scale interaction with convective systems, air-sea interaction, etc. for intensity forecasting	2007	Reduce intensity error by 12%.
5.2.4 Establish and publish an operational definition of formation and extra-tropical transition.	2004	Coordinate, establish, and publish in Typ hoon Committee Operations Manual – M eteorology Component.
5.2.5 Continue to explore statistical models for the prediction of intensity along with the dynamical approach.	2006	Publish results of statistical intensity mod els research and comparisons with dyna mic models
5.2.6 Investigate the intensity problem including (1) the prediction of heavy rainfall and other weather hazards associated with interaction between monsoon system and a tropical cyclone, based on the interpretation of numerical model output and latest observations available and (2) short-range forecasting of track and intensity for land falling tropical cyclone.	2006	Improve operational intensity forecasts b y 12%.

5.2.7 Evaluate and improve skills of numerical models in forecasting tropical cyclone formation and intensity changes. Use model validation techniques suitable for 3D high resolution verification for tropical cyclones in the process of extra-tropical transition or land-falling. Also include quality control of wind and rainfall evaluated from the microwave channel dataset (both from satellite and radar), and its climatology to construct conceptual models and validation of numerical models.	2006	Improve operational track and intensity forecasts by 1 2 % respectively in terms of standard verification measures .
5.2.8 Investigate data assimilation of retrieved wind and rainfall from satellite, radar, and aircraft winds for the dynamical prediction of intensity in conjunction with the initialization of tropical cyclone vortex for numerical models	Continuing through 2006	Incorporation of additional remote sensing data with demonstrable improvement in tropical cyclone forecasting accuracy.
5.2.9 Understand the structural change of tropical cyclone using a very high-resolution model (1 km) simulating multi-scale interaction with convective clouds. The interface of atmospheric model with hydrological process and ocean waves and tides need to be further developed. The model inter-comparison is encouraged to stimulate the research.	Continuing through 2007	Improve operational track and intensity forecasts by 15%.
5.2.10 Develop improved storm surge guidance models, hopefully in pc platform with the assistance of JMA, including guidance on breaking waves and featuring high resolution input and output.	Continuing through 2007	Improve storm surge forecasts by 10%

5.3 Objective 3: To facilitate the exchange of research results among Members.

Action	**Completion Date**	**Success**
5.3.1 Conduct exchange of meteorological experts among Members through the Typhoon Committee Research Fellowship Scheme.	2006	At least 2 by 2006 with the completion of one research paper per exchange.
5.3.2 Disseminate research results and case studies via Internet.	2004 and updated annually	Complete central web site to host research results
5.3.3 Organize workshops on typhoon forecasting research every two years.	2005	At least 2 forecasters from each Member participating.

5.4 Objective 4: To assist effective warning through the joint research among meteorologists, hydrologists, and DPP personals.

Action	Completion Date	Success
5.4.1 Develop technical procedures to convert the probabilistic information from EPS or other source, into deterministic instruction from the user's point of view, particularly focused on extreme events.	2007	Publication of guide book
5.4.2 Quantitatively assess the impact study and development of comprehensive risk management for the mitigation of socio-economic loss from tropical cyclone with demonstration projects.	2007	Launch of regional project with the support of TCTF or other fund source
5.4.3 Develop hydrological models with inputs from the ensemble prediction system and/or coupled model with land surface module of meteorological model for the flood forecasting and water levels	2008	Performance of model demonstrated
5.4.4 Apply Soil Water Index (for instance, SWI from JMA) model for landslide prediction and flow amount index for flooding	2008	Report of local application of the indexes with adopting relevant softwares

5.5 Other Important Objectives to Consider.

5.5.1 Study the relationship between ENSO and tropical cyclone activity, formation, timing and impacts. The seasonal prediction of tropical cyclone development in terms of probability and frequency using individual members of the multi-model ensemble prediction data.

5.5.2 Develop an expanded Best Track database to include storm surge, rainfall, and maximum winds.

5.5.3 Integrate track and intensity forecasts with GIS of inundated areas, which is very beneficial for hydrological authorities and DPP management officials.

APPENDIX X

Report of the Second Regional Workshop on
"Effective Tropical Cyclone Warning"
Shanghai, China, 24-28 April 2005

1. Introduction

1.1 At the kind invitation of the China Meteorological Administration (CMA), the workshop was hosted at the Shanghai Meteorological Bureau (SMB) and the SMB made excellent arrangements for the workshop. The workshop was designed to stimulate research and developments on the three components, i.e., meteorology, hydrology and disaster prevention and preparedness (DPP), to mitigate the natural disasters associated with tropical cyclones in typhoon affected regions.

1.2 The Workshop was convened by Chairman of the Typhoon Research Coordination Group (TRCG), Mr. Woo-Jin Lee (Republic of Korea) and attended by forty-seven participants. The list of participants is given in Annex I.

1.3 Prior to the Workshop, the Convener organized a Pre-Workshop Coordination Meeting at the SMB at 1420 hours until 1535 hours on 24 April 2005 to set up a detailed working arrangements and to assign sessions' Chairpersons and Rapporteurs.

1.4 The opening ceremony was held at 1600 hours until 1640 hours on 24 April 2005 at the Conference Hall of SMB. During the ceremony, Mr. Xu Xiaofeng, the Deputy Administrator of CMA extended warmest welcome to the participants at the opening of the Workshop on behalf of CMA and himself. In hi s welcoming address, Mr. Tang Xu, the Director-General of SMB, expressed full support to the Workshop and wished the W orkshop a success. The representative of WMO, Mr. Katsuhiro ABE, also delivered a welcoming address.

1.5 The program of the Workshop is contained in Annex II. Following are major issues and recommendations and/or suggestions resulted from the active discussions in the Workshop.

2. Special lecture

Findings

2.1 Mr. Abe was invited to make a special lecture on "Reducing Risks Through Effective Early Warnings of Tropical Cyclones – Lessons learnt from the Kobe World Conference on Disaster Reduction". He outlined that the Meeting featured a series of presentations which dealt with most aspects related to tropical cyclones and associated storm surges, allowing in-depth analysis and experience sharing, as well as updates on technical advances in probabilistic forecasts and effective early warning.

2.2 One of the most effective measures for disaster preparedness is a well-functioning early warning system that delivers accurate and user-friendly information in a timely manner, considering the following aspects

(a) Adequate resources for disaster mitigation caused by tropical cyclones/severe weather hazards;
(b) Improved accuracy in meteorological and hydrological forecasts for longer-ranges and quantification of uncertainty;
(c) Qualified meteorological, hydrological and disaster prevention and preparedness personnel;
(d) Sufficient attention to non-structural (public awareness, information sharing, etc.) mitigation measures to cope with tropical cyclones/severe weather events;

(e) Adequate institutional and infrastructural practices for coordination and capacity-building at national, regional and international levels to cope with the negative impact of tropical cyclones/severe weather risks on economic growth and human progress;
(f) Adequacy of a National Disaster Management Policy that includes effective local dissemination of information to cope with the menace of meteorological and hydrological disasters;
(g) Community consciousness for all stakeholders involved in tropical cyclone/severe weather-related disaster mitigation process and measures.

Recommendations:
2.3 Develop an integrated network for sharing of enhanced observations (GEOSS), model forecasts and products at the regional and global levels;

2.4 Increase accuracy of existing forecasts of tropical cyclones/severe weather events;

2.5 Issue probabilistic forecasts of tropical cyclone/severe weather conditions up to 5 days ahead in all regions, to allow appropriate response. A better way is needed to communicate with the public so as to improve their understanding of probabilistic prediction. One solution for more understandable probabilistic prediction might be to translate it into a more illuminative language, for different stakeholders. Assistance from social scientists may be necessary in the translati on process;
2.6 Increase investment in awareness programmes related to the risks and consequences of natural hazards for decision-makers, emergency managers, media, NGOs, public and other stakeholders for prompt and effective response at the national to community levels;

2.7 Educate stakeholders annually on proper interpretation of forecasts, advisories, warnings and other meteorological and hydrological information. The goal is to c onduct at least one session for each stakeholder; and

2.8 Ensure dependable and effective dissemination of nowcasts, forecasts, advisories, watches and warnings in real-time to decision-makers including emergency managers, media, general public and other stakeholders in most countries and regions.

3. Forecast Accuracy and Reliability

Meteorology

Findings:
3.1 The current status and prospects of forecasting systems at RSMC Tokyo Typhoo n Center and Joint Typhoon Warning Center were presented at the workshop. L evel of complexity for analysis and forecasting is growing with increasing need f or more refined information by the user, requiring regional and/ or international cooperation and coordination.

3.2 The performance of tropical cyclone track forecasts by leading centers has been continuously improving in recent years. However tropical cyclone fix has uncertainty especially in the early stages. Position foreca st of Tropical Depression is less reliable than that of Tropical Storm. Intensity is more difficult to forecast than position.

3.3 Storm surge model with forcing of surface pressure and wind stress is operated by JMA. This model can be run on PC.

3.4 Making use of more observational data improves short range forecast.

3.5 Mesoscale numerical prediction for local wind and precipitation have not been im proved significantly

Recommendation:

3.6 Making the most of observational data and output of NWP model is necessary. Meteorological data such as raingauge data and radar data observed by organizations other than NHMSs should be obtained and utilized in order to monitor weather more effectively and to improve weather forecast. Raingauge data by volunteers could also be useful.

3.7 JMA would assist Members in storm surge forecasting by giving them PC storm surge model if requested. Recommend JMA to provide training at the next South China Sea Workshop.

3.8 Development of mesoscale models should be promoted and shared by Members through collaboration and workshops

3.9 Continued interaction through workshops and advanced forecaster training sessions should be encouraged to develop national TC forec asting capability.

3.10 The objectives, targeted trainees and interactive sessions should be specified fo r future workshops.

Hydrology

Findings:

3.11 Hydrologists need forecasts of the positions of typhoons and the associated precipitation for various purposes. The required horizontal resolution, temporal resolution and lead time of the precipitation forecast depends on the specific purpose as well as the scale of the river. The precipitation forecast in the time scale of 1 day with the lead time of 3 days is required for the purpose of water resources management, drought relief and flood control for large basins. On the other hand, rainfall forecasts with intervals of 6 hours or less are required for flash floods, landslides, sediment disasters, and other hydrological requirements.

3.12 Large uncertainty in rainfall prediction is associated with track errors, interaction s with other weather systems, and topography. The local dams or levee failure, debris in channels and streams, and debris backup behind bridges may increas e the possibility and scale of flash flooding.

3.13 The workshop was informed of the WMO/NOAA International workshop on flash flood forecasting to be held in Costa Rica from 23rd September 2005.

3.14 It was noted to the workshop that Regional Cooperation Program Implementation Plan (RCPIP) includes a pilot project to establish a flash flood and sediment disaster forecasting and warning system in TC Member area in cooperation with DPP (2005-2007)

Recommendations:

3.15 Direct communications between Meteorological Service and Hydrological Service sho uld be engaged in real time for hydrologists to understand the probability of TC forecasts and for meteorologists to understand and the requirements of hydrological issues.

3.16 Hydrologists should explore the use of ensemble model outputs in flood forecas ting.

3.17 Through regional cooperation, very short range precipitation forecast capability should be developed.

3.18 Through regional cooperation, hydrological models with inputs from meteorologi cal models and /or coupled models should be developed for forecasting of flood s and water levels.

3.19 The flood forecasting system should be flexible enough to facilitate experimenta l runs of different flood scenarios. NMHSs (National Meteorological and Hydrol ogical Services) should consult relevant parties running flood forecast models a nd form a party line before releasing flood forecasts to the public.

Ensemble Prediction System (EPS)

Findings

3.20 TC forecasting and the associated decision making process involves high uncertainty. Ensemble Prediction Systems (EPS) provides extreme scenarios on severe weather phenomena, and they serve as pre-alerts to forecasters well ahead of time, and inputs to other models such as storm surge and wave model, flood forecasting model, etc.

3.21 EPS has been operated in many NWP centers in recent years. Some others are being developed. Several products to support forecasters in issuing typhoon forecast are presented. Since the horizontal resolution of the global NWP models used in the EPS is relatively low, the models cannot always represent TC. Therefore, a cali bration method to reduce underestimation of TC intensity should be developed.

3.22 JMA verifies the ensemble track forecasts in terms of reliability, ROC curve, and economic values. A similar approach was independently developed by other Me mbers.

3.23 Various EPS products are available on the Web, and will increase in the future through international projects under THORPEX Interactive Gland Global Ensemble (TIGGE). Several international/ regional projects give insight to the regional cooperation utilizing EPS.

(a) TIGGE in conjunction with Global Interactive Forecast System

(b) Asian THORPEX, investigating the effects of initial condition and model uncertainty on forecast of interesting phenomena in Asia, i.e. tropical cyclones, Asian monsoon and intra-seasonal oscillations. Data management group has been established.

(c) Forecast Demonstration Projects have been under plan or progress; east Asian tropical cyclone landfall at the International workshop (Macau, March 2005), Short-range EPS for the 2008 Beijing Olympics; provision of city-specifi c Numerical Weather Prediction (NWP) products (maybe EPSgrams) via the I nternet (the initiative of the Hong Kong Observatory, RAII session 2004)

3.24 It was noted to the workshop that Regional Cooperation Program Implementation Plan (RCPIP) includes a plan to promote the application of EPS on tropical cyclone forecasting and the associated DPP measures.

(a) Use of ensemble (2005), available to all members (2006), with training provided (2007)

(b) Establish storm-surge forecast, including river flooding and wave action (probably with the use of EPS downscaling , 2007)

Recommendations:

3.25 Outputs of EPS operated by NWP centers should be made available to NMHSs for TC forecasting.

3.26 Techniques to make EPSs applicable to TC forecasting should be developed. Methods for calibration of TC intensity, utilization of an ensemble of EPSs, interpretation techniques of probabilistic forecasts for decision makers, and downscaling techniques should be developed.

3.27 The potential benefits of EPS have to be realized through collaboration among meteorologists and various users.

3.28 The ongoing projects under Asian THORPEX and WMO demonstration projects have to be accelerated through regional cooperation

3.29 Once EPS is shown to be operationally useful, seminars and workshops for the training of forecasters to be acquainted with EP S should be held. Further recommendations are that at least two d emonstration projects be held for the application of EPS in storm surge, landslide, wave model, and flood forecasting.

Disaster Prevention and Preparedness (DPP)

Findings

3.30 The occurrence of disastrous tropical cyclones cause adverse socio-economic consequences

3.31 The vulnerability varies geographically, the most vulnerable being in the areas w ith the least means to cope with the physical impacts.

3.32 Warnings on rainfall amount are not enough for decision makers. Information on the probability of disaster is also needed in understandable terms.

3.33 The workshop was informed that the soil water index developed at JMA, based on a tank model, is effective in operational use as an indicator for the prediction of landslides.

3.34. It was noted to the workshop that Regional Cooperation Program Implementation Plan (RCPIP) includes a project to conduct a social impact study on tropical cyclone.

3.35 The vulnerability to tropical cyclones can be addressed by an early and effective warning system, among others. The Workshop noted that many Members including PAGASA in the Philippines and DDPM in Thailand, as a warning agency can carry out its function by formulating a strategy along the lines of a “disaster to management” concept.

Recommendation:

3.36 DPP, meteorological and hydrological experts should develop t echnical procedures to convert the probabilistic information into deterministic ins truction from the users ' point of view for the occurrence of weather related hazards.

3.37 Warnings have to be interpreted in terms of actions on how to prepare and how to cope with the hazard. Under the sponsorship of ESCAP/WMO Typhoon Com mittee, social impact studies should be conducted with the participation of DPP personnel, meteorologists, hydrologists and social scientists.

3.38 Some Members may wish to consider adopting the use of Japan's Soil Water Index (SWI) for landslide prediction and Flow Amount Index for flooding.

3.39 NMHSs should collaborate with scientists and researchers to develop TC disaster scenarios and visualize hazards in the form of hazard map, risk map or disaster management map, etc. All stakeholders including national and local governments, non-government organisations, private sectors and individuals should develop disaster management plans stipulating the roles of different stakeholders. The plans should be updated constantly to reflect the current situation. Drills of disaster management plans and test of communication links involving all stakeholders should be organized by local government.

3.40 NMHSs should provide proper training for trainers such as national and local government officers, non-government organisation staff, community leaders, school teachers and personnel in charge of disaster management in private companies.

3.41 DPP should gear towards the prediction of extreme weather events. Studies on the climate variability and change impacts on extreme weather events should be carried out to enhance disaster preparedness.

4. Impact and Vulnerability Analysis

Vulnerability

Findings:

4.1 Theoretical background on concepts of vulnerability and resilience were presented in the workshop. Vulnerability is very difficult to quantify, but there are specific elements that may be predicted, quantified and targeted for mitigation. Vulnerability can be presented in term of indicators. Linkages between indicators, constructs and model and sources of data for these indicators were also discussed.

4.2 The elements at risk and community vulnerability may be graded into 5 components: settings, shelter, sustenance, security and society. Resilience requires a different set of indicators as this is based on strengths and capacities to cope with a hazard and bounce back. Building a database for these indicators is both costly and time consuming. Qualitative characteristics of people and communities are the best predictors of vulnerability and resilience, but these are even costlier to gather.

4.3 Asian Disaster Reduction Center (ADRC)'s experience was noted at the workshop. Damage and GDP are two disaster indicators. The methods can be a pplied to other hazards like earthquakes and tsunamis, as well as TC. Self asse ssment includes individual self checks, local government self checks and community capacity. The three matrices of indicators include: disaster type, targ et and objective.

4.4 Vulnerability in the Philippines was presented as an example with the statistics of damage, people affected by TC from 1948 to 2004.

Recommendations to enhance effectiveness of TC warnings:

4.5 Recognize and incorporate social diversity in the design of TC warnings.
(a) Develop action words that are relevant to different groups

4.6 Conduct research to find out what people understand and do not understand, the n evaluate through demonstration projects.

4.7 Enhance capacity building through
(a) Work i n g with local government such as engineers, hydrologists, and emergency managers to target local hazards;
(b) Teaching children about hazards, community empowerment and awareness – educational websites;
(c) Developing a list of websites, publications for teaching materials, guidelines, demonstration of past achievements on the assessment of vulnerability and risk management.

4.8 Raise public awareness in the community with
(a) Community based hazard mapping (Town watching)
(b) Designating evacuation sites and displaying warning/evacuation signs

Flood risk management

Findings

4.9 Requirements of flood forecasting for flood mitigation were presented in the Workshop. Japanese experience was demonstrated in the Workshop on structural measures (engineered and non-engineered works) to reduce flood disaster including;
(a) Construction of dams and river embankments (levee)
(b) River improvement works, floodway, flood (stormwater) retarding basin, etc.
(c) Slope protection (Sabo - erosion control)
(d) High-floored houses, shelters, riverside forests and bamboo, etc. (non-engineered)

4.10 Even in the presence of structural means, these is a necessity for comprehension of flood disaster prevention and mitigation through inclusion of nonstructural means including:
(a) Legal framework, coordination among stakeholders
(b) Land use (spatial) management
(c) flood monitoring, forecasting & early warning systems
(d) Preparedness –hazard mapping, improving communication, education to raise awareness
(e) Insurance and mutual aid

4.11 The Workshop noted that self reliance and ownership are the basis of resilience. Flash flood and disaster prevention requires coordination among meteorologis ts, hydrologists, DPP, other stake holders.

4.12 The Workshop also noted that the International Workshop on Flash Flood Disaster Mitigation in Asia- Understanding Current Situations and Identifying Future actions (February 28 to March 4, 2005, Public Works Research Institute, Tsukuba, Ibaraki, Japan) discussed the following issues:

(a) To recognize flash flood forecasting and disaster prevention as fundamentally different from the ones used in riverine floods in terms of methods, approaches, warning times, communication etc
(b) To distinguish between approaches in developing and developed countries means evaluating the suitability of the application of high technology versus low technology with different upgrade options in the course of development
(c) Using improved collaboration between meteorological and hydrological services, communities, disaster management authorities etc. is required.

Recommendations

4.13 Flash flood vulnerability indicators such as hazard mapping should be developed considering the urbanization and extension of megacities.

4.14 Implement comprehensive flood disaster prevention and mitigation with the inco rporation of structural and non-structural measures.

4.15 Improve flash flood forecasting for ungauged basins and rainfall forecasts.

4.16 Improve coordination among meteorologists, hydrologists, DPPs, and other stakeholders for flash flood forecasting.

4.17 Support the HYOGO Declaration (Kobe WCDR concluding statement) that all L DC development projects contain risk management and utilize evaluation data to incorporate community knowledge into cyclone warnings.

5. Warning Dissemination

Findings

5.1 NMHSs need to be aware that the warning message may change in the transmission process and the recipients may not understand the warning and know how to respond in their own best interests.

5.2 In some Member countries like Cambodia, the GTS communication network is not available and the only means of communication with foreign countries is the Internet.

5.3 Cambodia, Vietnam, the Philippines, DPR Korea, and Lao PDR expressed the need for additional rain gauges to monitor rainfall for improving flood forecasts.

5.4 Specific tropical cyclone warning information is indicated by some Members with the warning signal/category so that people can understand the warning more easily.

5.5 In tourist cities, tourists and visitors will get to know tropical cyclone warning information from hotels and other sources.

5.6 Automatic telephone inquiry system (telephone recorders and poll faxes) provides a direct and simple way for the public, especially the underprivileged who will have to rely on the phone, for acquiring the latest weather forecast and warning information.

5.7 Radio offers an extremely effective and widely adopted means of disseminating weather information and will continue to be one of the most common and critical components of the dissemination system of warning messages.

5.8 To facilitate broadcast of the change in the tropical cyclone warning status by radio and TV stations simultaneously at the scheduled time and to avoid possible confusion by the public, the warning can be issued to the station 5 to 10 minutes earlier with an embargo on its release prior to the scheduled time.

5.9 The effectiveness of the tropical cyclone warning system can be further enhanced by harnessing the power of the Internet.

5.10 The WMO websites for Severe Weather Information Centre (SWIC) and World Weather Information Service (WWIS) containing official weather forecasts and tropical cyclone warnings in different regions of the world demonstrated the synergetic effect of contributing NMHSs, maximizing the effectiveness of warnings at the global level.

5.11 Tropical cyclone products and information are disseminated through multiple channels in most Member countries such as amateur radio, HF radio, GTS, fax, US NWS network, Internet, IRC chat and voice, military communication circuits in JTWC, EMWIN, and RANET.

5.12 Emergency Management Weather Information Network (EMWIN) and the RANET digital satellite radio broadcast are inexpensive ways to send communications to small, rural areas.

Recommendations

5.13 NMHSs should if possible disseminate warnings through multiple and diverse channels with varieties of high and low technology with backup capabilities to facilitate users to respond to the warning in a timely manner.

5.14 NMHSs in coordination with DPP managers should transform weather warning information to disaster information to facilitate timely response actions by emergency response units.

5.15 Members may consider adopting the use of colored or numbered codes/categories in a tropical cyclone warning system as an effective way in conveying tropical cyclone warning status to the public.

5.16 NMHSs should take advantage of the advances in communication means such as wireless broadband access, GPS, and GIS technologies to enhance the relevance and effectiveness of warning.

5.17 NMHSs should foster closer regional coordination and collaboration in the application of model and other forecasting guidance in tropical cyclone prediction and enhancement of telecommunications capability. Local NMHS can then adjust the service to cater for local characteristics.

5.18 Studies on the climate variability and change impacts on extreme weather events should be carried out to enhance disaster preparedness.

5.19 NMHSs should enhance their forecasting capabilities by utilizing current and e merging satellite data.

6. Warning Presentation

Findings

6.1 US tropical cyclone best track information is available in the form of TCW files on the website for JTWC.

6.2 During the passage of tropical cyclones, presentations of tropical cyclone warning information and advisories in caring wording with a human touch by experts from NMHSs through live broadcasts on radio and TV will be effective in capturing public attention and relaying the latest critical weather information and advice. The media are interested in personalities.

6.3 In Malaysia since Tropical Storm Greg, the TC warning has been revised to include direct TC impact.

6.4 Information on the uncertainties in tropical cyclone forecast and intensity were conveyed to the public on the tropical cyclone forecast track map and other methods so as to manage their expectation on the forecast accuracy.

6.5 While several Members use TC warnings, several Members use separate warnings concurrently to warn the public of heavy rain, strong wind, storm surg e, and high wave associated with tropical cyclones or their remnants as well as rain-induced disasters such as floods and landslides.

6.6 The set of precautionary announcements and advisories based on pre-agreed courses of actions with the parties concerned were selected at the time to reflect prevailing circumstances to give maximum protection to the public.

Recommendations

6.7 A good tropical cyclone warning system should be simple, easy to understand, and able to trigger organized responses of the government and orderly collective responses of the public to minimize loss of lives and damage to property.

6.8 To increase media use, the text warning bulletins broadcast on the radio and TV have to be compact without sacrificing safety

6.9 Tropical cyclone warning symbols/categories should be considered as an efficie nt way of conveying tropical cyclone warning message to the public and facilitates the public triggering of a timely collective response, hence promoting effectiveness of the tropical cyclone warning.

6.10 Different forms of presentation of tropical cyclone messages should be developed and fitted to the strength of the dissemination channels and the level of the intended audience to enable effective communication of the warning to different sectors of the community.

6.11 Liaison could be made with TV stations to make television crawler to convey urgent weather warnings and messages without interrupting scheduled programs.

6.12 Within Members' capabilities, warnings should be disseminated through as man y ways as possible such as :

(a) Text warning messages could be disseminated proactively to users via emails.
(b) Dedicated web pages with audio warning alerts can be developed to provide tailor-made weather services to special clients.
(c) Web pages in a variety of formats, viz. graphics, text-only, audio, Wireless Application Protocol (WAP) and Personal Digital Assistant (PDA), extensible Markup Language (XML) versions can satisfy the needs of diverse users.

6.13 U seful tropical cyclone information and advisories as well as appropriate protective measures should be given in warning bulletins accompanying the warning signal.

6.14 M e m b e r s ' tropical cyclone warning system s should have sufficient flexibility to allow actions to be taken in line with the spec ific needs of different sectors of the community.

7. Public education and promotion

Findings

7.1 One of the biggest obstacles to vulnerability reduction is the lack of public awareness of the threat and basic mitigation and preparedness measures.

7.2 Familiarity of the tropical cyclone warning system by the public is essential for an effective and orderly implementation of response actions.

7.3 Representative from Asian Disaster Reduction Centre (ADRC) summarized the good practices of total disaster risk management in Bangladesh, India, Japan, Lao PDR, Malaysia and Vietnam. To reduce disaster risk, it is important to;

(a) Lessen the level of vulnerability;
(b) Keep exposure as far away from hazards as possible through structural and non-structural means (e.g. engineering methods, relocation of populations and property);
(c) Systematically implement risk management procedures that include government initiatives, objective setting, risk identification, risk assessment, planning, countermeasures and evaluation.

7.4 NMHSs have to be aware that warnings and hazard awareness need to be internalized by the society through time, cyclone warnings have to be recognized in time and space ahead of or alongside the hazard. Warnings and responses are at the opposite ends of a chain of processes. Failure of links between and among players in the warning process will reduce effectiveness. The players may include meteorologists/hydrologists, government decision makers, emergency management disaster planners, media, local government units, community action and response teams as well as individuals.

7.5 Media liaison officers in NMHS are important in developing close connections among various stakeholders in the warning and response process. People have different types of attitudes and perceptions towards risk, warning and disaster preparedness education. It is important to promote the appropriate disaster preparedness education and school curriculum packages having in mind the intended audience.

7.6 The effectiveness of tropical cyclone warning can be enhanced by inter-agency partnerships and cooperation. In the process, effective communication and interaction through capacity building, governance, community empowerment, and disaster preparedness program are critical.

7.7 The Hong Kong Observatory and other local government departments jointly organized a year-long public education campaign in 2005 to promote public awareness and understanding of natural hazards. The campaign involved the active participation of the public ("Safer Living-Reducing Natural Disasters" campaign and the "Tropical Cyclone Name Nomination Contest"). The public supported this initiative.

Recommendations

7.8 The tropical cyclone warning criteria and protective measures must be publicized through as many channels as possible such as websites, pamphlets distributed at schools, district offices, entry ports, resource centers, short advertisement broadcast by radio and TV.

7.9 Promote public education and conduct outreach activities such as talks, exhibitions, school visits, TV documentary series, education and publicity campaigns to raise awareness and people's preparedness for possible tropical cyclone related disasters.

7.10 Include materials on tropical cyclone warning system, tropical cyclone related hazards and corresponding disaster preparedness in the school curriculum and educational resources to promote public education to students and teachers.

7.11 NMHSs must engage the assistance of the media before, during and after a major tropical cyclone event. The media are key partners in promoting public awareness of disaster preparedness, understanding of weather phenomena as well as advances and limitations in tropical cyclone forecasting.

7.12 Enhance the synergy among government departments, non-government organizations and the media in promoting public education on tropical cyclone warning system and disaster preparedness to increase the relevance and effectiveness of tropical cyclone warning.

7.13 NMHSs must formulate strategies on disaster risk management. These include

(a) establishing a legal frame that will allow coordination mechanisms and protocols;
(b) integrating disaster reduction concepts into land use planning;
(c) improving information sharing and management;
(d) promoting education and public awareness for example by integrating disaster education into the curriculum;
(e) developing multi-stakeholder partnerships and public participation.

8. Others

The workshop closed at 17:00 PM on 28th April 2005. It is recommended that joint workshops be held every 1-2 years.

APPENDIX XI

TRCG Roving Seminar in 2006

- Roving seminar
  - Vietnam
  - 3~4 days
  - Decisive factors for TC intensification, movement, heavy rainfall, and other local impacts
  - Require USD 15,000 for two lecturers, 7 participants
- TC research fellowship scheme
  - Continuation in parallel with review on current status and direction for improvement

APPENDIX XII

REVIEW OF TROPICAL CYCLONES IN 2005 AFFECTING TYPHOON COMMITTEE MEMBERS

In **China**, 10 tropical cyclones made their landfalls over China and they were Typhoon Nock-ten (0424), Typhoon Nanmadol (0427), Typhoon Haitang (0505), severe Tropical Storm Washi (0508), Typhoon Matsa (0509), severe Tropical Storm Sanvu (0510), Typhoon Talim (0513), Typhoon Khanun (0515), Typhoon Damrey (0518) and Typhoon Longwang (0519). The total number was noticeably more than the normal average number (about 7), which accounted for 37.04% of the total in comparison with the average percentage (25.46%). Moreover, in the same period there were another 4 TCs that had affected the coastal waters of China, despite of the fact they did not land over China. These TCs were Typhoon Muiha (0425), Tropical Storm Merbok (0426), Typhoon Nabi (0514) and Tropical Storm Vicente (0516). For specific tracks, please refer to Fig. 1.1.

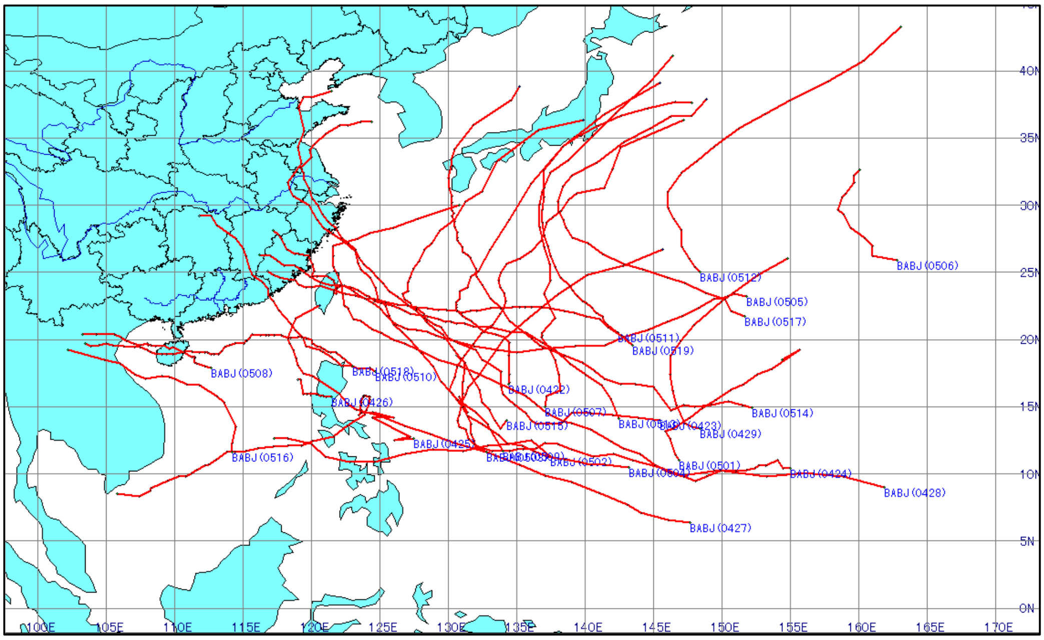


Fig. 1.1 Tropical Cyclone Tracks from Oct. 2004 to Sept. 2005

- **The Characteristics of Tropical Cyclones' Activities in Northwest Pacific in 2005**

  - ***The originating sources were focused in a region and located more eastward***.

The tropical cyclones were mostly originated in the NW Pacific region between east Philippines and the Marshall Islands, which was located slightly eastwards compared with the normal TC originating source region. Within it, 19 TCs were originated in a area east Philippines and west of 150ºE and 6 TCs over the waters east of 150ºE, which were more than the average occurrence. In contrast, only 2 TCs were originated over waters around Hainan Island – an area in which TC was usually believed to be an originating source with higher TC occurrence.

  - ***More typhoons with intermediate intensity.***

Compared with normal years, the total number of TCs and servere TCs developed in Oct. 2004-Sept. 2005 were slightly more than normal average. There were less weaker and stronger typhoons in terms of intensity, whereas there were more typhoons with intermediate intensity. The number of typhoons with maximum velocity exceeding or equivalent to 40m/s took 59.26% of the total, and it was higher than normal percentage (50.22%). However, the number of typhoons exceeding 60m/s were relatively less.

- ***Longer TC Lifespan.***

During the period, The TC lifespan was longer, e.g. 17 TCs lasted beyond 5 days, which took 62.96% of the total. The typhoons with longest lifespan were Typhoon Muiha (0425) and Typhoon Nesat (0504), which both lasted for about 252 hours, or approximately 10.5 days.

- ***Landing TCs with higher intensity.***

Out of 10 TCs that made their landfalls over China, 7 TCs fell into the typhoon category. The strongest one was Typhoon Khanun (0515) with the maximum velocity of 50m/s at its centre, and it was the most severe typhoon that landed over Zhejiang Province since 1956.

◆ **The Climate Background of Tropical Cyclones' Activities in Northwest Pacific in 2005**

● SST ***in the equatorial Pacific***

The index of region NINO Z (NINO 1+2+3+4) was above 0.5°C in Sep 2004, and reached the highest value 0.8°C in Dec 2004. Since then, it decreased quickly and dropped to 0.2°C in Feb 2005 (see Fig.1.2), and maintained between 0.2-0.4°C during the rest period. According to ENSO's definition, the duration and the strength of the warm process from Sep 2004 to Jan 2005 were both below the standard of El-Nino event.

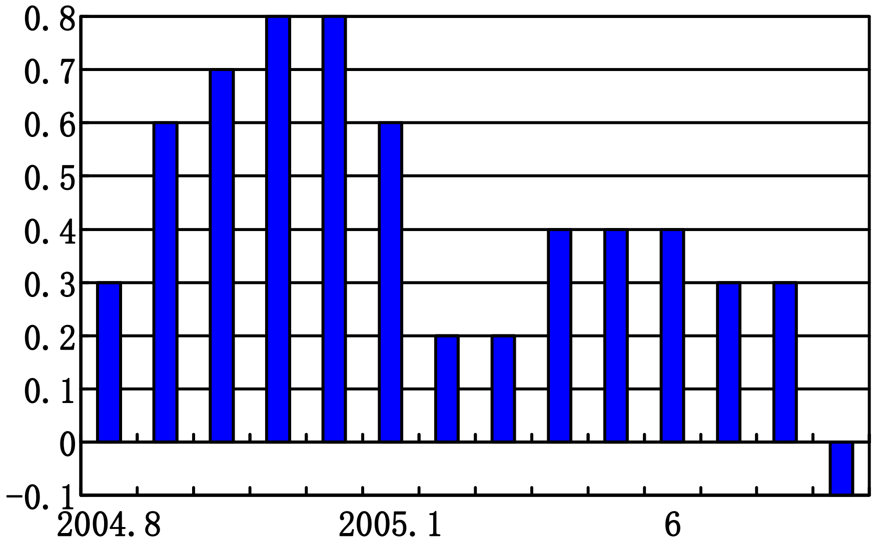


Fig.1.2 The index of Nino Z from Aug 2004 to Sep 2005

In Jul and Sep 2005, when tropical cyclones were more active, sea surface temperatures were above normal in the western equatorial Pacific, and there was a region with SST above 30°C that does not existed during the same period in 2004 (see Fig.1.3).

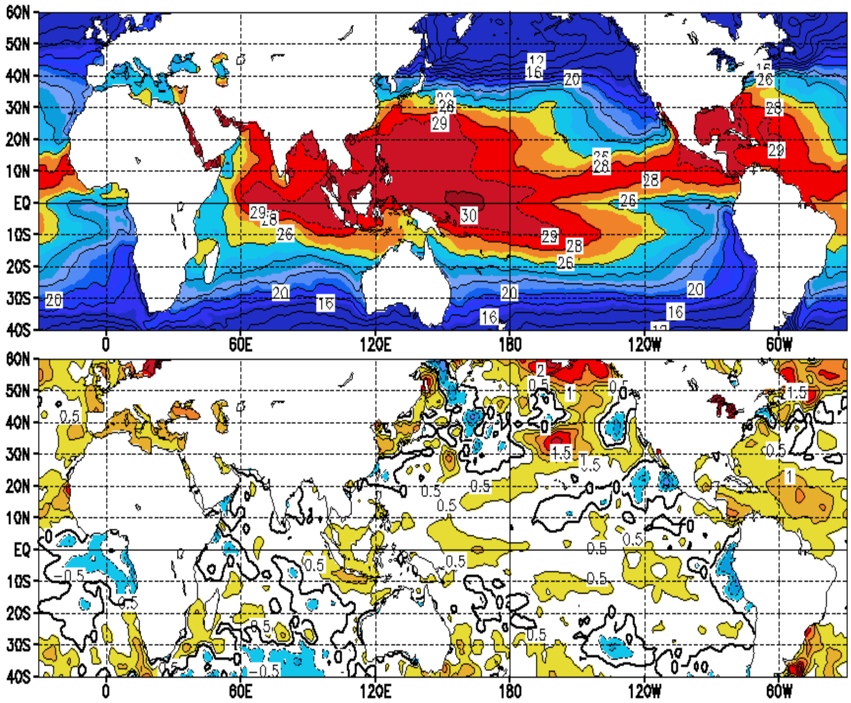


Fig.1.3 Monthly mean SST (top) and SSTA (bottom) in July, 2005

● ***OLR***

Tropical convection activity indicated by OLR in the Western Pacific in 2004/2005 winter was weaker than that in 2003/2004, but stronger than that in 2002/2003. In July and Sep 2005, it was stronger than normal, but weaker than normal in June 2005.

● ***NW Pacific Subtropical High***

In generally, the NW Pacific Subtropical High was stronger and more westward than normal from Oct 2004 to Sep 2005.

● ***Assessment of typhoon-induced rainfall***

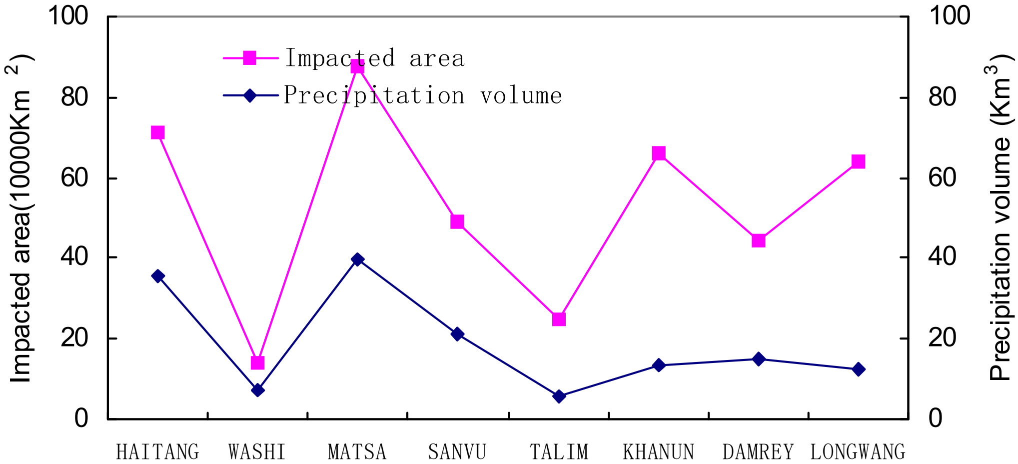


Fig. 1.4 The estimated precipitation volumes and impacted areas of typhoons which impacted China during Jan. to Oct. 10, 2005

From Jan. 1 to Oct. 10, 2005, totally there were 8 tropical cyclones that impacted China and all of them made landfall in China and brought precipitation in land during this period

(HAITANG, WASHI, MATSA, SANVU, TALIM, KHANUN, DAMREY, LONGWANG). With regard to impacted area, typhoon MATSA was the most serious one, with a precipitation volume of 39.5km^3, and the impacted area was 874,507km^2. In addition, typhoon HAITANG was the second most serious case during the period, with a precipitation volume being 35.6km^3 and the impacted area reaching 709,750km^2, which were smaller than that of MATSA. (Fig.1.4).

V. Typhoon that Impacted TC Members

1. Operational Forecast

From January 1 to October 10 2005, 19 tropical cyclones formed over NW Pacific and the South China Sea. The table 5.1 gives the mean distance errors of prediction of these tropical cyclones. It shows that the 24h, 48h and 72h mean errors of NMC forecasts are about 101, 171 and 248km respectively.

Table.5.1 Mean distance errors of prediction of tropical cyclone landed over China (km)
Jan. 1 to Sept. 30 2005, unit: km.

Forecast time	24h	48h	72h
Mean distance errors	101	171	248

2. Narrative Accounts of Tropical Cyclones

a. Characteristics of Landing Tropical Cyclones

As mentioned above, from Oct. 1 2004 to Oct.10 2005, 27 tropical storms in total were formed over the Northwest Pacific and the South China Sea. 10 made their landfalls over China during this period (see table5.2).

TC Name/Number	Landing location	Time/Date	Maximum wind speed when landing (m/s)	Minimum SLP When landing (hPa)
Nock-ten (0424)	Yilan, Taiwan province	02:30UTC,Oct.25	40	960
Nanmadol (0427)	Pingdong, Taiwan province	23:40UTC,Dec.03	28	980
Haitang	Yilan, Taiwan province	06:50UTC, Jul.18	45	945
	Lianjiang, Fujian	09:10UTC, Jul.19	33	975
Washi (0508)	Qionghai, Hainan	21:25UTC, Jul.29	25	984
Matsa (0509)	Yuhuan, Zhejiang	19:40UTC, Aug.05	45	950
	Dalian, Liaoning	23:10UTC, Aug.08	12	995
Sanvu (0510)	Shantou, Guangdong	04:45UTC, Aug.13	28	982
Talim (0513)	Hualian, Taiwan province	22:00UTC, Aug. 31	50	930
	Putian, Fujian	06:30UTC, Sept.01	35	970
Khanun (0515)	Taizhou, Zhejiang	06:50UTC, Sept.11	50	945
Damrey(0518)	Wanning, Hainan	20:00UTC, Sept.	45	950

		25		
Longwang(0519)	Hualian, Taiwan province	21:30UTC, Oct.01	50	940
	Jinjiang, Fujian	13:35UTC, Oct.02	33	975

Table.5.2. List of Tropical cyclone landing over China (Oct.1 2004. -Oct.10, 2005)

Table 5.2 showed that the intensity of 10 landed tropical cyclones was relatively intense when they landed. Seven of them were in typhoon category, three were severe tropical storms, Typhoon Talim(0513), Typhoon Khanun(0515) and Typhoon Longwang(0519) were the most severe tropical cyclones landed in 2005, their maximum wind speeds near center reached 50m/s.

b. Narrative on Tropical Cyclones

◆ **Nock-ten（0424）**

Tropical storm Nock-ten (0424) formed before dawn on Oct. 17 in 2004 over Northwest Pacific, southeast of Guam. Afterwards it moved westwards with its intensity upgrading to severe tropical storm and typhoon in the next day afternoon and evening respectively. From the evening Oct.19, Nock-ten moved northwestwards and approached east coast of Taiwan. It made landfall on 02:30UTC Oct. 25 at Yilan, Taiwan province with the maximum winds at 40m/s near center. After landing, Nock-ten turned to move northwards with its intensity being reduced quickly. It reentered into East China Sea in the afternoon and changed to northeastward direction in the nighttime. At last, Nock-ten became an extratropical cyclone over the sea southwest of Japan in the afternoon Oct. 26.

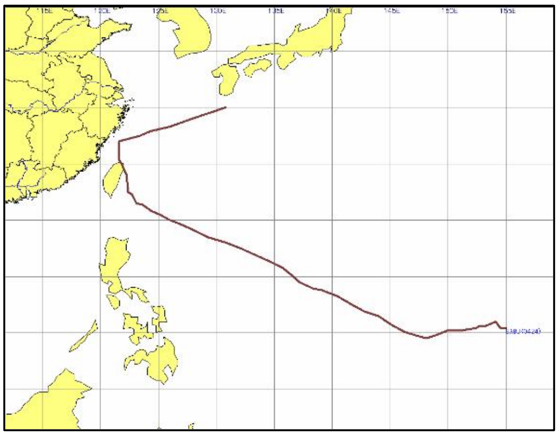


Fig. 5.1a Track of Typhoon Nock-Ten (0424)

Fig. 5.1b FY-1D VIS Image at 0003UTC on Oct. 24 2004 when Typhoon Nock-ten(0424) was approaching to Eastern Taiwan province, China

◆ **Nanmadol（0427）**

Tropical storm Nanmadol (0427) was formed in the morning of Nov. 29 over Northwest Pacific moving northwestwards steadily with its intensity intensified gradually. It became a severe tropical storm and later a typhoon in the afternoon and evening the next day. Typhoon Nanmadol landed on the southeastern part of Luzon Island at 12:00UTC Dec. 2 with the max winds of 45m/s near center. After the first landing, it continued to move northwestwards and its intensity reduced badly. Nanmadol passed through southern part of Luzon Island and entered into the northeastern part of South China Sea in the morning Dec. 3. Quickly it turned northeastwards and made its second landfall at Pingdong Taiwan, China on 23:40UTC Dec. 3 with the max winds of 28m/s near center. Thereafter Nanmadol passed through southern part of Taiwan and it was weakened into an extratropical cyclone over the sea east of Taiwan in the afternoon Dec. 4.

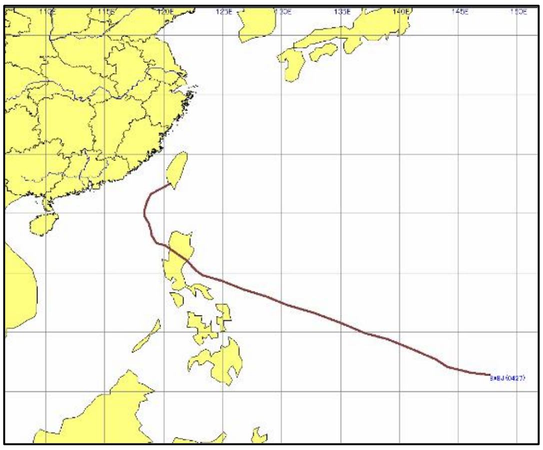


Fig. 5.2a Track of Typhoon Nanmadol (0427)

Fig. 5.2b NOAA-16 VIS Image at 1836UTC on Dec. 2 2004 when Typhoon Nanmadol (0427) passed through the Philippines into the South China Sea

◆ **Haitang (0505)**

Tropical storm Haitang (0505) was formed in the morning on June 12 in 2005 over Northwest Pacific, and then it moved westward in 15 km per hour .It became intensified to be a severe tropical storm and a typhoon on 12UTC June 13 and on 06UTC the next day respectively. Start from 06UTC June 15, Haitang turned northwestward with relatively quicker motion at 25 km per hour. As it was gradually approaching to Taiwan China, its intensity reached the climax with 65m/s and 910hpa on 12UTC June 16. Haitang was less than 50 km distance from Taiwan China on 21UTC June 17. From then on Haitang suddenly began to move southwestward and rotated anticlockwise slowly following a circle with radius of about 25 km. Until 06UTC June 18, Haitang rotated without much movement and then resumed moving northwestward. Because of its interactions with Taiwan coast, its intensity had been greatly reduced during the rotation. Less than one hour later it made landfall at Yilan, Taiwan province at 06:50UTC on July 18, on which the maximum wind at 45m/s near center. It took almost 7 hours for Haitang to pass through Taiwan from east to west. Haitang entered Taiwan Strait on 14UTC June 18 and turned from northwestward to westward. But beginning from 21UTC June 18, it suddenly turned northeastward for 3 hours. Haitang started to move north-northwest with 10 km per hour approaching Fujian province. It landed again on Lianjiang, Fujian on 9:10UTC July 19, with its maximum speed at 33m/s near center at the time of landing. After its second landing, Haitang moved northwestward with its intensity weakened quickly. It reduced to a severe tropical storm and a tropical storm on 12UTC and 18UTC July 19 respectively in Fujian province. At last Haitang faded away in Jiangxi province on 12UTC July 20 (Fig. 5.1a, 5.1b). It could be seen from the above description, the typhoon Haitang firstly had a long lifespan as it survived 204 hours. Next, its path is rather complex. 6 people died. The economic loss was estimated about 119.2 million Yuan RMB.

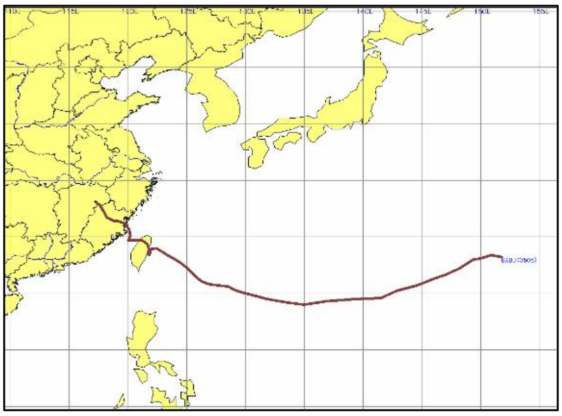


Fig. 5.3a Track of Typhoon Haitang (0505)

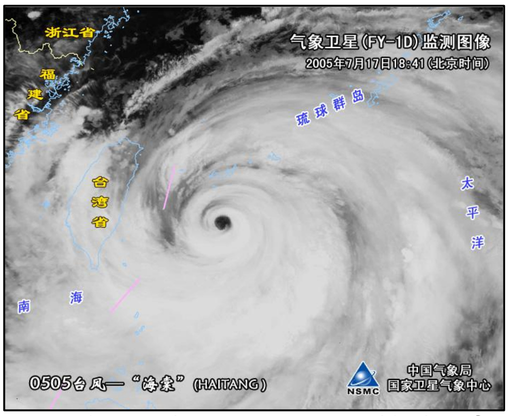


Fig. 5.3b FY-1D IR Image at 1041UTC on July 17 2005 when Typhoon Haitang (0505) was approaching to Taiwan province, China

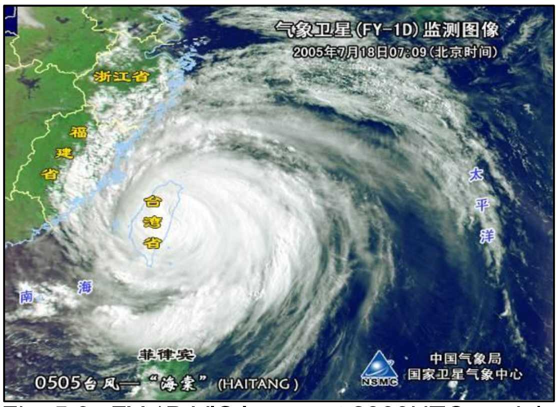


Fig. 5.3c FY-1D VIS Image at 2309UTC on July 17 2005 when Typhoon Haitang (0505) was landing over Taiwan province, China

Fig. 5.3d Changle Radar echo at 0707UTC on Jul. 19, 2005 before Haitang made landfall over Fujian province, China

◆ **Washi (0508)**

Tropical storm Washi (0508) was generated in the morning on July 29 in 2005 over northern part of the South China Sea. Afterwards it moved northwestwards with a speed of 10 km per hour and intensified to a severe tropical storm in the sea near eastern coast of HAINAN province. At 21:25UTC July 29, Washi landed over Qionghai, Hainan province with the maximum winds of 25m/s near center. After landing, it was reduced into a tropical storm quickly. Later it went through Hainan Island and entered into Beibu Gulf at 4PM. At last tropical storm Washi landed again over Nanding to Qinghua Vietnam at 05:10UTC July 31 and it became a tropical depression in northern Vietnam on the morning August 1. One people died during its landfall in China. The economic loss was estimated about 1.4 million Yuan RMB.

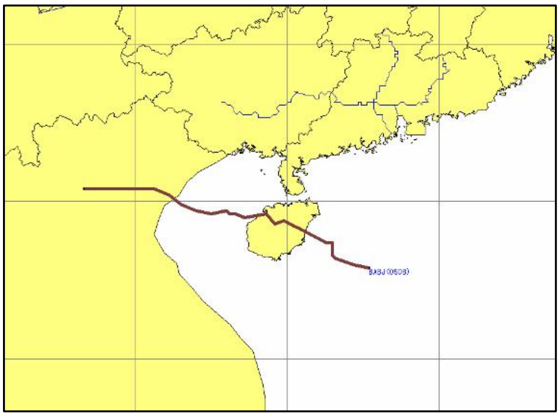


Fig. 5.4a Track of Severe Tropical Storm Washi (0508)

Fig. 5.4b NOAA-17 VIS Image at 0242UTC on July. 30 2005 after Severe Tropical Storm Washi (0508) made landfall over Hainan province, China

◆ **Matsa (0509)**

Tropical storm Matsa was developed in the evening of July 31, 2005 over Northwest Pacific Ocean. After its generation, Matsa moved northwest at a speed of 20km per hour and it was intensified into a severe tropical storm and then a typhoon in the morning August 2 and before dawn the next day respectively. Typhoon Matsa entered the southern part of East China Sea in the morning August 5 and it gradually approached to the coast of Zhejiang province. It made landfall over Yuhuan of Zhejiang province at 19:40UTC August 5 with the max winds of 45m/s near center. After landfall it continued to move northwestward with its intensity being reduced gradually. It became a severe tropical storm in northwestern part of Zhejiang province in the evening August 6.Afterwards it changed to move northward and weakened into a tropical storm in southeastern part of Anhui province. And then Matsa entered into Jiangsu province in the afternoon August 7 and went into Shandong province in the morning August 8.At last it entered into Bohai Sea and made landfall at Dalian Liaoning province in the morning August 9 becoming an extratropical cyclone at the same time. Typhoon Matsa was well known for its intensive wind, the long lifespan and the large coverage. It was one of the typhoons that had severe impacts on East China in the recent 8 years since typhoon 9711. 20 people died as result of its landfall. The economic loss was estimated about 177.22 million Yuan RMB.

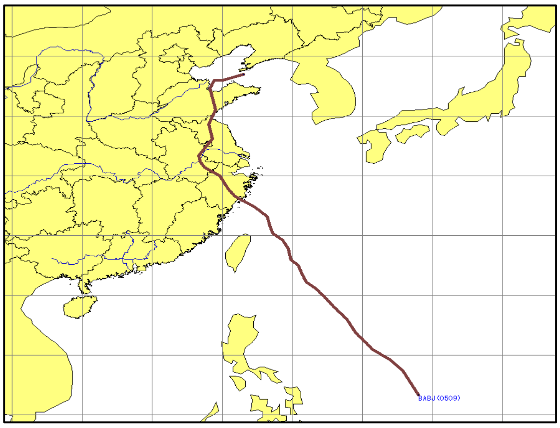


Fig. 5.5a Track of Typhoon Matsa (0509)

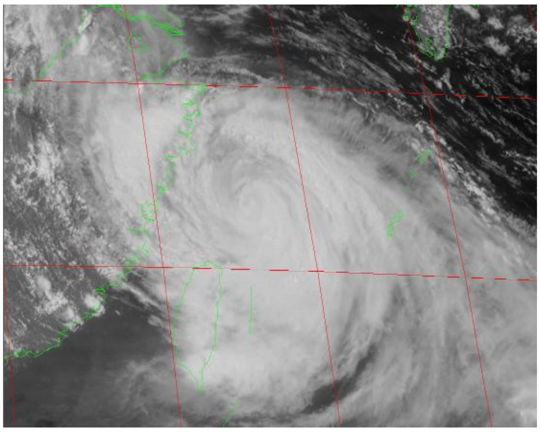


Fig. 5.4b FY-2C VIS Image at 0600UTC, Aug. 5 2005 when Matsa (0509) was approaching to Zhejiang, China

Fig. 5.4c NOAA-16 VIS Image at 1822UTC on Aug. 5 2005 when Typhoon Matsa (0509) was landing over Zhejiang province, China

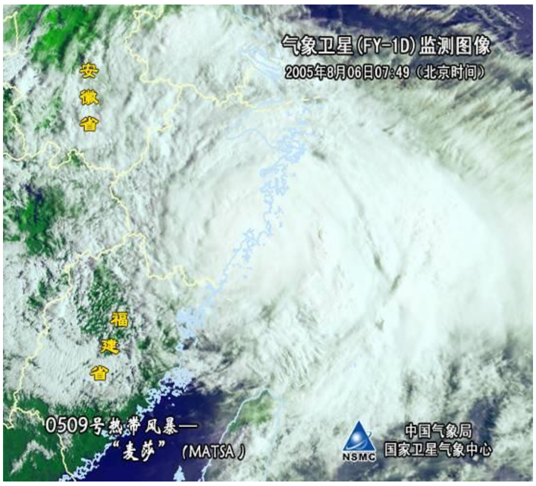


Fig. 5.4d FY-ID VIS Image at 2349UTC on Aug. 5 2005 after Typhoon Matsa (0509) made landfall over Zhejiang province, China

Fig. 5.5d Wenzhou Radar echo at 1940UTC on Aug. 5, 2005 when Matsa was landing over Zhejiang province

Fig. 5.5d Wenzhou Radar Velocity at 1940UTC
on Aug. 5,2005 when Matsa was landing over Zhejiang province

◆ **Sanvu (0510)**

The tropical storm Sanvu was generated in shape in the afternoon August 11 in 2005 over Northwest Pacific, east of Luzon Island of the Philippines. It moved northwestwards with its intensifying .After passing through Bashi channel in the evening August 11, Sanvu entered into south China sea and upgraded to severe tropical storm in the afternoon the next day. It landed at Santou, Guangdong province on 04:45UTC August 13 with the max winds of 28m/s near center. Sanvu continued to move northwestwards after landing and reduced to tropical storm in the afternoon intraday. Then it entered into southern part of Jiangxi province and reduced to tropical depression before dawn August 14. 16 people died as result of it. The economic loss was estimated about 26.7 million Yuan RMB.

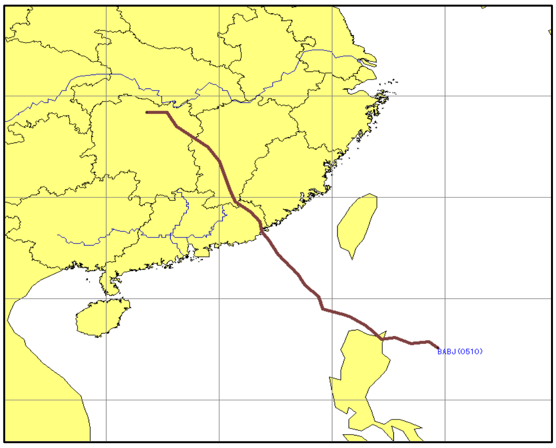


Fig. 5.6a Track of Severe Tropical Storm Sanvu(0510)

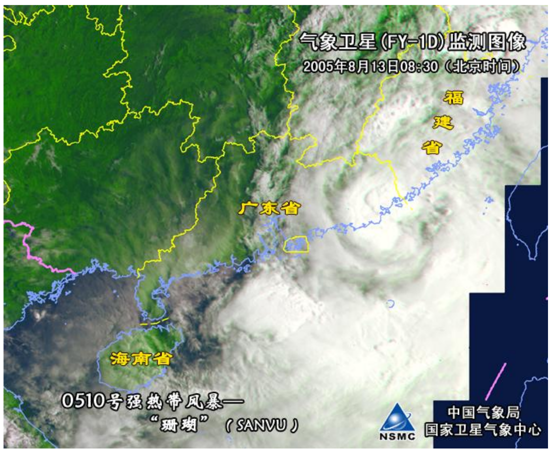


Fig. 5.6b FY-ID VIS Image at 0030UTC on Aug. 13 2005 before Severe Tropical Storm Sanvu (0510) made landfall over Guangdong province, China

◆ **Talim (0513)**

The tropical storm Talim was formed in the morning of August 27 in 2005 over Northwest Pacific moving northwestwards at a speed of 20 km per hour, it grew into a typhoon in the afternoon the next day quickly. Its intensity reached the climax with 65m/s and 910hpa on 09UTC August 30 and was retained until 01UTC August 31. Typhoon Talim landed on Hualian, Taiwan province at 22:00UTC August 31 with the max winds of 50m/s near center. After landing its intensity was severely reduced. It passed over Taiwan Strait and made landfall again at Putian, Fujian province at 06:30UTC September 1 with the max winds of 35m/s near center. After the second landing Typhoon Talim still moved northwestwards and reduced to severe tropical storm and tropical storm in the afternoon and in the evening intraday .Tropical storm moved into Jiangxi province in the morning September 2 and reduced to a tropical depression. 96 people died. The economic loss was estimated about 120.6 million Yuan RMB.

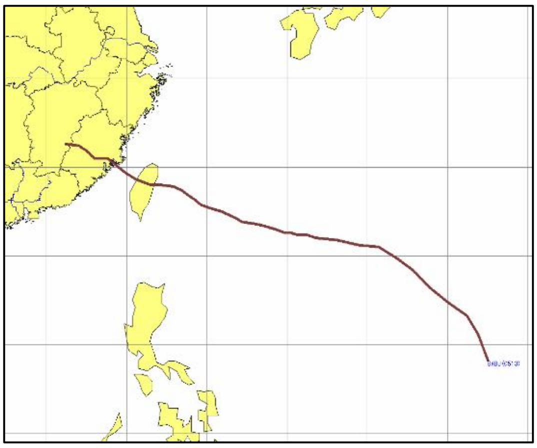


Fig. 5.7a Track of Typhoon Talim (0513)

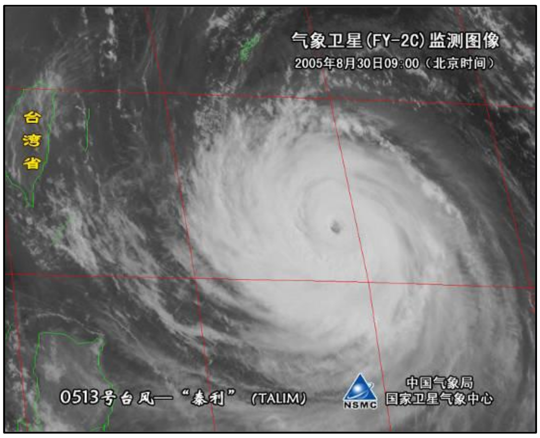


Fig. 5.7b FY-2C VIS Image at 0100UTC on Aug. 30 2005 when Typhoon Talim (0513) was over the sea of Taiwan province , China

Fig. 5.7c FY-1D VIS Image at 1100UTC on Aug. 31 2005 when Typhoon Talim (0513) was approaching to Taiwan province, China

Fig. 5.7d FY-1D VIS Image at 2329UTC on Aug. 31 2005 when Typhoon Talim (0513) was approaching to Fujian province, China

- **Khanun (0515)**

The 15th tropical storm Khanun was formed over in the morning September 7 in 2005 over Northwest Pacific, east of Luzon Island of the Philippines. Then it moved northwestward by north with a speed of 15 km per hour and it was intensified into a severe tropical storm and a typhoon in the morning Sept. 8 and in the morning Sept.9 respectively. Starting from Sept. 9, typhoon Khanun turned northwestwards with a quicker pace, and it approached the coast of Zhejiang province. Its intensity reached 50m/s with 945hpa on 06:00UTC Sept. 10, and it maintained the same intensity until its landfall over Taizhou, Zhejiang province the next day in the afternoon. After its landing, Khanun continued to move northwestwards with intensity reduced quickly and it became a severe tropical storm on 15:00UTC Sept.11 over Zhejiang. Khanun entered Jiangsu province before dawn Sept.12, and reduced to tropical storm in the morning, turning northwards. Starting from the afternoon Sept.12, Khanun moved northeastwards and entered into Yellow Sea in the evening. Finally Khanun was weakened into an extratropical cyclone in the mid Yellow Sea at 09:00UTC Sept. 13. Typhoon Khanun was the strongest typhoon landing in Zhejiang province since the twelfth typhoon in 1956.16 people died. The economic loss was estimated about 92.5 million Yuan RMB.

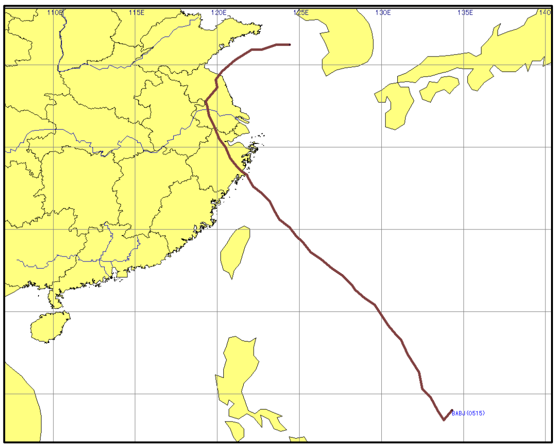


Fig. 5.8a Track of Typhoon Khanun (0515)

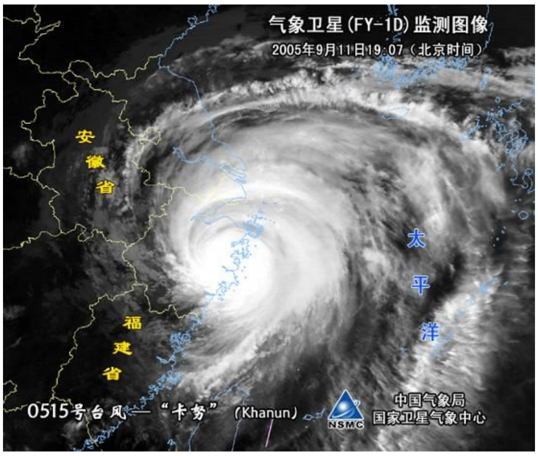


Fig. 5.8b FY-1D VIS Image at 1107UTC on Sept. 11 2005 after Typhoon Khanun (0515) landed over Zhejiang province

Fig. 5.8c Wenzhou Radar echo at 0652UTC on Sept. 11, 2005 when Khanun was landing over Zhejiang province

Fig. 5.8d Zhoushan Radar echo at 0653UTC on Sept. 11, 2005 when Khanun was landing over Zhejiang province

◆ Damrey (0518)

Tropical storm Damrey (0518) was generated in the morning on Sep. 21 in 2005 over sea near northeastern part of Luzon Island. Afterwards it moved northwestwards with a speed of 10 km per hour and intensified gradually. In the evening Sep. 22,the center of storm entered into northeastern part of South China Sea and intensified to severe tropical storm and typhoon before dawn and in the afternoon Sep. 24 respectively. Its intensity reached climax with the max winds of 55m/s near center at 09:00UTC Sep. 25. 23 hours later, Damray landed at Wanning Hainan province with the max winds of 45m/s near center. After landing, it went westwards and passed through Hainan province with a speed 15 to 20 km per hour. Damray entered into Beibu Gulf twilight Sep. 26 and it was weakened into a severe tropical storm in the next morning over western part of Beibu Gulf. Later it landed again at Qinghua Vietnam around noon Sep. 27 with the max winds of 30m/s near center and reduced to a tropical storm in Yian Vietnam in the afternoon intraday. At last it turned to tropical depression before dawn the next day. According to statistics of the past 50 years, Damray's intensity while landing were only next to Typhoon Marge (7314) and stronger than Typhoon Kelly (8105) a little. But precipitation intensity with Damray was much more than the two previous 2 typhoons. 16 people died. The economic loss was estimated about 95.9 million Yuan RMB.

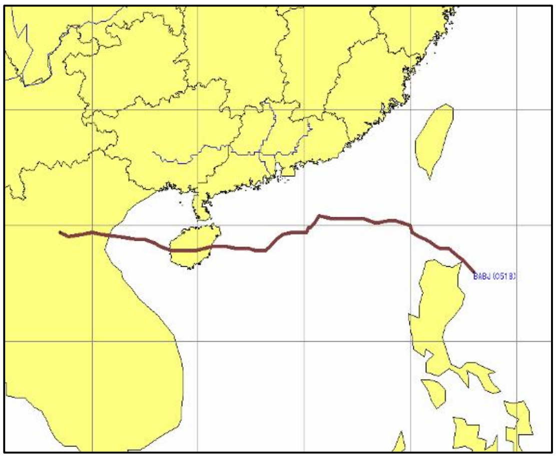


Fig. 5.9a Track of Typhoon Damrey (0518)

Fig. 5.9b NOAA-18 VIS Image at 1854UTC on Sept. 25 2005 when Typhoon Damrey (0518) was landing over Hainan provinces

- **Longwang (0519)**

Tropical storm Longwang (0519) was formed in the morning on Sep. 26 in 2005 over Northwest Pacific, about 690 kilometre northwest of Guam. Firstly, it moved northwestward about 10 km per hour and became intensified to be a typhoon in the morning Sep.27. Then it turned to move northwestwards by north with quicker speed and continued to strengthen. Up to before dawn Sep. 31, Longwang's intensity reached climax with the max winds of 60m/s near center. It retained the intensity for 19 hours, and then it was reduced slightly. Longwang made landfall at Hualian, Taiwan province at 21:30UTC on Oct.1 with max winds of 50m/s near center. Then it went through Taiwan quickly and entered into Taiwan Strait around noon Oct. 2. After it entered into Taiwan Strait its moving speed slowed down and the moving direction changed from west to northwest. Several hours later, It landed again on Jinjiang, Fujian province on 13:35UTC with its max speed of 33m/s near center and reduced to severe tropical storm whereat. And then it continued to move northwestward and eventually it was weakened into a tropical storm before dawn Oct. 3. At last Longwang faded away in Longyan, Fujian province in the morning. Consequently, 15 people died. The economic loss was estimated about 32.78 million Yuan RMB.

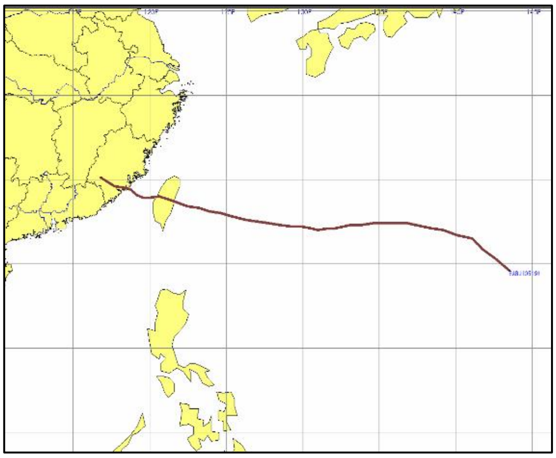


Fig. 5.10a Track of Typhoon Longwang (0519)

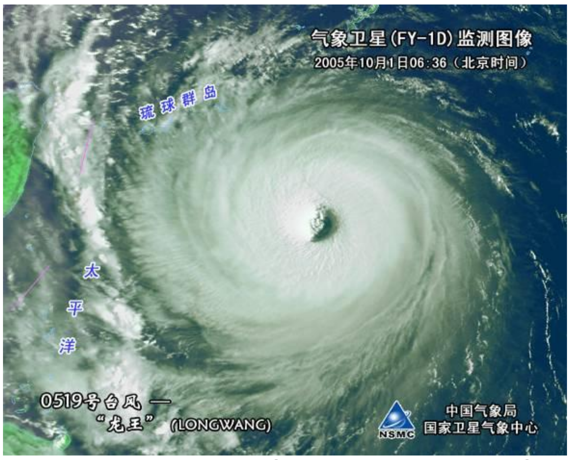


Fig. 5.10b FY-1D VIS Image at 2236UTC on Sept. 30 2005 when Typhoon Longwang (0519) was at sea east of Taiwan provinces, China

VII. Report on Damage Caused By Cyclones, Floods and Drought

COUNTRY : China

PERIOD COVERED BY THIS REPORT

from :	1	Jan.	2005	to :	15	Oct.	2005
	(date,	month,	year)		(date,	month,	year)

PREPARED AND SUBMITTED BY:

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DATE PREPARED :	15	Oct.	2005
	(date,	month,	year)

INTRODUCTION

1. It was decided at the fourteenth session of the Typhoon Committee (Manila, November 1981) that information on damage caused by typhoons and floods should be compiled and sent to the Typhoon Committee Secretariat (TCS) before each annual session of the Typhoon Committee. This information shall consist of statistics on loss of human life, damage to houses, public facilities, agricultural products, etc.

2. At the fifth session of Management Board of the Typhoon Operational Experiment (TOPEX) (Tokyo, February 1982) UNDRO and LRCS were asked to co-operate in the preparation of a simple standard format for the region and make proposals for consideration by the Board at its sixth session.

3. The Board considered the proposed format at its sixth session (Bangkok, November 1982) and requested ESCAP and WMO in consultation with UNDRO and LRCS to revise the format with a view to incorporating more elaborately ESCAP long experience in flood statistics and to avoiding duplication with the ongoing efforts of ESCAP to improve disaster statistics.

4. Accordingly, this format was prepared for consideration at the third Planning Meeting for TOPEX (Tokyo, February 1993). The revised format was considered and adopted by the Meeting after some minor editorial amendments.

REPORT

1. This report should cover the total damage caused by typhoons and heavy rainfall, and associated storm-surges, floods, landslides, etc.

2. This report should be prepared by an official of the agency responsible for the disaster preparedness and relief in consultation with other agencies concerned.

* Such official should be designated by each member and reported to TCS beforehand.

FORMAT

1. This format is designed to aid compilation of data and information which are already collected in each country. In other words, it does not propose any change in the existing systems of disaster damage survey in the various countries.
2. If final official figures for the reporting period are not available, it is recommended that tentative data be reported with appropriate notations.
3. Although this format covers broad aspects of disasters and detailed data, if the country is not prepared to provide data on some of the items, those may be left blank. However, it is recommended that the country report provides data at least on vital items marked with an asterisk and enclosed thick lines which are regarded as basic elements in disaster statistics on typhoon damage.
4. Data processing involved in the estimation of damage costs require much time, therefore, if the data are still being processed at the time of reporting, it should be noted when such data will become available.

* = Applicable for the members of Typhoon Committee.

Noted

For consistency, please use the following necessary:

... data are not available or not separately reported

… amount is negligible or nil

N/A item is not applicable

I. GENERAL	Sequence No.	1	2	3	4	5	6	7	8	9
1. Type of disasters Sequence number/code name of the typhoon and or type of disaster caused by it or by a combination of weather disturbances such as rainfall, strong winds, storm-surges, floods and landslides.		0505 Haitan g	0508 Wahsi	0509 Matsa	0510 Sanvu	0513 Taltm	0515 Khanu n	0516 Vicente	0518 Damrey	0519 Longwa ng
2. Date or period of occurrence		18, JUL. 19, JUL.	30, JUL	6, AUG	13, AUG	1, SEP 1, SEP	11, SEP		26, SEP	2, Oct

3. Name of regions/areas seriously affected*		Fujian Zhejiang Jiangxi Hubei Henan Anhui	Hainan Guangdong	Zhejiang Shanghai Jiangsu Anhui Shandong Hebei Liaoning Fujian	Guangdong Fujian Jiangxi Hubei	Fujian Zhejiang Hubei Henan Jiangsu Jiangxi Anhui Guangdong	Zhejiang Jiangsu Anhui	Hainan Guangdong	Hainan Guangdong Gguangxi	Fujian Jiangxi Zhejiang
II. HUMAN DAMAGE	**Unit**									
4. Dead and missing*	persons	14		25	36	167	25	1	29	133
5. Injured	persons	356		303	81	871	24			
6. Homeless*	families	339600	5000	461000	109200	371400	226600		108400	129400
7. Affected	persons	11753000	131000	31575000	4576100	20088500	12715500	282000	8907000	4591900
8. Total	persons									

1) Please specify other categories of disaster victims covered here e.g. assisted by emergency relief, activities, those whose normal activities are seriously disrupted.
Remarks:

III. MATERIAL DAMAGE IN PHYSICAL TERMS	**Sequence No.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
A. Houses and buildings	Unit									
9. Destroyed*	Units	20900		59600	25700	116400	23800	100	33900	9400
10. Damaged*	Units	154800		191300	43900	292100	40600		109400	
11. Affected*	Units									
12. Total*	Units									
B. Farmland										
13. Farmland	hectares	478750		2140200	265140	131649	895020	2350	1133000	156190

						0				0
C. Agricultural Products										
14. Crops	tons									
15. Livestock	heads	10100		200	1300	67000			31900	40900
16. Fruit plants	number hectares									
17. Others										

2) Houses and buildings include public buildings and are classified into three groups: Those not able to be used without reconstruction enter into destroyed", those which can be required enter into damaged" and others which were inundated, damaged in minor parts or those fixtures and furniture were damaged enter into affected".

3) Please specify other types of damage e.g. inundated marooned, evacuated.

4) Farmland affected are those buried, washed away, inundated and/or whose products were damaged.

5) If data are available for other products such as vegetables, marine products, forest products, please use this column.

Remarks:

	Sequence No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
D. Public works facilities	Unit									
18. Road	km	1489		726	283	1	809		518	417
19. Bridge	sites			301	17					
20. River embankment	km	251		447	35	80	647	2	4	103
21. Irrigation facilities	hectares sites	10124		4472	964	5641	3540	57	4492	4559
22. Reservoir and dam	number									

23. Harbor and port	number sites									
24. Other please specify										
B. Public Utilities										
25. Railway	km sites									
26. Electric Supply	affected families sites (km)	926		559	130	1	970	0	395	428
27. Water Supply	affected families sites									
28. Telecommunication	circuits sites (km)	508		479	18		711		712	133
29. Other please specify										

6) There are two types of classification methods in the public works facilities:

a) Classification in accordance with the nature of the service provided;

b) Classification in accordance with the administrative structure of the government. Although the format was prepared according to the former classification, if necessary appropriate changes might be allowed.

7) Public utilities include both private owned and state owned facilities. Column of 揙ther” can be used for the damage in airport, gas supply, etc.

	Sequence No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
F. Others	Unit									
30. Ships lost or damaged	number			53	388					
31. Landslide and collapse of slope	sites									

IV. MATERIAL DAMAGE IN MONETARY TERMS	**Sequence**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
32. Damage of houses and loss of private property* includes:										

		1	2	3	4	5	6	7	8	9
∗ houses and buildings for residential use, ∗ household furniture, appliances and possession, ∗ stored good and other assets of farmers and fisherman扭 households ∗ Other										
33. Loss of agricultural production includes: * crops, vegetables, fruits, etc. * livestock * Other: Fisheries	ten thousand dollars	3333 9		34863	7136	51675	55380		102484	22635

8) Damage of houses and loss of private property includes damage to a) houses and buildings for residential use; b) household furniture, appliances and possessions;

c) stored goods and other assets of farmers' and fishermen 扭 households. Damage to shops and manufactures could be classified under item 34. Loss of industry,

however, if such separation was not possible for small shops and home-industries, such damage could be included in this item with an appropriate note.

Damage costs can be estimated by means of surveys listing the number of houses and buildings, their floor area and extend of damage, priced according to the value

of the building or per unit area of floor space. Damage to household articles and personal effects such as clothing, furniture, electric appliances, cars, etc. are included

in this category. If information on the household articles of an average family is available; loss may be calculated by multiplying the number of affected families by their total properties and an assessed percentage of damage.

Damage to stored goods and other assets of farmers and fishermen 扭 household can be assessed in a similar manner.

9) Loss of agricultural production includes damage to a) crops, vegetables, fruits, etc., b) livestock, c) marine products, d) forest products. Damage to agricultural products

which had been stored in farmers' houses or warehouses should be counted under item 32. Damage of houses and loss of private properties.

Crop damage can be estimated by multiplying the damaged crop area by the average loss per hectare and unit price of the crop, after considering the extent of damage

to crops inundated and buried under debris. Loss of livestock can be estimated in the same manner by multiplying the head of stock lost by unit market price.

	Sequence No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
34. Loss of industry	ten thousand dollars				272		38530		10357	43585

35. Loss of public work facilities includes items under III. MATERIAL DAMAGE IN PHYSICAL TERMS * road bridge, river embankment, etc., irrigation facility * reservoir and dam, harbor and port, and public bridges * rehabilitation cost of farmland at government expense * Other	ten thousand dollars	3671		12361	20665	6070	8300		7929	26996
36. Loss of public utilities includes items under III. MATERIAL DAMAGE IN PHYSICAL TERMS * railway, electric supply, water supply, telecommunication * Other										
37. Total estimated/counted damage cost, sum of items 32, 33, 34, 35, 36	ten thousand dollars	158669	2886	223279	54215	205661	117871	692	152028	94468

10) Loss of industry includes damage to buildings, factories, warehouses, machinery, stored good and other assets in factories and wholesale, retail and other service industries, but excludes agriculture, fishing and public utilities. Indirect losses due to suspension of routine activities are excluded here and if such data is available,
please use column V. OTHER ADDITIONAL INFORMATION AND DATA AVAILABLE.

Estimates of the damage incurred can be sought from the industries concerned.

11) Loss of public works facilities is the cost required for the following facilities at Government expense: a) road and bridges, b) flood control installations, c) agricultural land, d) irrigation and drainage installations, e) reservoirs and dams, f) harbor, fishing port and airport installations, g) erosion control and landslide structures, h) streets, urban sewerage system and other public works facilities.

12) Public utilities include both private owned and state owned facilities.

In Hong Kong,China,

In 2005, three tropical cyclones necessitated the issuance of local warning signals in Hong Kong. A summary of these tropical cyclones is given below.

(a) Severe Tropical Storm Sanvu (0510) : 10 – 14 August 2005

In Hong Kong, the Standby Signal No. 1 was issued for the first time in the year at 10.40 a.m. on 12 August when Sanvu was about 770 km to the east-southeast. Locally, squally showers and thunderstorms set in that evening as Hong Kong came under the influence of Sanvu. It came closest to Hong Kong at around 1 p.m. on 13 August when it was about 300 km to the east-northeast. The lowest hourly sea-level pressure of 997.0 hPa was recorded at the Hong Kong Observatory Headquarters at 3 p.m. that afternoon. All tropical cyclone warning signals were cancelled at 6.45 p.m. the same day as Sanvu gradually moved away from Hong Kong.

The rainbands of Sanvu brought heavy squally showers to Hong Kong on 13 August. More than 80 millimetres of rainfall were recorded at the Observatory Headquarters. The Amber Rainstorm Warning Signal was in force between 11.40 a.m. and 1.15 p.m. on 13 August, and between 8.45 p.m that night and 0.20 a.m. the next day. Sanvu brought no significant damage to Hong Kong.

The track of Sanvu and the rainfall distribution over Hong Kong associated with Sanvu are shown in Figures 1 and 2 respectively. Figure 3 is the infra-red imagery of Sanvu.

(b) Tropical Storm Vicente (0516) : 16 – 19 September 2005

In Hong Kong, the Standby Signal No. 1 was issued at 2.40 p.m. on 17 September when Vicente was about 760 km to the south. As Hong Kong came under the influence of its outer rainbands, local weather became unstable with squally showers and thunderstorms. During the passage of Vicente, the lowest hourly sea-level pressure of 1010.4 hPa was recorded at the Hong Kong Observatory Headquarters at 3 p.m. and 4 p.m. on 17 September. Vicente was closest to Hong Kong at around 8 p.m. when it was about 670 km to the south-southwest. Vicente then gradually moved away from Hong Kong and all tropical cyclone warning signals were cancelled at 7.40 a.m. on 18 September.

Under the combined effect of Vicente and a ridge of high pressure over southeast China, winds were generally strong offshore and on high grounds on 17 and 18 September. Seas were rough and red flags were hoisted at a number of beaches in Hong Kong. Locally, a swimmer was drowned on 17 September and another one on the following day in rough seas at Ham Tin Wan of Sai Kung.

Figure 4 shows the track of Vicente. The rainfall distribution over Hong Kong and infra-red imagery of Vicente are shown in Figures 5 and 6 respectively.

(c) Typhoon Damrey (0518) : 21 – 28 September 2005

In Hong Kong, the Standby Signal No. 1 was issued at 10.40 a.m. on 22 September when Damrey was 710 km to the east-southeast of Hong Kong. With Damrey edging closer to Hong Kong, the Strong Wind Signal No. 3 was issued for the first time this year at 8.40 a.m. on 24 September. Subsequently, winds strengthened and showers set in as Hong Kong began to come under the influence of Damrey’s outer rainbands.

The lowest hourly sea-level pressure of 1002.7 hPa was recorded at the Hong Kong Observatory Headquarters at 3 p.m. and 4 p.m. on 23 September. Damrey was closest to Hong Kong at around 8 a.m. on 24 September when it was centred about 290 km to the south-southeast. As Damrey moved away, all tropical cyclone warning signals were cancelled at 8.20 a.m. on 26 September. The rainbands of Damrey affected Hong Kong for several days. More than 200 millimetres of rainfall were recorded at the Observatory Headquarters.

During the passage of Damrey, three people were hit and injured by fallen objects in Yau Ma Tei, Tsim Sha Tsui and Yuen Long. Road flooding occurred at Wong Tai Sin. Several cases of fallen trees and signboards, and loosened scaffolding were reported.

The track of Damrey and the rainfall distribution over Hong Kong are shown in Figures 7 and 8 respectively. The infra-red imagery depicting the eye of Damrey is shown in Figure 9.

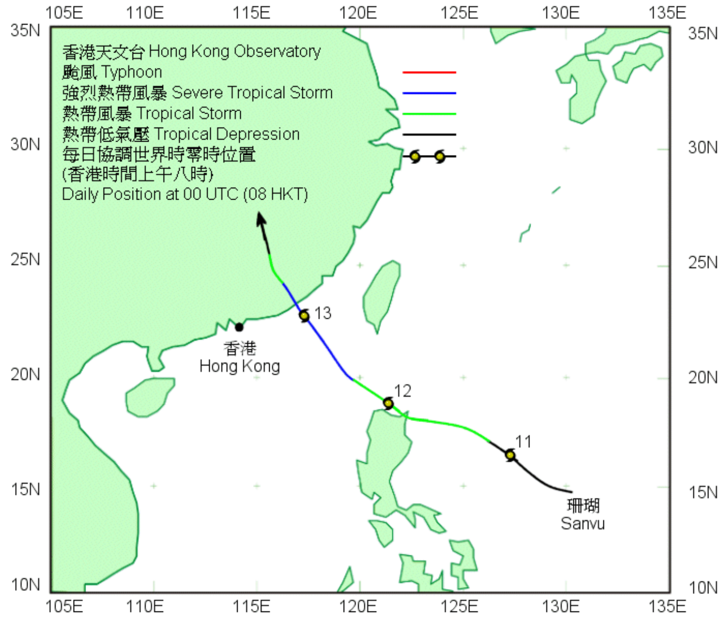

Figure 1. Track of Sanvu (0510) on 10 - 14 August 2005.

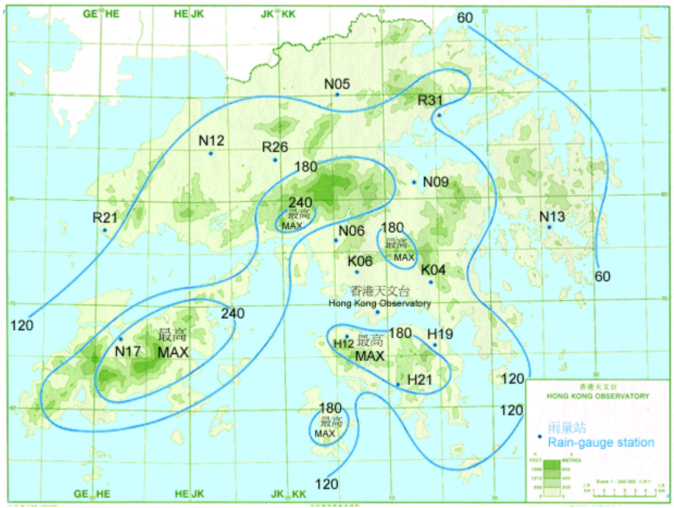

Figure 2. Rainfall distribution over Hong Kong on 12-16 August 2005 (isohyets are in millimetres)

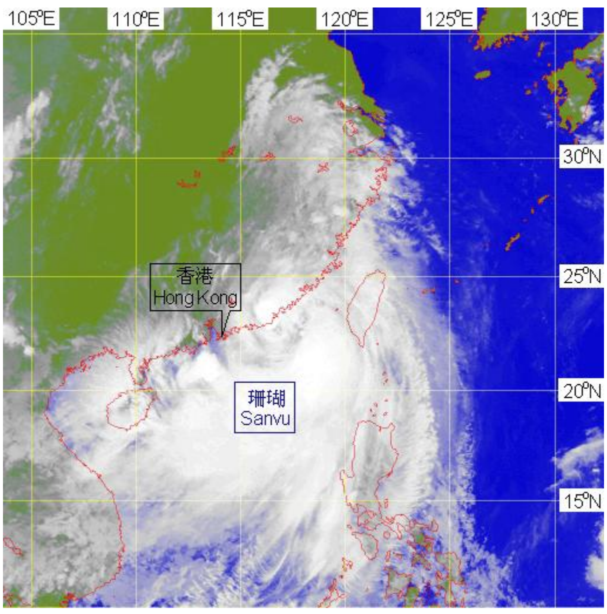

Figure 3. Infra-red imagery at around 8 a.m. on 13 August 2005 of Sanvu.

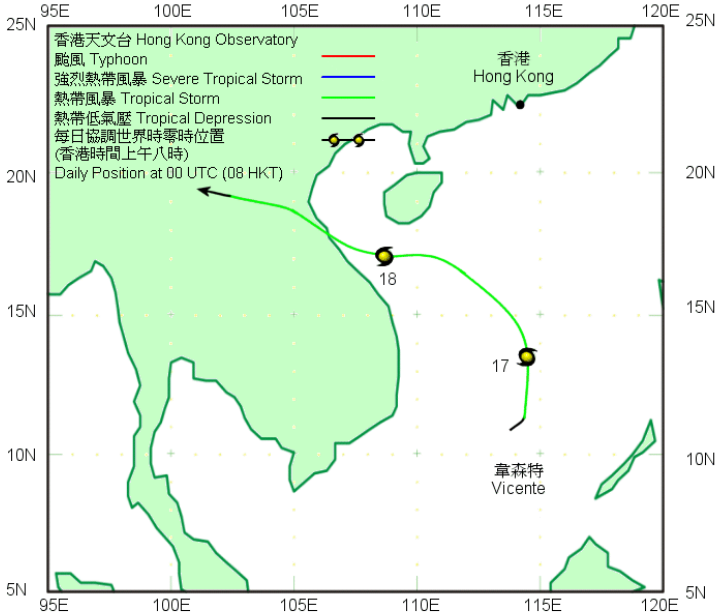

Figure 4. Track of Vicente (0516) on 16 - 19 September 2005.

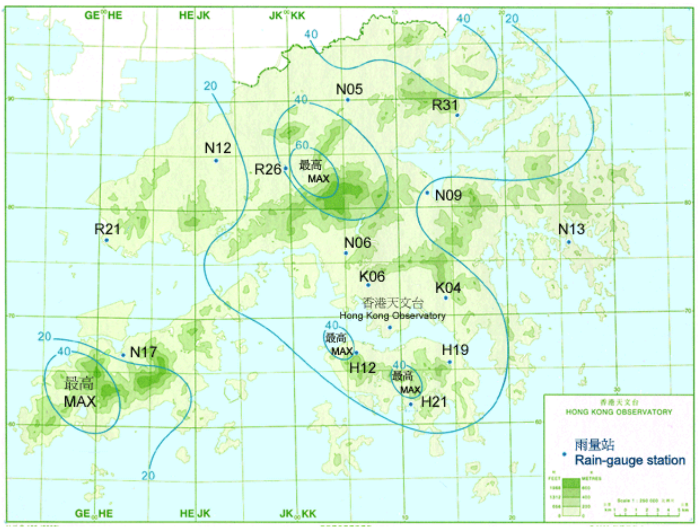

Figure 5. Rainfall distribution over Hong Kong on 17-18 September 2005 (isohyets are in illimetres).

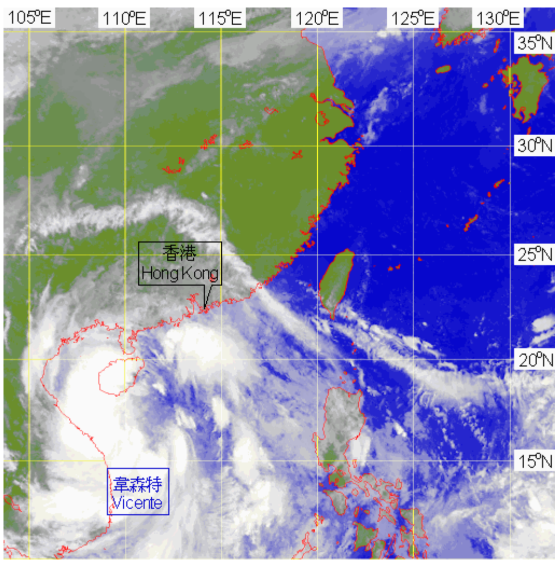

Figure 6. Infra-red imagery at around 2 a.m. on 18 September 2005 of Vicente.

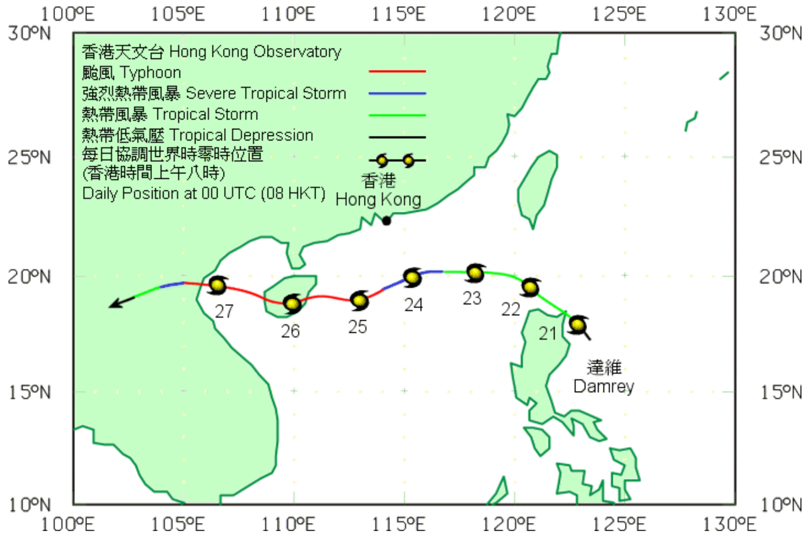

Figure 7. Track of Damrey (0518) on 21 - 28 September 2005.

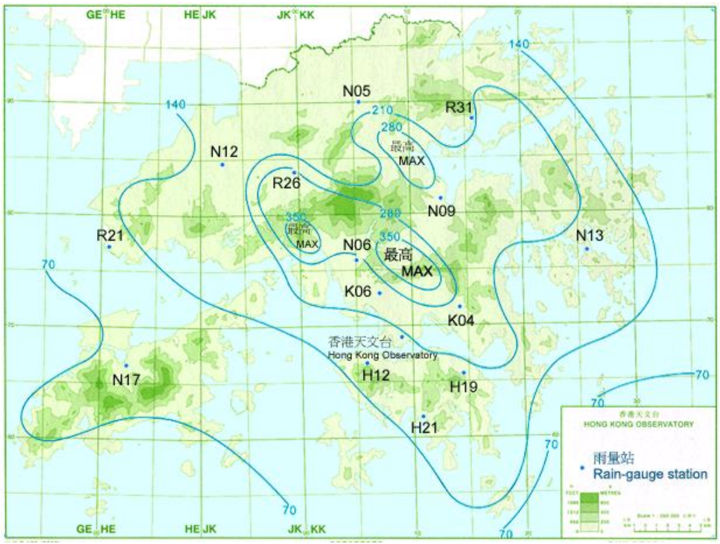

Figure 8. Rainfall distribution over Hong Kong on 22-27 September 2005 (isohyets are in millimetres).

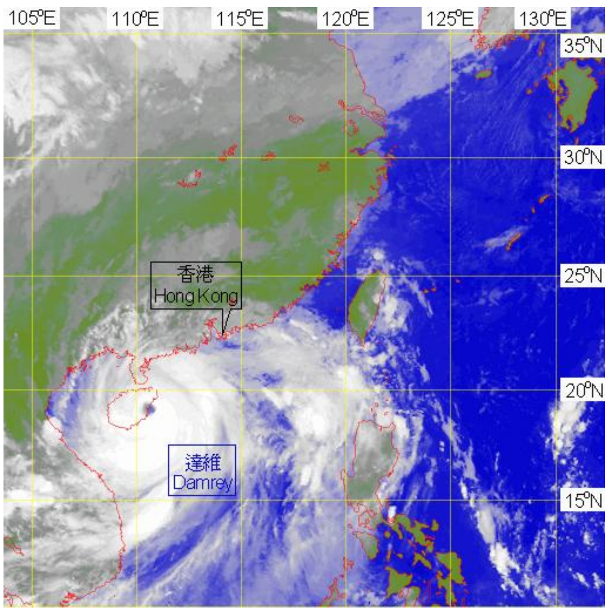

Figure 9. Infra-red imagery at around 2 a.m. on 26 September 2005 depicting the eye of Typhoon Damrey.

In **the Republic of Korea,**

Only typhoon 'Nabi' affected the Korean Peninsula directly this typhoon season, mainly from May to September in 2005. No typhoon landed on the Korean Peninsula. Typhoon Nabi(0514) passed nearby(about 80km) Dokdo(island), which located on the East Sea of Korean Peninsula. Typhoon 'Nabi' affected the country caused 6 death and lose of property worth of US$11.2 million.

Typhoon Nabi (0514)

A tropical depression over the sea 1,210 km east-north-westward of Guam, strengthened to a tropical storm(TS) status on 09UTC 29 August, and gradually strengthened to a typhoon on 18UTC 30 August. The typhoon reached a peak intensity of 95 kt during 15UTC 1 September and 21UTC 2 September, when the center of typhoon moved within 1000 ~ 1700 km of Guam. The center slowly moved to a northwestward direction and reached the sea 200 km east-south-east of Busan, located in the southern part of the Korean Peninsula at 21UTC 6 September. The hourly rainfall was the range of 50 ~ 60 mm, and sustained winds were 30 ~ 40 m/s at the southeast part of the Korean Peninsula as the typhoon came to close.

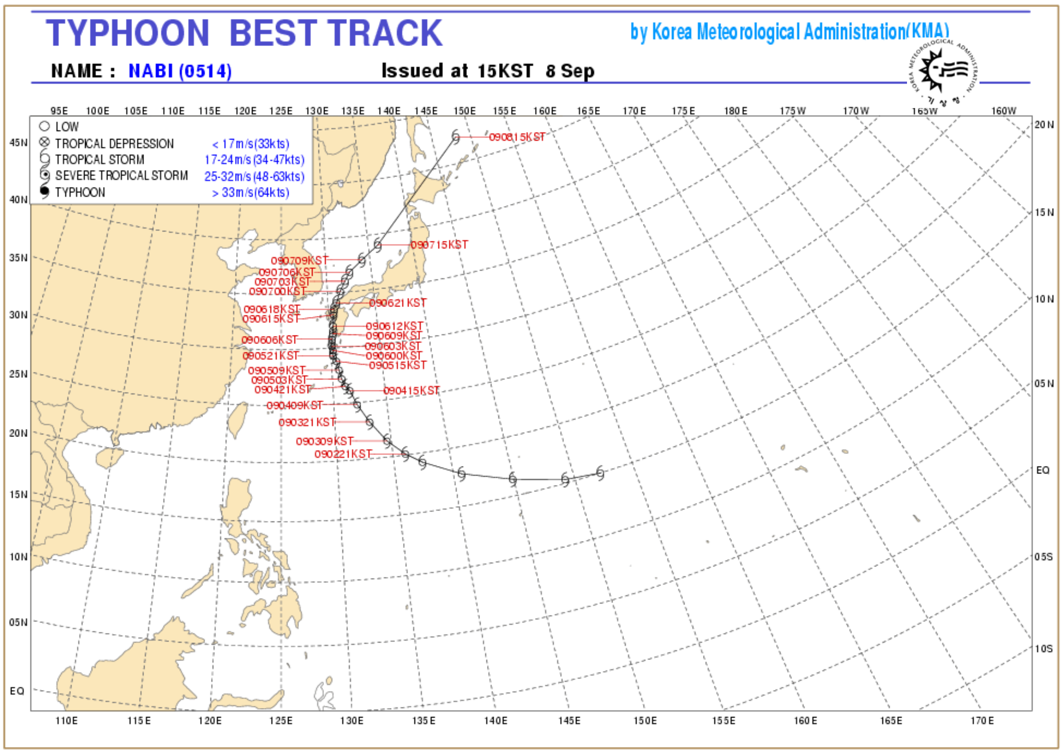

Figure 1. Best track of typhoons for affecting Korean Peninsula in 2005.

The cyclone was weakened to an extratropical low around 06UTC 8 September at the East Sea near Sapporo, Japan. The best track chart of the tropical cyclone path is given in figure 1. Accumulated precipitation and maximum wind speeds are given in figure 2.

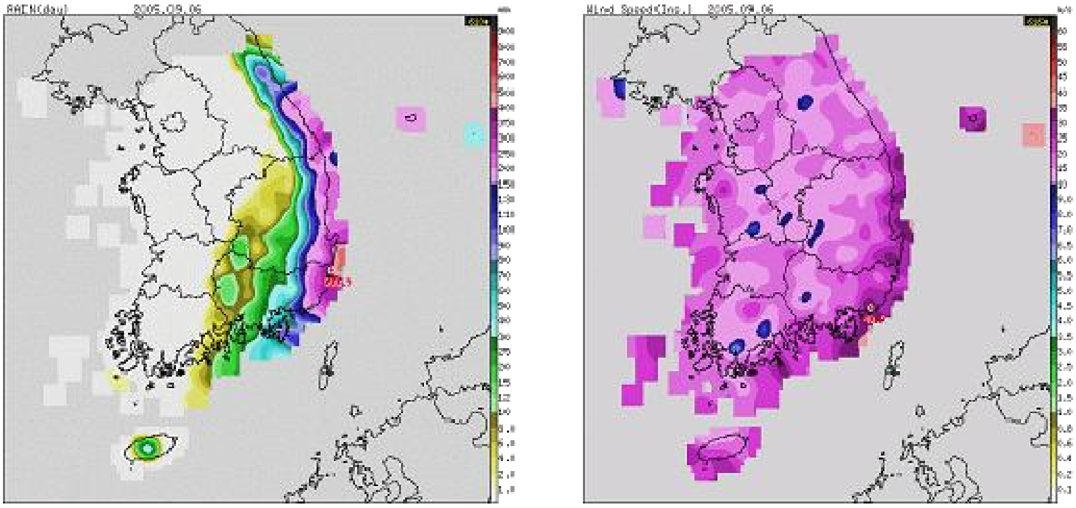

Figure 2. Accumulated rainfall amounts and maximum wind speed for typhoon 'Nabi' during 6 Sep. 2005.

Macao, China

During 2005 typhoon season, Macao was affected by Washi(0508) and Sanuv(0510) on
July and August respectively.

Table 1 shows the extreme values recorded during the passage of severe tropical storm Washi. As seen in the table, during its passage, minimum station pressure recorded was 986.9hPa, while maximum mean wind of 49 km/h and gust wind of 77 km/h were recorded respectively. Average of about 25mm of precipitation were generally recorded but with no report of flooding. Washi was at its closest position to Macao at about 430km to the southwest around 08:00 L.T. on 30th July 2005.

Table 1: Extreme Values Recorded During the Passage of Tropical Storm "WASHI" (0508) (2005/07/29 - 2005/07/30)
Minimum Station Pressure Maximum Wind Speed and Corresponding Direction Instantaneous Minimum (hPa)
Date
986.9
July 29
at 16:41
Station
Hourly
Maximum Date
(km/h)
Maximum
Gust Date
(km/h)
Precipitaion
During the Signal
Hoisting Period
(mm)
Taipa Grande SE 28.7 July 30 09:00 73.8 July 30 07:33 23.8 Minimum distance of the centre of storm from Macao Ponte de Amizade Sul E 49.3 July 29 22:00 75.6 July 29 21:20 --- E.T.A.R. de Macau E 31.2 July 29 18:00 54.7 July 29 21:21 30.8 430km SW of Macao (July 30 08:00) Ponte de Sai Van E 49.2 July 29 19:00 77.0 July 29 21:23 --- Signal No.1 was hoisted at 11:45 L.T. on July 29.
All signal was lowered at 09:30 L.T. on July 30.

Table 2 shows the extreme values recorded during the passage of severe tropical storm Sanuv. During its passage, minimum station pressure recorded was 984.4hPa, while maximum mean wind of 36 km/h and gust wind of 85 km/h were recorded respectively.

Average of about 35mm of precipitation were generally recorded but also with no report of flooding. Both of them caused no significant damage to the society and living.

Table 2: Extreme Values Recorded During the Passage of Severe Tropical Storm "SANVU" (0510) (2005/08/12-2005/08/13)

Minimum Station Pressure Maximum Wind Speed and Corresponding Direction
Instantaneous
Minimum (hPa)
Date
984.4
Aug 13
at 15:30
Station
Hourly
Maximum Date
(km/h)
Maximum
Gust Date
(km/h)
Precipitaion
During the Signal
Hoisting Period
(mm)

Taipa Grande SE 25.5 Aug 13 02:00 70.9 Aug 13 17:00 39.4 Minimum distance of the centre of storm from Macao Ponte de Amizade Sul ESE 36.0 Aug 13 02:00 61.2 Aug 13 17:01 --- Ka - Hó SW 24.1 Aug 13 18:00 85.0 Aug 13 17:04 35.4 E.T.A.R. de Macau SE 26.1 Aug 13 02:00 47.2 Aug 13 01:13 27.6 430km SW of Macao (July 30 08:00) Ponte de Sai Van SW 29.6 Aug 13 17:00 61.2 Aug 13 17:02 --- Signal No.1 was hoisted at 12:30 L.T. on Aug 12. All signal was lowered at 18:30 L.T. on Aug 13.

Following table shows the damages caused by the two tropical cyclones affecting Macao
during the period from 1/9/2004 to 31/8/2005:.
Date Name of TC Local Warning
Singal No. Events Amount
29/7/2005 WASHI 1 Injuries 0
12/08/2005 SANVU 1
Injuries 0
Fall of metal shelf 1
Fall of sun shield 1

In **Malaysia**, Ino tropical cyclones occurred in 2005

In the Philippines,

Between September 2004 to August 2005, there were 22 tropical cyclones that entered the Philippine Area of Responsibility (PAR) but only 6 had directly affected the country (Table 1). The series of tropical cyclones namely, Unding {Muifa}, Violeta {Merbok}, Winnie and Yoyong {Nanmadol}, that occurred within a span of 20 days (November 14 to December 04) brought continuous rains that resulted to massive flashfloods and landslides. The tracks of the 4 tropical cyclones are found in Figure 1. A total of 216 severe weather bulletins were issued during the period under review. The summary of tropical cyclone occurrences during the period is shown in Table 1.

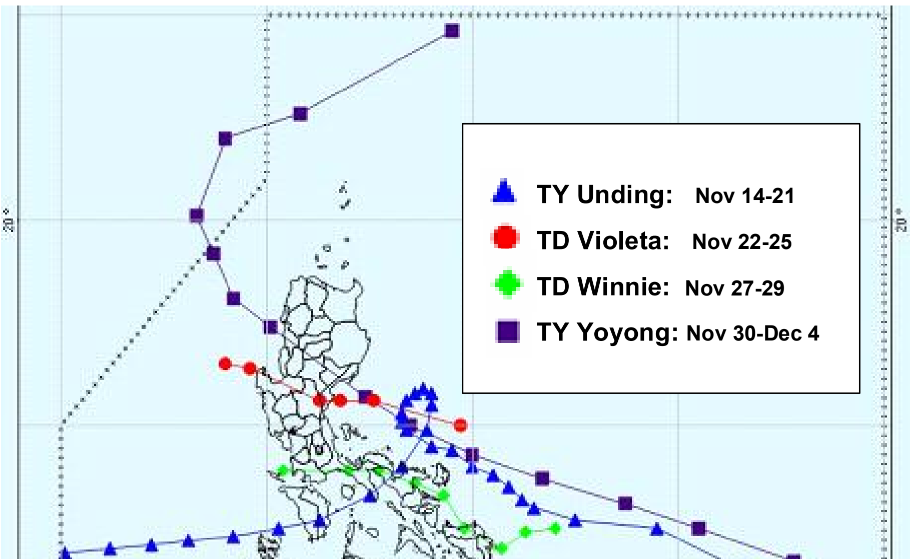

Figure 1. Tracks of tropical cyclones that affected the Philippines from Nov 14 – Dec 4, 2004

1.2. Impacts

1.2.1 Rainfall

The observed rainfall in some PAGASA synoptic stations during the passage of TD Winnie broke the maximum recorded rainfall in the central and southeastern Luzon. The resulting flashfloods and landslides practically buried several towns and barangays including the town proper of Infanta in the province of Quezon. The PAGASA synoptic station in Infanta was buried with mud which rendered the station inoperational for 5 months.

1.2.2 Dam operation

The rainfall brought about by TD Winnie triggered widespread flooding over Central Luzon as well as flashfloods and landslides in southeastern Luzon. Two of the monitored reservoirs namely the Angat and Magat dams spilled a considerable volume of excess water. This resulted to flooding in areas downstream of the reservoirs. In Angat dam, the deficit of more than 20 meters was filled in less than 24 hours. The maximum observed inflow of more than 10,000 cubic meters per second in Angat exceeded the design inflow of 8,500 cubic meters per second in the midnight of November 29, 2004. The observed inflow is equivalent to a flood of 200-year return period. The Angat dam which is also a flood control structure served as a buffer for the unprecedented volume of inflow which could have caused massive floods in Bulacan and adjacent areas.

Table 1: List of tropical cyclones monitored in the Philippine Area of Responsibility between September 2004 to August 2005

Year	No.	Tropical Cyclone	Date of Occurrence	Maximum Sustained Winds	Central Pressure
2004	1	TY NINA (Songda)	Sep 03-05	160	958
	2	TS OFEL (Haima)	Sep 11-12	70	995
	3	TD PABLO	Sep 15-17	85	1000
	4	TY QUINTA (Meari)	Sep 23-26	160	958
	5	TY ROLLY (Ma-on)	Oct 04-08	185	948
	6	TY SIONY (Tokage)	Oct 15-19	175	948
	7	TY TONYO (Nock-Ten)	Oct 22-25	150	963
	8	TY UNDING (Muifa)*	Nov 14-22	120	976
	9	TD VIOLETA (Merbok)*	Nov 22-23	55	1000
	10	TD WINNIE*	Nov 28-30	55	1000
	11	TY YOYONG (Nanmadol)*	Dec 01-04	185	943
	12	TS ZOSIMO (Talas)	Dec 15-20	65	997
2005	13	TS AURING (Roke)*	Mar 15-18, 2005	105	982

	15	TY BISING (Sonca)	Apr 22-26	160	958
	16	TD CRISING	May 16-17	55	1000
	17	TY DANTE (Nesat)	June 3-8	160	958
	18	TD EMONG	July 4-6	55	100
	19	TY FERIA (Haitang)*	July 15-19	195	938
	20	TY GORIO (Matsa)	Jul 31 – Aug 4	150	963
	21	TS HUANING (Sanvu)	Aug 10- 13	95	987
	22	TY ISANG (Talim)	Aug 29 – Sep 1	175	948

1.2.3 Extent of flooding

All the monitored major river basins (Pampanga, Agno, Bicol and Cagayan) and two of the major reservoirs (Angat and Magat) were affected by the four tropical cyclones. The extent of flooding in the four monitored river basins is shown in the satellite images provided by the Dartmouth Flood Observatory, Hanover, USA (Figures 2 to 5).

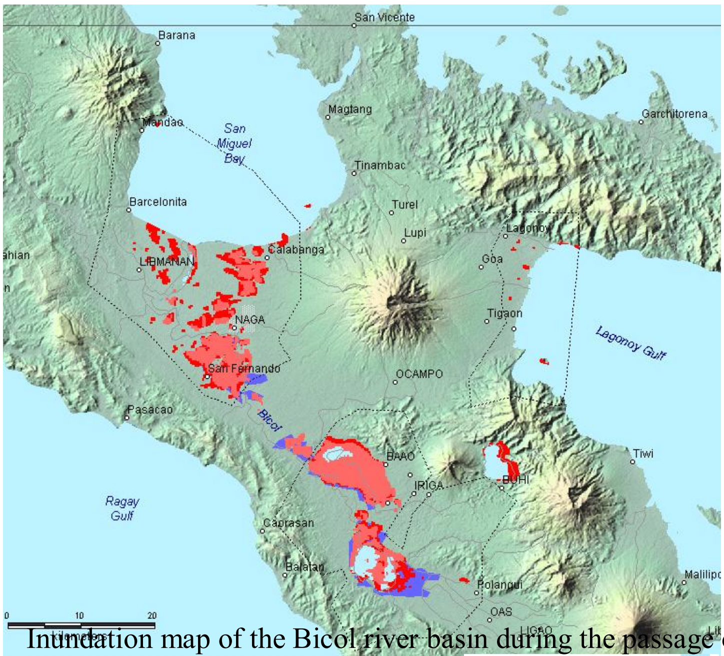

Figure 2. Inundation map of the Bicol river basin during the passage of TY M

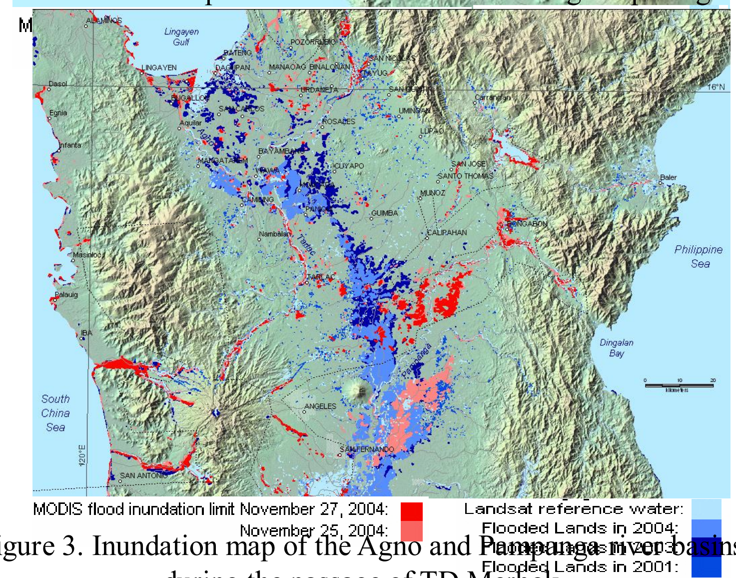

Figure 3. Inundation map of the Agno and Pampanga river basins during the passage of TD Merbok

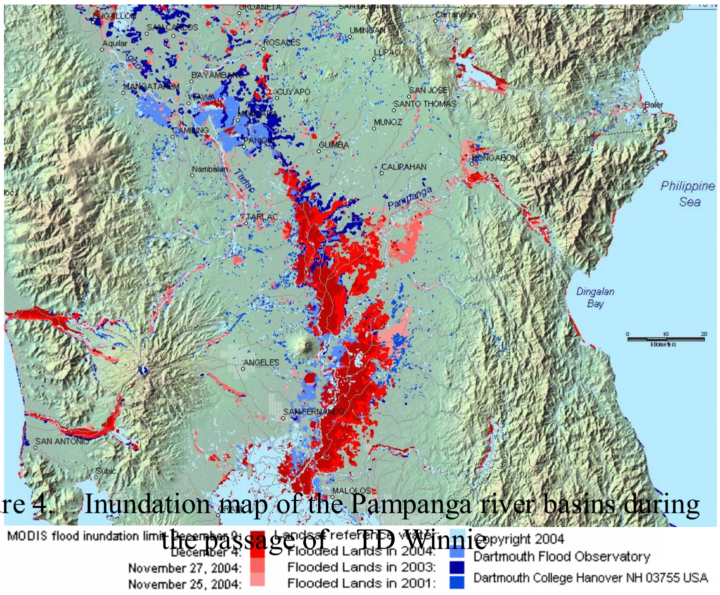

Figure 4. Inundation map of the Pampanga river basins during the passage of TD Winnie

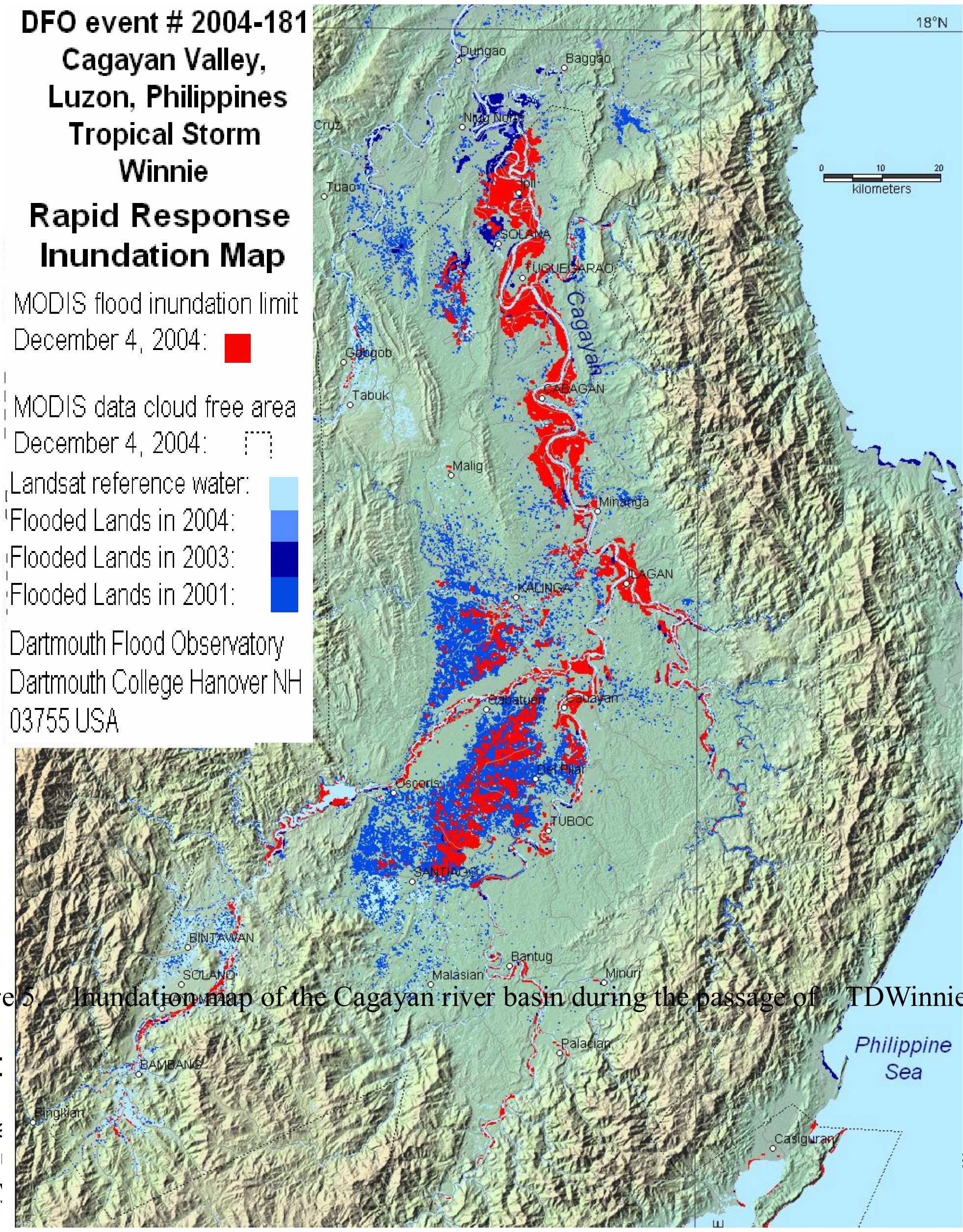

Figure 5. Inundation map of the Cagayan river basin during the passage of TDWinnie

1.2.4 [

Ba ... griculture and infrastruct ... and persons affected by

Table 2. Damage due to tropical cyclones between Nov 14 to Dec 04, 2005

Date	Name of Tropical Cyclone	Population Affected		Casualty	Damaged to Property		TOTAL DAMAGES
		Person	Family	Dead	Agriculture	Infrastructure	

Nov 14-21	TY Unding	774,411	147,049	66		467.709	921,994
Nov 22-23	TS VIOLETA	99,461	21,151	26		47	120,685
Nov. 26–30	TD WINNIE	1,462,497	271,926	280		689.825	1,735,393
Dec 1–4	TY YOYONG	1,431,923	281,976	73	5,683.06	628.852	1,720,284
Total		**3,768,292**	**722,102**	**445**	**PhP 5,683.06**	**1,833.386**	**PhP 4,498,356**

V. Typhoons that impacted TC Members

TY UNDING (0425, MUIFA)

Unding formed near Yap Island on the 13th of November. It entered the Philippine Area of Responsibility (PAR) as a tropical depression with 55 kph winds in the morning of November 14. Later, it intensified into a tropical storm and moved towards Southern Luzon. It stalled at sea just east of Luzon for two and a half days but eventually made landfall with typhoon strength over Bicol region. Unding made an exit in the evening of the 21st . Typhoon Its strong winds caused some damages in Camarines Norte and Camarines Sur and over Mindoro.

TD VIOLETA (0426, MERBOK)

This weather disturbance formed about 330 kms east southeast of Baler, Aurora in the morning of Nov. 22. Violeta tracked to the west northwest direction and accelerated towards Aurora province. In the evening of the same day, it made landfall near Baler, Aurora. By morning of the 23rd, it was off the coast of Pangasinan in western Luzon

TD WINNIE

Five days after the passage of Violeta, Tropical Depression Winnie was formed at about 250 kms east of the Bicol region. It followed a west-southwest course and made landfall in the afternoon of November 28. It brought heavy rains in Central Luzon and adjacent areas and triggered widespread floods and massive landslides. It dissipated on November 30 after crossing land areas.

TY YOYONG (0427, NANMADOL)

Yoyong was a strong typhoon with 150 kph center winds when it the PAR at about 1,000 kms east of the Visayas region in the morning of December 01. It moved west northwest in the general direction of Luzon. Later, its wind strength intensified to 185 kph and headed towards Central Luzon. It hit land near Baler, Aurora on the night of December 02.Yoyong then crossed Northern Luzon and headed to Taiwan in the early morning of December 04 and exited the PAR later in the afternoon.

Damages from the four successive tropical cyclones in the latter part of 2004 amounted to almost PhP1.7 billion (US$30.8 million). There were over 40,000 families affected and causing the deaths of 175 people with 495 injured and 110 missing. These were from tropical cyclones “Unding” {Muifa}, “Violeta” {Merbok}, “Winnie” and “Yoyong” {Nanmadol}.

Unding left 71 persons dead, 160 injured and 69 missing. Total damages amounted to PhP 434.25 million.

Violeta caused 31 persons dead, 167 injured and 17 missing. Affected families totaled 21,151.

Winnie moved across densely- populated areas and caused a lot of damage. Winnie caused 893 persons dead, 648 injured, and 443 missing. It affected 170,036 families and damages totaled to about PhP701.64 million.

Yoyong brought widespread rains over Luzon and Samar and left 73 dead, 168 injured and 24 missing. Total cost of damage was estimated at PhP560.829 million.

In Thailand,

V. Typhoons that Impacted Thailand

There were only one Typhoon and one tropical storms that impacted Thailand : -

- Typhoon “Muifa” (0425) : 24 – 27 Nov 2004
- Tropical Storm “ Washi” (0508) : 30 July – 1 Aug 2005

Although they have their names in the list of TC name, they were downgraded into tropical depressions before moving into Thailand, thus they gave minor impacts in some parts of the country.

1. Typhoon “Muifa”

After it originated in the Pacific Ocean and later moved across Philippines on 19th November 2004, Muifa moved west southwest and made land fall over southern Thailand on 25th, fortunately, it didn’t brought so much rain to the Thailand since Muifa downgraded into depression before hitting the South.

2. Tropical Storm “Washi”

Formed in the South China Sea, Washi moved through Vietnam, Lao PDR before downgraded into depression near the upper most of Thailand on 31st July 2005. Heavy rain falls with flash – floods were reported in some areas of northern Thailand.

3. Tropical Depression (TD1)

Originated in the South China Sea on 10th August 2005, moved west and downgraded into a low pressure over Lao PDR before moving to Chiang Rai of Thailand. It brought very heavy fall into northern Thailand, and caused widespread flood in several areas of the North.

4. Tropical Depression (TD2)

It formed in the South China Sea on 28th August 2005, and moved into Lao PDR and became low pressure just close to upper most of northern Thailand. Moderate to heavy rain occurred in the North and Northeast. Fortunately, only minor flood took place in the North due to this storm.

5. Tropical Depression (TD3)

Formed in the South China Sea on 12th September 2005 and moved into Thailand on 13th September 2005. It brought very heavy falls about 300 mm of 2 days accumulated rain into the central part of Thailand. Flood took place in several provinces of central and eastern Thailand. It also aggravated the flooding situation Thailand faced in 2005.

During 1st October 2004 – 15th September 2005, there were two tropical cyclones passing through Thailand and three tropical depressions affected Thailand (Fig.1). One formed over the western North Pacific Ocean and the other four tropical cyclones in the South China Sea. Brief descriptions as follows:

1. Typhoon “MUIFA” (0425)

A low pressure cell intensified into the tropical depression over the western North Pacific Ocean on 14 November 2004. It developed into a tropical storm on the next day and tracked west-northwestward approach to the Philippines. It then intensified to a typhoon on the 18th and crossed over the central Philippines on the 19th before moving to the central part of the South China Sea on the following day. During its moving, the typhoon was downgraded to the tropical storm and became intense and was upgraded to typhoon once again on the 21st. It was weakened to the tropical storm as located near east of Vietnam and continued to move near the southern most of Vietnam before tracking to the Gulf of Thailand on the 25th. It gradually downgraded to the tropical depression and made landfall over the southern Thailand at Surat Thani province on 25th. It passed through Ranong province and finally dissipated in the Andaman Sea on the next day. The rainfall figure from MUIFA are given in Fig.2.

2. Tropical Storm “WASHI” (0508)

A tropical depression formed in the upper part of the South China Sea (east of Hainan Island) at 1800 UTC on 28 July 2005. It moved west-northwest course and reached a tropical storm at 1800 UTC on the 29th .The storm hit Hainan Island before entering the Bay of Tonkin on the next day. It made landfall over the upper Vietnam on the 31st as tropical storm and then tracked west- northwest to Lao PDR. The storm moved close to the upper most of Thailand and was downgraded to a tropical depression at 1800 UTC on the 31th and dissipated on that day.

3. Tropical depression (TD 1)

A low pressure cell in the upper part of the South China Sea was upgraded to a tropical depression at 0000 UTC on 10 August 2005. It moved west – northwestward and made landfall over Hainan Island. It continued to move to the Bay of Tonkin before entering upper Vietnam on the 12th. It moved further inland and downgraded to a low pressure cell over Lao PDR on the following day before moving to cover Chiang Rai province in northern Thailand on the same day. It caused very heavy rainfall in northern and northeastern regions (Fig.3). Severe flash floods occurred at downtown of Chiang Mai province on the 13th -14th.

4. Tropical depression (TD 2)

A tropical depression formed in the central part of the South China Sea on 28 August 2005. The tropical depression tracked westward initially and gradually curved to the west-northwest approach along the coastline of the central Vietnam. It turned its track from the west-northwest to the north-northwest and moved close to Hainan Island. The storm then moved westward and made landfall over upper Vietnam at 1800 UTC on the 30th. It continued to move to Lao PDR and moved very close to the upper most of the northeastern region of Thailand. During the passing, it gradually downgraded to a low pressure cell in Lao PDR on the following day. The remnant of the storm covered the northern Thailand and induced rainfall in northern and northeastern of Thailand. (Fig.4)

5. Tropical depression (TD 3)

An active low pressure cell in the central part of the South China Sea developed into a tropical depression at 0000 UTC on 12 September 2005. It moved slowly westward and landed over Vietnam in the morning of the following day. It continued to move to northeastern Thailand at Ubon Ratchathani province on the 13th. It moved further through Si Saket, Surin, Burirum and Nakhon Ratchasima provinces. It tracked westward to move across the central region of Thailand into Myanmar and the Gulf of Martaban on the 15th, finally. The tropical depression brought downpour rainfall to Thailand especially in eastern, lower northeastern and central regions on the 13th and the following day (Fig. 5). In addition, flash floods were reported in the several areas during the passage of the tropical depression.

In the **United States of America,**

WFO GUAM, Micronesia, Western North Pacific

E. Typhoon that Impacted TC Members

Name	Date	Island(s) affected
0422 Ma-on (26W)	28 September – 07 October 2004	CNMI: Rota, Tinian, Saipan; Guam
0423 Tokage (27W)	09 -17 October 2004	CNMI: Rota, Tinian, Saipan; Guam; Chuuk State: Ulul, Fananu
0424 Nockten (28W)	14 - 24 October 2004	Chuuk State: Ulul, Fananu; CNMI: Rota, Tinian, Saipan; Guam Yap State: Satawal, Woleai, Faraulep, Fais, Ulithi
0425 Muifa (29W)	12 -14 November 2004	None
0427 Nanmadol (30W)	28 November – 01 December 2004	Yap State: Satawal, Woleai, Faraulep, Fais, Ulithi, Yap, Ngulu; Republic of Palau: Koror, Kayangel
0428 Talas (31W)	09 -17 December 2004	Republic of the Marshall Islands: Kwajalein, Ebeye, Ujae, Ailinglaplap, Enewetak; Chuuk State: Fananu, Ulul; Guam; CNMI: Rota, Tinian, Saipan
0429 Noru (32W)	12 -21 December 2004	CNMI: Rota, Tinian, Saipan, Agrihan
0501 Kulap (01W)	12 -18 January 2005	Chuuk State: Chuuk, Puluwat, Ulul; Yap State: Satawal, Faraulep, Woleai, CNMI: Rota, Tinian, Saipan; Guam
0502 Roke (02W)	11-16 March 2005	Yap State: Yap, Ulithi, Fais

0503 Sonca (03W)	16 - 23 April 2005	Yap State: Yap, Ulithi, Fais and Ngulu
0504 Nesat (04W)	28 May – 3 June 2005	Chuuk State: Ulul; Yap State: Satawal, Faraulep Guam
0507 Banyan (07W)	20 - 21 July 2005	Guam
0509 Matsa (09W)	27 July – 01 August 2005	Chuuk State: Ulul, Puluwat Yap State: Woleai, Satawal, Faraulep, Fais, Ulithi, Yap
0511 Mawar (11W)	19 - 21 August 2005	None
0512 Guchol (12W)	22 - 22 August 2005	None
0513 Talim (13W)	22 - 30 August 2005	CNMI: Rota, Tinian, Saipan Guam
0514 Nabi (14W)	28 August - 02 September 2005	CNMI: Tinian, Saipan, Agrihan; Guam
0515 Khanun (15W)	03 - 08 September 2005	Yap State: Fais, Ulithi, Yap
0518 Saola (18W)	22 - 22 September 2005	None
0519 Longwang (19W)	27 - 30 September 2005	None

The following are narratives for tropical cyclones that reached minimal tropical storm intensity (intensity is expressed as a 1-minute average maximum sustained surface wind) within the Guam area of responsibility.

General Information: WFO Guam issues Tropical Storm and Typhoon Watches and Warnings for 37 islands in Micronesia. A Tropical Storm Watch indicates that tropical storm-force winds (34 to 63 kt, 1-minute average sustained wind) are possible within the next 48 hours. A Tropical Storm Warning means that tropical storm-force winds are expected in the next 24 hours. A Typhoon Watch means that typhoon conditions (defined as damaging winds from a typhoon with sustained winds of 64 kt or more) are possible within 48 hours. A Typhoon Warning means that typhoon force winds of 64 kt or more are expected within 24 hours or less.

When a tropical cyclone enters the Guam Area of Responsibility, WFO Guam issues Public Advisories based on the JTWC Tropical Cyclone Bulletin. When Watches and or Warnings are issued for any of the 37 island warning points, a Typhoon Local Statement is issued that provides tailored, highly specific tropical cyclone information for each specific island. When a tropical cyclone moves within the range of the Guam Doppler Radar, hourly Radar Position Estimates are also issued.

1. **Typhoon Ma-on.** Typhoon Ma-on developed east of the Marianas on September 28 and passed through the island chain as a monsoon disturbance the following day, bringing primarily rain to the islands. Further development did not begin in earnest until 3 October 2004 when it was upgraded to tropical storm 600 miles west of the Marianas near 16N 135E. Ma-on began to intensify rapidly after this point as it moved towards the northwest and out of the Guam AOR. No damage or injuries were reported in Micronesia.

2. **Typhoon Tokage.** Typhoon Tokage developed as a monsoon depression southwest of Pohnpei on 9 October. Organization did not really take place until 11 October as it passed north of Chuuk State. Satellite imagery indicated that heavy monsoon rains fell on the islands of Ulul and Fananu during this period. By 13 October, a tropical storm warning was issued for Rota, Tinian and Saipan in the CNMI for the approaching Tropical Depression by the Guam WFO. Tokage reached tropical storm intensity later that day as it passed 10 miles south of Rota. The automated station on Rota reported maximum sustained winds of 35 kt with gusts to 60 kt with 3.92 inches of rain. No injuries or serious damage were reported on Rota.

3. **Typhoon Nockten.** Typhoon Nockten developed in the Republic of the Marshall Islands around 14 October. The cyclone intensified to a tropical storm on the 16th and to a typhoon on the 18th as it moved slowly westward toward the Marianas. Tropical storm watches and warnings were issued for the northern islands in Chuuk State on the 18th as the cyclone passed to the north of the islands. Typhoon watches were also issued for Guam, Rota, Tinian and Saipan on 18 October. Guam was later upgraded to a typhoon warning as forecasts indicated a track just south of the island. Guam Doppler radar showed that Nockten was a very small but intense typhoon. Although typhoon force winds did not occur on the island (strongest gusts were 51 kt at the automated station at the University of Guam), typhoon force winds were less than 100 miles south of the island at its closest approach. As the typhoon passed through the Micronesian waters, watches and warnings were issued for many of the islands of Yap State, including Satawal, Woleai, Faraulep, Fais and Ulithi.

No significant damage, fatalities, or injuries were reported.

4. **Typhoon Nanmadol.** Typhoon Nanmadol developed in the vicinity of Chuuk State on 28 November and intensified rapidly to a typhoon on 29 November. WFO Guam issued watches and warnings for several islands and atolls in both Yap State and the Republic of Palau. Between 28 to 30 November, the fast moving Nanmadol passed within 70 miles of Satawal and Faraulep and nearly directly over the island of Woleai. During this time, Woleai reported maximum sustained winds of 50 to 60 kt and over 6 inches of rain. Most of its agricultural banana, papaya, and breadfruit crop were lost. Nanmadol continued on past Fais, Ulithi and passed about 20 miles north of Yap late in the evening on 30 November. Ulithi and Yap had peak gusts of near 60 kt as the strongest winds of this fast moving storm were north of the center and away from the islands by this time. Yap also reported over 7.4 inches of rain in a 24-hour period. Damage from this storm was primarily agricultural as no fatalities or injuries were reported. Estimated crop loss within Yap State was on the order of $50,000.

5. **Tropical Storm Talas.** Tropical Storm Talas developed unusually far to the east in the Guam AOR and was identified on satellite imagery as a tropical disturbance east of Majuro, Republic of the Marshall Islands around 9 December. Although never getting stronger than tropical storm intensity, the rapidly moving storm sped westward across Micronesia over the next 4 to 5 days and required tropical storm watches and warnings for several islands and atolls in the Republic of the Marshall Islands, the Federated States of Micronesia, Guam, and the Commonwealth of the Northern Marianas. The Kwajalein Doppler radar showed the passage of an eye-like center passing only 16 miles south of the island shortly before midnight on 10 December. This is the closest approach of a organized tropical system in the past 40 years. Maximum wind gusts measured as high as 56 kt during the closest point of approach. Although no deaths or serious injuries were reported, the complete collapse of a recently-erected sandblast shelter at the marine facility valued at $700K and damage to several other buildings on Kwajalein Island accounted for over $1M in damage. On the nearby island of Ebeye, numerous poorly constructed houses and a school were heavily damaged, most losing their tin roofs with a total estimated value of $50K. In the Marshall Island atoll of Ujae, there was also extensive crop damage. Talas managed to slip through most of the rest of Micronesia without causing any other significant damage as intensification was limited due to continuous strong vertical wind shear during its passage.

6. **Tropical Storm Noru**. This late season tropical storm had its origin as a relatively large but disorganized westerly moving cloud cluster in the vicinity of Pohnpei, FSM around 12 December. Organization remained sloppy until 17 December when it was approximately 280 miles north of Chuuk and about 500 miles east of Guam. It then began to consolidate and became a tropical storm on the 18th while being forecasted to pass over the CNMI the following day. As the tropical storm approached the Marianas, tropical storm warnings were issued for Tinian, Saipan and Agrihan and a tropical storm watch for Rota. However by 19 December, the cyclone began to slow its westward motion and it eventually passed 50 miles east of Saipan as it skimmed by the mostly uninhabited islands of the northern Marianas. Noru passed within 35 miles of Agrihan as a 50 kt tropical storm. Agrihan did not have any meteorological observations to report, however the nearby automated weather station on Pagan reported a peak gust of 50 kt on the 20th. No significant injuries or damage were reported for this tropical cyclone.

7. **Tropical Storm Kulap**. The first tropical cyclone of 2005 in the western North Pacific developed in Chuuk State, FSM between 12 and 14 January as a large disorganized but heavy rain-producing disturbance. Initially, Chuuk WSO reported up to 10 inches of rain in a 24-hour period on the 14th. Over the next three days, WFO Guam issued tropical storm watches and warnings for several islands in the FSM, including both Chuuk State (Chuuk, Puluwat, and Ulul) and Yap State (Satawal, Faraulep, and Wolaei); for Guam, and for the CNMI, (Rota, Tinian, and Saipan). In addition, a typhoon watch was also issued for Saipan and Tinian as the cyclone briefly headed in that direction. Kulap was upgraded to a tropical storm on the 15th as it moved very slowly towards the west and then northwest towards the Marianas. However, it seemed unable to consolidate as its central convection remained under the influence of an upper-level shearing pattern for most of its life. Finally on the 16th, as Kulap moved to within 120 miles of the Marianas, it began to recurve back to the east under the influence of a deep frontal zone moving down from the north. Kulap then began to intensify to near typhoon intensity as it merged into the frontal zone east of 150E on the 18th. No injuries or damage were reported with this tropical cyclone although several of the islands of Chuuk and Yap State reported some crop damage and flooding.

8. **Typhoon Roke.** Typhoon Roke began as a large monsoon circulation within Chuuk and Yap States around the 12 March. At the time, it appeared to have more than one circulation center and was difficult to position accurately. The first warning by the Joint Typhoon Warning Center (JTWC)

occurred on the 13th for a Tropical Depression, however positioning was still difficult and so only a Tropical Storm Watch was issued for Yap, Ulithi and Fais of Yap State, Federated States of Micronesia by the WFO Guam. By midday of the 14th, consolidation had begun and the system finally began to move rapidly at over 15 kt forward speed towards the north, and then west, and away from the islands of Yap State. All tropical storm advisories were dropped by early on the 15th with no significant reports of injuries or damage to any of the islands.

9. **Typhoon Sonca.** Similar to that for Typhoon Roke, Typhoon Sonca also began as a large, disorganized monsoon circulation in the region of Chuuk State. Between 16 April and 21 April, the monsoon system only managed to drift 10 degrees longitude to the west. Finally a warning was issued by JTWC for a Tropical Depression on 20 April. WFO Guam then issued tropical storm watches for Yap, Ulithi, Fais and Ngulu, all in Yap State of the Federated States of Micronesia. The system, however, failed to intensify to tropical storm intensity until the 23rd when it was well west of the Micronesian Islands. There were no reports of deaths, injuries, nor any reports of damage.

10. **Typhoon Nesat.** Typhoon Nesat had its origins as a westward moving tropical disturbance passing through Chuuk State on 28 – 29 May. Although it appeared to consolidate quickly, the first warning by the JTWC did not come until 30 May when the Tropical Depression was approximately 300 miles southeast of Guam. It, in turn, was upgraded to a tropical storm on the 30th and a typhoon on June 1. While intensification continued to occur, Nesat managed to maintain a fairly steady course towards the west-northwest at 8 to 10 kt while steering clear of Guam to the north and the islands of the Yap State to the south. Despite issuing two special weather statements and 21 tropical cyclone advisories, WFO Guam did not issue any tropical storm or typhoon warnings or watches during this entire period. No adverse weather or significant injuries or damage were reported by any of the supported islands. This unlikely event of not issuing any warning or watches for a typhoon passing through Micronesia can be possibly attributed to several reasons including the relatively compact nature of the system, the accuracy and steadiness of the tropical cyclone forecasts, and the ability to make use of the available microwave imagery and scatterometer data to better detect the confines of the damaging winds and structure of the system.

11. **Tropical Storm Banyan.** Tropical Storm Banyan formed almost 500 miles west of the Marianas on July 21. Although no watches or warnings were issued for this cyclone for the Marianas by WFO Guam, the extensive westerly monsoon flow associated with this system extended all the way back to the Marianas. During this period, WFO Guam was kept busy providing continuous weather bulletins to local Guam officials for a 6-hour period during the annual Guam Liberation Day Parade. During the time of the parade, Guam had several periods of squalls in excess of 30 kt and continuous lightning.

12. **Typhoon Matsa.** Typhoon Matsa originated as a tropical disturbance south of the islands of Chuuk and Yap States between the 27 and 29 July. Although the first warning by the JTWC was not issued until 31 July when Matsa was already northwest of Yap, WFO Guam had earlier issued two special weather statements for heavy rain and gusty winds to the islands of Chuuk and Yap States. Rainfall and wind speeds were determined indirectly for these islands from both traditional infrared and visual satellite imagery and via special microwave imagery and scatterometer data. No injuries or damage were reported for this system.

13. **Typhoon Talim.** Typhoon Talim had its initial stages as a tropical disturbance on 22 August while forming northwest of Chuuk and moving slowly towards the Mariana Islands. While still a disturbance, the system that would soon become Typhoon Talim passed over the southern Marianas between 24 to 26 August bringing heavy rains and thunderstorms to Guam and Rota. Large westerly swells affected the Marianas after the passage and subsequent development of Talim after this period. Talim was upgraded to a tropical storm by JTWC on 27 August and to a typhoon on the following day. No watches or warnings were issued by WFO Guam although a Special Weather Statement was issued for a developing disturbance on 25 August and six Public Advisories were issued for its passage through the Micronesian waters. There were no reports of deaths, injuries, nor any reports of damage.

14. **Typhoon Nabi.** Typhoon Nabi formed east of the Marianas on 28 August and rapidly intensified from tropical depression to typhoon intensity in little over 24 hours between 29 and 30 August. Nabi passed 60 miles north of Saipan as it continued to intensify as it moved toward the west. WFO Guam issued Typhoon Warning for Saipan and Tinian and Tropical Storm Warning for Guam, Rota and Agrihan. Highest wind report for Saipan was 51 kt with gusts to 65 kt and for Guam 37 kt with gusts to 55 kt. Rainfall for Guam and Saipan ranged from 7 to 8.5 inches from 30 August to 1 September. There were no injuries of deaths with this tropical cyclone, although several roads in the CNMI and Guam were closed temporarily due to flooding.

15. **Typhoon Khanun.** Typhoon Khanun developed south of Guam within eastern Yap State between 3 and 5 September. Similar to other systems this season, intensification did not really begin until Khanun was well west of the Micronesian Islands. Although no warnings or watches were issued by WFO Guam, several special weather statements and advisories were issued during the initial stages of development for periods of heavy rain and gusty winds to several islands of Yap State. No significant damage or injuries were reported with this system

II. RSMC HONOLULU/WFO HONOLULU, Central Pacific

E. Typhoon/Severe Weather Events that Impacted TC Members

Severe Weather Event in Hawaii. Thunderstorms and severe weather accompanied a strong cold front as it moved across the state of Hawaii on January 8-9, 2005. Winds over 65 mph, hail, a waterspout, and a tornado were reported near and on Kauai. Winds gusted as high as 63 mph were reported on Oahu. The strong winds downed trees and power lines and spectacular lightning displays lit up the skies across the two islands. WFO Honolulu issued two severe thunderstorm watches, five severe thunderstorm warnings and nine special marine warnings. All five severe thunderstorm warnings verified with an average lead time of 20 minutes.

In **Viet Nam,**

The tropical storms and depressions that affected Viet Nam in 2005 are summarized in the table below

Name	Duration	Max wind at landfall (m/s)	Place of landfall
TC No. 1 ROKE 0502	7-18 Mar	-	Off shore near Ninh Thuan Binh Thuan
TC No. 2 WASHI (0508)	28 Jul - 1 Aug	24, gust 30	Thai Binh – Nam Dinh
TC No. 3 NONAME	9 - 12 Aug	18, gust 21	Thanh Hoa
TC No. 5 NONAME	27 - 31 Aug	12, gust 15	Nghe An
TC No. 6 VINCENT (0516)	12 - 18 Sep	22, gust 25	Nghe An
TC No. 7 DAMREY (0518)	22 - 27 Sep	33, gust 39	Thanh Hoa
TD No. 8 NONAME	6 - 7 Oct		Quang Nam – Da Nang
TC No. 8 KAITAK (0521)	28 Oct - 2 Nov	23, gust 30	Off shore Thanh Hoa-Nghe An

APPENDIX XIII

SUMMARY OF THE 2005 TYPHOON SEASON

As of 30 September, nineteen tropical cyclones of tropical storm (TS) intensity or higher formed in the western North Pacific and the South China Sea in 2005. The total number almost equals the 30-year average* frequency of 19.2 by the end of September. Eleven cyclones out of them (58% of the total) reached typhoon (TY) intensity. Five out of the remainder attained severe tropical storm (STS) intensity and the others reached only TS intensity (see Table 1).

Table 1 List of tropical cyclones which attained TS intensity or higher in 2005

Tropical Cyclone			Duration					Minimum Central Pressure				Max Wind
			(UTC)			(UTC)		(UTC)	(N)	(E)	(hPa)	(kt)
STS	KULAP	(0501)	151200	Jan	−	190600	Jan	171200	15.7	149.6	985	50
STS	ROKE	(0502)	150000	Mar	−	171200	Mar	160600	11.7	128.9	980	55
TY	SONCA	(0503)	230000	Apr	−	271200	Apr	241200	14.5	130.8	935	90
TY	NESAT	(0504)	311200	May	−	110000	Jun	040000	14.6	131.4	930	95
TY	HAITANG	(0505)	130000	Jul	−	200600	Jul	160600	20.3	129.1	920	105
TS	NALGAE	(0506)	201200	Jul	−	241200	Jul	220600	30.6	158.7	990	45
STS	BANYAN	(0507)	211800	Jul	−	280000	Jul	231800	21.2	137.5	975	55
TS	WASHI	(0508)	291200	Jul	−	311800	Jul	291800	19.1	110.9	985	45
TY	MATSA	(0509)	311200	Jul	−	071200	Aug	041800	25.2	123.7	950	80
STS	SANVU	(0510)	110600	Aug	−	131800	Aug	121800	21.5	117.7	985	50
TY	MAWAR	(0511)	191800	Aug	−	280000	Aug	211800	22.9	139.8	930	95
STS	GUCHOL	(0512)	210600	Aug	−	251200	Aug	220600	28.2	146.7	980	55
TY	TALIM	(0513)	270000	Aug	−	020600	Sep	291800	21.2	130.6	925	95
TY	NABI	(0514)	291200	Aug	−	080600	Sep	020600	19.6	136.8	925	95
TY	KHANUN	(0515)	070000	Sep	−	130000	Sep	100900	24.5	124.9	945	85
TS	VICENTE	(0516)	161200	Sep	−	181800	Sep	180000	17.2	108.5	985	45
TY	SAOLA	(0517)	201800	Sep	−	261200	Sep	230600	27.6	139.2	950	80
TY	DAMREY	(0518)	210000	Sep	−	271800	Sep	250600	19.1	112.4	955	80
TY	LONGWANG	(0519)	260000	Sep	−	030000	Oct	010000	22.5	126.9	930	95

The tropical cyclone season of this year began in mid January with the formation of Kulap(0501). Roke(0502) is a named cyclone which formed in March since Lewis (9303). From April to May, two named cyclones formed around active convection area over the sea far east of the Philippines.

In June, no named cyclone formed (1.7 for the 30-year average*). Figure 1 shows low-level convergence between southwesterly wind in the South China Sea and easterly wind in the western North Pacific was found just over the Philippines in June.

Since July, low-level wind cyclonic circulations were found from the South China Sea to the sea east of the Philippines (shown by Figure 1). Many cyclones formed around low-level wind cyclonic circulations. Five named cyclones formed every month from July to September (4.1, 5.5 and 5.1 for the 30-year average* in July, August and

September, respectively). Nine out of fifteen cyclones, which formed from July to September, took west to northwestward track without recurving and made landfall on the continent or Taiwan. Among them, Talim (0513) which made landfall on China in early September brought serious damage to the country. Damrey (0518) which took westward track in the South China Sea and made landfall on Viet Nam in late September brought great damage to China, Laos, Viet Nam, Philippines and Thailand. On the other hand, Nabi (0514) took slow northward track in the Nansei Islands and damaged Japan and Republic of Korea severely.

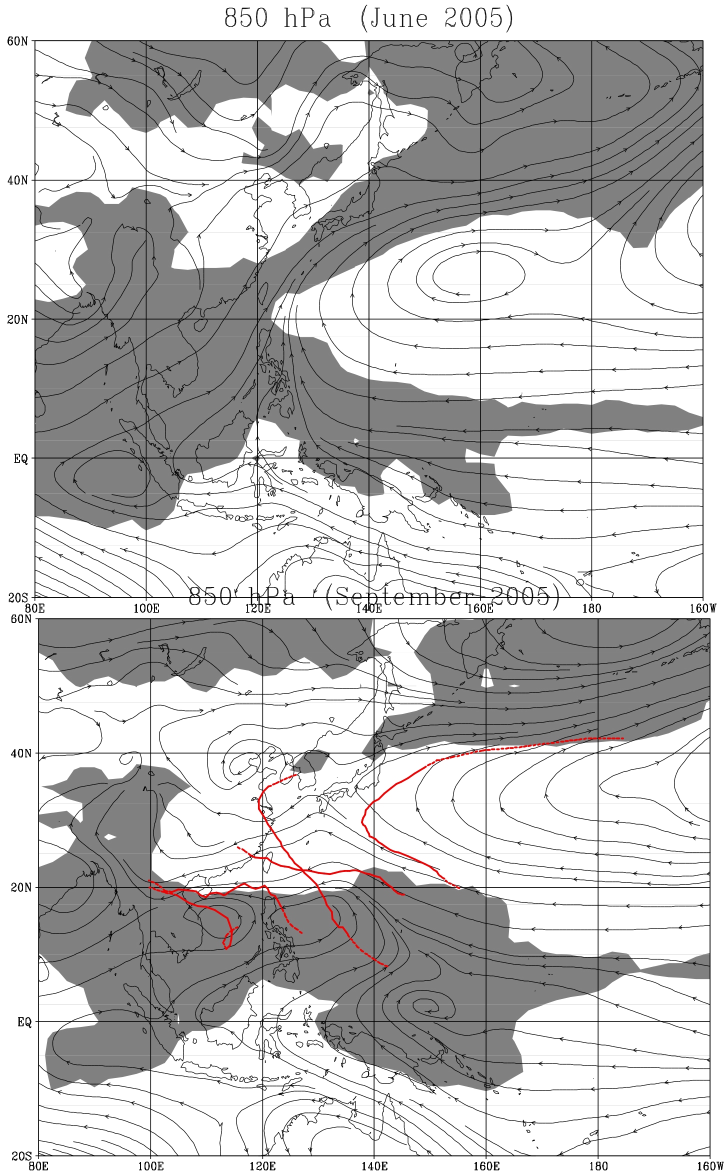

Figure 1 Monthly mean streamline at 850 hPa (lines with arrows) and area of less than 230 w/m^2 of OLR (shaded) in June and September 2005. Tracks of TCs formed in September are superimposed (red lines)

In 2005 (as of 30 September), the mean formation latitude** of 16.5ºN was almost the same as the 30-year average* of 16.2ºN, while the mean formation longitude** of 138.5ºE was to the east of the 30-year average* of 136.9ºE. Two and seventeen named cyclones formed west and east of 120ºE, respectively (3.3 and 14.6 for the 30-year average* by the end of September).

*30-year average from 1971 to 2000

**Mean formation latitude (longitude) here is defined as arithmetic average of latitudes (longitudes) of formation points of all the tropical cyclones of TS intensity or higher in the year.

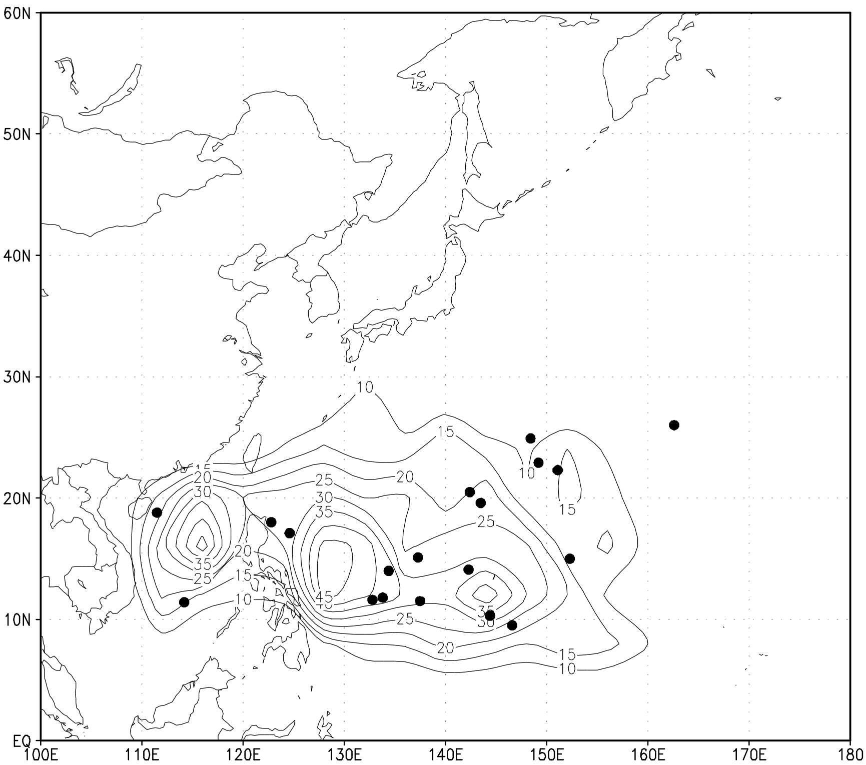

Figure 2 Genesis points of 19 TCs generated from January to September 2005 (dots) and frequency distribution of genesis points for 1951-2004 (lines).

Narrative Accounts of Tropical Cyclones in 2005

KULAP (0501)

Kulap formed as a tropical depression (TD) over the sea west of Truk Island at 00UTC, 14 January 2005. Moving northward, it developed into a tropical storm (TS) over the sea south of Guam at 12UTC, 15 January. Turning gradually to the northeast over the sea east of Guam, it attained the peak strength with the maximum sustained wind of 50kt and central pressure of 985hPa, and was upgraded to the Severe Tropical Storm (STS) intensity east of the Mariana Islands at 12UTC, 17 January. Keeping the track to the northeast, it was downgraded to the TS intensity and then transformed into an extratropical cyclone over the sea south of Minamitorishima Island at 18UTC, 18 January, 06UTC, 19 January respectively. It dissipated over the same waters at 18UTC, 19 January.

ROKE (0502)

Roke formed as a tropical depression (TD) around Truck Island at 00UTC on 12 March 2005. It moved west-northwestward, and developed into a tropical storm (TS) far east of the Philippines at 00UTC, 15 March. Moving westward, it was upgraded to the Severe Tropical Storm (STS) intensity, and then reached the peak intensity with maximum sustained wind of 55kt and central pressure of 980hPa over the waters east of the Philippines at 00UTC and 06UTC, 16 March, respectively. Crossing the Philippines, it was downgraded to the TS intensity at 18UTC, 16 March and then weakened into a TD at 12UTC, 17 March. Keeping the track to the west, Roke dissipated in the South China Sea at 12UTC, 19 March.

SONCA (0503)

Sonca formed as a tropical depression (TD) around the Caroline Islands at 06UTC on 21 April and moved west-northwestward. Continuing on the west to the west-northwestward track, it became a tropical storm (TS) over the sea east of the Philippines at 00UTC on 23 April. Then turning gradually to the north, it developed quickly into the typhoon (TY) intensity at 18UTC, 23 April. It reached the peak strength with maximum sustained wind of 90kt and central pressure of 935hPa over the same waters at 12UTC on 24 April. After recurvature, Sonca accelerated toward the east-northeast and quickly weakened into an extratropical cyclone east-northeast of Chichijima Island at 12UTC on 27 April. Then it turned to the east and dissipated north of Wake Island at 12UTC, 29 April.

NESAT (0504)

Nesat formed as a tropical depression (TD) around the Caroline Islands at

00UTC, 30 May and moved west-northwestward. It reached the tropical storm (TS) intensity south of Guam at 12UTC, 31 May. Then it developed quickly into the typhoon (TY) intensity over the sea southwest of Guam at 12UTC, 1 June. Nesat gradually turned to the northwest on 3 June and reached its peak intensity with maximum sustained wind of 95 kt east of the Philippines at 00UTC on the next day. After the recurvature, it moved northeastward with slight meander. After passing south of Hachijojima Island, it weakened into a TD over the sea east of Japan at 00UTC, 11 June and dissipated at 12UTC on the same day.

HAITANG (0505)

HAITANG formed as a tropical depression (TD) over the sea south of Minamitorishima Island at 18UTC on 10 July 2005. It moved westward, and developed into a tropical storm (TS) west of Minamitorishima Island at 00UTC, 13 July. Moving to the west-southwest, it developed quickly to the typhoon (TY) intensity north of the Mariana Islands at 18UTC, the same day. Turning westward and then west-northwestward, HAITANG reached the peak intensity with maximum sustained wind of 105kt and central pressure of 920hPa over the waters south of Okinawa Island at 06UTC, 16 July. After it moved northwestwards over the sea south of Ishigaki Island on 17 July, it turned in the counterclockwise direction off the eastern coast of Taiwan. Haitang turned toward the northwest, crossed Taiwan on 18 July, and then made landfall on Fujian, China on 19 July. It weakened into a TD and dissipated in the central China at 06UTC, 20 July and 18UTC, 21 July, respectively.

NALGAE (0506)

Nalgae formed as a tropical depression (TD) northeast of Wake Island at 00UTC on 18 July 2005. It moved northwestward, and developed into a tropical storm (TS) over the sea east of Minamitorishima Island at 12UTC, 20 July. During its recurvature, it reached the peak intensity with maximum sustained wind of 45kt and central pressure of 990hPa over the waters northeast of Minamitorishima Island at 06UTC, 22 July. Moving to the northeast it weakened slightly and transformed into an extratropical cyclone over the waters far east of Japan at 12UTC, 24 July. It turned to the north and dissipated over the same waters at 00UTC, 28 July.

BANYAN (0507)

Banyan formed as a tropical depression (TD) over the sea far east of the Philippines at 12UTC on 20 July 2005. Moving northward, it developed into a tropical storm (TS) over the same waters at 18UTC, 21 July. Keeping the track to the north, it was upgraded to the severe tropical storm (STS) intensity and reached the peak intensity with maximum sustained wind of 55kt and central pressure of 975hPa over the waters east of Okinotorishima Island at 12UTC and 18UTC, 23 July, respectively. From 24 to 25 July, it moved northward with weakening the intensity slowly. After it turned northeastward south of Japan, Banyan made landfall on Honshu after 11UTC, 26 July. Keeping the northeast track, it transformed into an extratropical cyclone around the Kurile Islands at 00UTC, 28 July. It turned gradually toward the east and crossed the International Date Line around the Aleutian Islands before 06UTC, 31 July.

WASHI (0508)

Washi formed as a tropical depression (TD) in the South China Sea at 18UTC on 28 July 2005. Moving westward, it developed into a tropical storm (TS) east of Hainan Island at 12UTC on the next day. Keeping the westward track, it reached the peak intensity with maximum sustained wind of 45kt and central pressure of 985hPa at 00UTC, 30 July. It moved westward in the Gulf of Tongking and then made landfall on Viet Nam on 31 July. Washi weakened into a TD and dissipated around boundary of Laos and Viet Nam at 18UTC, 31 July and 00UTC 1 August.

MATSA (0509)

Matsa formed as a tropical depression (TD) over the sea south of Yap Island at 12UTC on 30 July 2005. Moving northwestward, it developed into a tropical storm (TS) far east of the Philippines at 12UTC, 31 July. It moved to the northwest, and was upgraded to the typhoon (TY) intensity over the waters east of the Philippines at 12UTC, 2 August. Keeping the northwest track, it passed Ishigakijima Island before 11UTC, 4 August. Soon after it entered the East China Sea, it reached the peak intensity with maximum sustained wind of 80kt and central pressure of 950hPa at 18UTC on the same day. Moving to the northwest, Matsa made landfall on the central China and then was downgraded to the severe tropical storm (STS) intensity at 00UTC, 6 August. After it turned abruptly toward the north, it weakened into a TD north of Nanjin at 12UTC, 7 August. It transformed into an extratropical cyclone around Shandong Peninsula at 06UTC, 8 August and then turned toward the northeast. Matsa passed the Bohai and then dissipated around Liaodong Peninsula at 12UTC, 9 August.

SANVU (0510)

SANVU formed as a tropical depression (TD) over the waters east of the Philippines at 18UTC on 9 August 2005. Moving to the west-northwest, it developed into a tropical storm (TS) over the same waters at 06UTC, 11 August. Keeping the west-northwestward track, it approached the northern part of Luzon Island after 12UTC on the same day. Turning gradually to the northwest, it was upgraded to the severe tropical storm (STS) intensity and reached the peak intensity with maximum sustained wind of 50kt and central pressure of 985hPa in the South China Sea at 12UTC and

18UTC on the next day. SANVU made landfall on the southern China after 00UTC, 13 August. Moving to the northwest, it was downgraded to the TS intensity and then weakened into TD in the southern China at 12UTC and 18UTC on the same day. It dissipated in the central China at 00UTC, 15 August.

MAWAR (0511)

Mawar formed as a tropical depression (TD) over the waters northwest of the Mariana Islands at 06UTC on 19 August 2005. Moving westward, it developed into a tropical storm (TS) over the same waters at 18UTC, 19 August. Turning to the northwest, it was upgraded to the typhoon (TY) intensity over the same waters at 00UTC, 21 August and then reached the peak intensity with maximum sustained wind of 95kt and central pressure of 930hPa at 18UTC on the same day. After it recurved south of Honshu on 24 August, it made landfall on Honshu with the TY intensity after 19UTC, 25 August. Soon after Mawar entered the Pacific again, it was downgraded to the TS intensity at 06UTC, 26 August. Moving to the east, it transformed into an extratropical cyclone over the same waters at 00UTC, 28 August. It turned abruptly to the north and then to the east again, and dissipated over the waters east of Japan at 06UTC, 1 September.

GUCHOL (0512)

Guchol formed as a tropical depression (TD) south of Minamitorishima Island at 18UTC, 18 August 2005. Moving to the west-northwest, it developed into a tropical storm (TS) at 06UTC, 21 August. Turning to the north, it was upgraded to the severe tropical storm (STS) intensity and reached the peak intensity with maximum sustained wind of 55kt and central pressure of 980hPa over the sea east of Chichijima Island at 00UTC and 06UTC on the next day, respectively. After recurvature on late 22 August, it moved northeastward east of Japan keeping the intensity. Guchol transformed into an extratropical cyclone over the waters east of the Kurile Islands at 12UTC, 25 August. It dissipated over the same waters at 06UTC, 27 August.

TALIM (0513)

Talim formed as a tropical depression (TD) south of Guam at 18UTC on 25 August 2005. Moving to the west and then to the north-northwest, it developed into a tropical storm (TS) west of Guam at 00UTC, 27 August. Turning to the west-northwest, it developed into a typhoon (TY) far east of the Philippines at 06UTC, 28 August and reached the peak intensity with maximum sustained wind of 95kt and central pressure of 925hPa over the waters southeast of Okinawa at 18UTC on the next day. With almost the peak intensity, it passed south of Yonagunijima Island and then made landfall on Taiwan on late 31 August. Moving to the west-northwest, Talim entered the Taiwan

Strait and then made landfall on the southern China on 1 September. It weakened into a TD at 06UTC, 2 September and dissipated in the central China at 00UTC on the next day.

NABI (0514)

Nabi formed as a tropical depression (TD) east of the Mariana Islands at 00UTC on 29 August 2005. Moving to the west, it developed into a tropical storm (TS) over the same waters at 12UTC, 29 August. Turning to the west-northwest, it developed into a typhoon (TY) around the Mariana Islands at 18UTC, 30 August and reached the peak intensity with maximum sustained wind of 95kt and central pressure of 925hPa far east of the Philippines at 06UTC, 2 September. Turning toward the north, it passed slowly around Minamidaitojima Island and Yakushima Island, and then made landfall on Kyushu with the TY intensity after 05UTC, 6 September. It moved northeastward in the Japan Sea and made landfall on Hokkaido on the next day. Turning to the east, Nabi transformed into an extratropical cyclone in the Sea of Okhotsk at 06UTC, 8 September and dissipated south of the Aleutian Islands at 00UTC, 10 September.

KHANUN (0515)

Khanun formed as a tropical depression (TD) over the waters east of Yap Island at 00UTC, 5 September 2005. It moved northwestward and developed into a tropical storm (TS) over the waters far east of the Philippines at 00UTC, 7 September. Moving to the northwest, it was upgraded into the typhoon (TY) intensity over the same waters at 18UTC on the next day. Keeping the track to the northwest, Khanun approached Miyakojima Island and reached the peak intensity with maximum sustained wind of 85kt and central pressure of 945hPa at 09UTC, 10 September. After it made landfall on China with the TY intensity on 11 September, it recurved with weakening the intensity in China. It transformed into an extratropical cyclone and dissipated in the Yellow Sea at 00UTC and 18UTC, 13 September, respectively.

VICENTE (0516)

Vicente formed as a tropical depression (TD) in the South China Sea at 06UTC, 15 September 2005. Moving to the southwest and then turing in anticlockwise direction, it developed into a tropical storm (TS) over the same waters at 12UTC, 16 September. Then it turned to the west-northwest and attained the peak intensity with maximum sustained wind of 45kt and central pressure of 985hPa over the same waters at 00UTC, 18 September. Vicente made landfall on Viet Nam on the same day, and weakened into a TD around the boundary between Laos and Thailand at 18UTC, 18 September. It crossed the 100°E longitudes at 00UTC on the next day.

SAOLA (0517)

Saola formed as a tropical depression (TD) over the sea northeast of the Mariana Islands at 00UTC, 19 September 2005. It moved to the west-northwest and developed into a tropical storm (TS) over the same waters at 18UTC on the next day. Keeping the west-northwesterly track, it was upgraded into the typhoon (TY) intensity north of the Mariana Islands at 00UTC, 22 September. After it passed south of Minamiiwojima Island, it reached the peak intensity with maximum sustained wind of 80kt and central pressure of 950hPa northwest of Iwojima Island at 06UTC on the next day. After recurvature south of Honshu, Saloa approached Hachijojima Island with the TY intensity before 00UTC, 25 September. Turning to the east, it transformed into an extratropical cyclone over the sea east of Japan at 12UTC, 26 September and crossed the international date line at 00UTC, 28 September.

DAMREY (0518)

Damrey formed as a tropical depression (TD) east of the Philippines at 06UTC, 19 September 2005. Moving to the northwest, it developed into a tropical storm (TS) off the northeastern coast of Luzon Island at 00UTC, 21 September. Turning to the west, it passed the Luzon Strait and entered the South China Sea. Keeping the westward track, Damrey was upgraded into the typhoon (TY) intensity and reached the peak intensity with maximum sustained wind of 80kt and central pressure of 955hPa in the South China Sea at 12UTC, 24 September and 06UTC, 25 September, respectively. After its landfall on Hainan Island with the TY intensity on 26 September, it landed again on Viet Nam with the severe tropical storm (STS) intensity on the next day. It weakened into a TD and crossed the 100°E longitudes at 18UTC, 27 September and 06UTC, 28 September, respectively.

LONGWANG (0519)

Longwang formed as a tropical depression (TD) over the waters west of the Mariana Islands at 06UTC, 25 September 2005. Moving to the west, it developed into a tropical storm (TS) over the same waters at 00UTC, 26 September. It moved west-northwestwards and was upgraded into the typhoon (TY) intensity south of Iwojima Island at 00UTC on the next day. It turned to the west and reached the peak intensity with maximum sustained wind of 95kt and central pressure of 930hPa south of Okinawa Island at 00UTC, 1 October and then made landfall on Taiwan with the TY intensity on the same day. Keeping the westward track and weakening the intensity, it passed the Taiwan Strait and made landfall again on southern China on 2 October. It turned to the northwest and then weakened into a TD in the southern China at 00UTC, 3 October. It dissipated in the same area 12 hours later.

APPENDIX XVI

UPDATED RCPIP FOR 2005 - 2010

1. **METEOROLOGY. Broad Goal.** To produce and communicate accurate, timely, and informative guidance, forecasts, and warnings to mitigate the devastating impacts of tropical cyclones. These can be achieved through the use of the latest observational and forecasting technology, facilitating the sharing of data/latest information in accordance with WMO Resolution 40 of Congress 12, and effective communications methods.

1.1 Objective 1: *To enhance in-situ and remote meteorological observing and communications systems to improve tropical cyclone forecasting through collaboration and coordination among Members.*		
Action	**Target Dates**	**Success**
1.1.1 Improve observations of tropical cyclone position and structure including rain bands and outer and inner wind structures through in-situ and remote meteorological observing systems, such as satellite, radar, and aircraft observations.	2005	All Members will meet 75% of their identified requirements for data and 50% of neighboring Members requirements.
1.1.2 Upgrade facilities to receive and process MTSAT and/or FY satellite data.	2005	Through assistance among Members, all interested Members will have operational satellite receiving systems for MTSAT and/or FY.
1.1.3 Exchange information and methods on the effective use of in situ and remotely sensed data from satellite and ground-based observations (e.g., microwave sounders and imagers, Doppler radars).	2005	Each Member will have one documented cases on the effective use of in situ and/or remotely sensed data obtained through exchanged of information or methods.
1.1.4 Improve network communications to guarantee accessibility of meteorological data and products for all forecast centers.	2005	Three documented significant network communications improvements within the region.
1.1.5 Develop tools and techniques to combine the most useful observational and model data to aid the forecaster in real-time analysis and forecasting of tropical cyclone structure and intensity.	2006	Three documented new tools and/or techniques on the combined use of observational and model data within the region.
1.1.6 Establish and train human weather spotter networks to report significant rainfall, flooding, storm surge and high surf and exchange data with other Members.	2005	Interested Members will establish one new network of trained human observers and exchange these data with at least one other Member.
1.2 Objective 2: *To develop, obtain, and effectively use current and new tropical cyclone numerical forecast guidance.*		
Action	**Target Dates**	**Success**
1.2.1 Improve the Typhoon Model output and to provide additional tropical cyclone forecasting guidance to Members by RSMC Tokyo.	2007	RSMC Tokyo/JMA will provide additional tropical cyclone forecasting guidance products to Members in consideration of efficiency and reliability of the products.

1.2.2 Identify regional tropical cyclone forecasting guidance requirements.	2004	All Members provide their prioritized requirements to RSMC Tokyo. Discuss requirements and establish prioritized regional requirements.
1.2.3 Consider Members identified requirements, and if possible implement, by RSMC Tokyo.	2005	RSMC Tokyo will implement regional requirements when they are prepared from both technical and administrative aspects.
1.2.4 Provide gust forecast guidance out to 72 hours by RSMC Tokyo.	2005	Guidance will include 72 hour gust forecast.
1.2.5 Establish web site for dissemination and exchange of numerical model information.	2004	RSMC Tokyo will establish web site and make accessible to all.
1.2.6 Utilize consensus/ensemble/ multi-model super-ensemble forecasting techniques to improve tropical cyclone track predictions. These products should be made available to all Tropical Cyclone Warning Centers. Training should be provided on how to apply these techniques in an operating setting.	2005 Use of ensembles 2006 Available to all centers 2007 Training provided.	All tropical cyclone centers reduce their track error by 12% and intensity error by 5%.
1.2.7 Establish storm surge forecast and warning techniques and models, including river flooding and wave action. Conduct vulnerability assessments for all countries threatened by storm surge.	2007	All Members affected by storm surge will use a local storm surge model or will have access to another Member's output for their area.
1.2.8 Exchange information through Internet on the validation of model in terms of size, asymmetries, rainfall, etc.	2005	All Members will receive model validation and verification information.
1.3 Objective 3: *To improve meteorological forecasts and warnings accuracy, false alarm rates, and lead time, plus improve risk assessments of tropical cyclone impacts.*		
Action	**Target Dates**	**Success**
1.3.1 Utilize the newest techniques to improve tropical cyclone forecasting.	2006	All Members will improve track, intensity, storm surge, and/or rainfall forecasts, as appropriate, by 10% through introduction of new techniques.
1.3.2 Establish standard verification rules for track and intensity forecasts, particularly for model outputs, and exchange of the scores through Internet.	2005	A working group will develop with Members involved standard verification rules and submit to Typhoon Committee for approval.
1.3.2 Develop efficient, effective dissemination methods for advanced forecasts and analysis to the developing Members and their populations.	2005	All developing Members' NMHSs will receive guidance and have developed plans to get forecasts to all of the public.

1.4 Other Important Objectives to Consider.

1.4.1 Update Typhoon Committee Operational Manual published primarily as a Web version, with limited hard copy and a CD ROM version.

1.4.2 Enhance the Typhoon Committee web site by posting operational studies, forecasting rules, and other relevant material.

1.4.3 Actively share all official tropical cyclone forecasts and warnings with other Members, media, public, and other agencies through actively contributing towards WMO pilot website on Severe Weather/Tropical Cyclones.

1.4.4 Identify relevant tropical cyclone analysis and forecasting publications and their sources and distribute to the Members.

TRAINING. Broad Goal. To enhance capacity building for all Members through identification of operational tropical cyclone training needs and then achieve through collaboration the development and presentation of workshops, seminars, co-sponsored training courses, and computer-based and Internet-based courses to fulfill these needs.

1.5 Objective 1: *To facilitate the transfer of the latest forecasting and analysis techniques among Members.*		
Action	**Target Dates**	**Success**
1.5.1 Exchange of experts and fellowships programme under Typhoon Committee Research Fellowship Scheme.	2006	Each interested Member will have at least one exchange of experts or fellowship.
1.5.2 Exchange of typhoon forecasters among the Members.	2006	Each interested Member will either host or send an exchange forecaster.
1.5.3 Attachment of two forecasters to RSMC Tokyo.	2006	Each interested Member will have at least two forecasters attached to RSMC Tokyo.
1.5.4 Hold and attend annual workshops on South China Sea Storm Surge, Wave, and Circulation Forecasting.	2006	Each participating Member will have at least two participants attend the workshop series.
1.5.5 Hold and attend international seminar on MTSAT/LRIT and FY data utilization.	2004	Each participating Member will have at least one participant attend the seminar.
1.5.6 Hold and attend workshops/seminars on how to use new observation data and model products, such as the technique of detecting tropical cyclones using Doppler radar, satellite, consensus or ensemble forecast and Dvorak techniques and typhoon bogussing in operation model.	2005	Each participating Member will have at least one participant attend each seminar and workshop.
1.5.7 Attend USA National Hurricane Center training course on tropical cyclone.	2006	Each participating Member will have at least one participant attend the training.
1.5.8 Research the availability of computer-based and Internet-based tropical cyclone training materials and publish sources.	2004 and update yearly.	List will be prepared and disseminated.
1.6 Objective 2: *To facilitate group training courses in meteorology, hydrology, and disaster prevention and preparedness to improve forecasts and warnings.*		
Action	**Target Dates**	**Success**
1.6.1 Attend training course on Weather Forecasting for Operational Meteorologists in the Asian Pacific Region.	Annually through 2006	Highest priority Members requiring the training will have at least one participant attend the training.

1.6.2 Attend training course on Meteorology, River and Dam Engineering, and Disaster Mitigation and Restoration System for Infrastructure.	Annually through 2006	Highest priority Members requiring the training will have at least one participant attend the training.
1.6.3 Conduct training and roving seminars to effectively build capacity of Members.	Annually through 2007	Highest priority Members requiring the training for capacity building will have at least seminar in their area.
1.7 Objective 3: *To develop, organize, and conduct meteorological and hydrology training courses to meet Members requirements.*		
Action	**Target Dates**	**Success**
1.7.1 Prepare a list of training requirements for meteorology and hydrology and circulate among members (see attached recommended list, not in priority order).	2004	Finalized list distributed to all Members.
1.7.2 Determine sources of the required training.	2006	Completion of at least one high priority training course annually from finalized list.

1.8 Other Important Objectives to Consider.

1.8.1 To increase the availability and sharing to all Members of current and new training materials developed by Members especially via the Internet.

RESEARCH. Broad Goal. To effectively collaborate among Members on research activities applicable to more than one Member and to facilitate the transfer of technology and relevant research to all Members and into operational use.

1.9 Objective 1: *To increase the knowledge and understanding of tropical cyclones through observational programmes to improve tropical cyclone forecasting.*		
Action	**Target Dates**	**Success**
1.9.1 Organize an International Intensive Observing Experiment.	Before 2006	Completion of experiment.
1.9.2 Use the International Intensive Observing Experiment data set in numerical modeling of tropical cyclones. Improved boundary layer representation for coupled air/sea/land models by, for example, exploiting results from field experiments/projects (e.g., improved parameterization of surface fluxes in high wind regimes and effects of seas spray on transfer coefficients).	2006	Demonstrate and present an improvement in tropical cyclone forecasting in regional workshop/seminar for all Members.
1.9.3 Conduct additional research into use of current and future remote sensing data.	Continuing through 2006	Incorporation of additional remote sensing data with demonstrable improvement in tropical cyclone forecasting accuracy.
1.10 Objective 2: *To improve techniques for tropical cyclone track, intensity, storm surge, destructive winds, rainfall, and flood forecasting.*		

Action	Target Dates	Success
1.10.1 Improve Dvorak technique for the diagnosis of position and intensity of a tropical cyclone, toward an objective technique blending with microwave imagery, which should be operationally feasible for application.	2006	Operationally implement an objective method to determine position and intensity available to all Members.
1.10.2 Improve utilization of multi-model ensemble through the application of systematic approach with interactive tools for track forecasting for the extended period beyond 48 hours. Enhance methods for identification and reduction of the occurrence of guidance and official track outliers, focusing on both large speed errors (e.g., accelerating "re-curvers" and stalling storms) and large direction errors (e.g., loops and unusual tropical cyclone tracks).	2007	Reduce track error by 12% and intensity error by 5%.
1.10.3 Improve operational procedures based on the latest findings associated with vertical shear, interaction with upper level trough, multi-scale interaction with convective systems, air-sea interaction, etc. for intensity forecasting	2007	Reduce intensity error by 5%.
1.10.4 Establish and publish an operational definition of formation and extra-tropical transition.	2004	Coordinate, establish, and publish in Typhoon Committee Operations Manual – Meteorology Component.
1.10.5 Continue to explore statistical models for the prediction of intensity along with the dynamical approach.	2006	Publish results of statistical intensity models research and comparisons with dynamic models
1.10.6 Investigate the intensity problem including (1) the prediction of heavy rainfall and other weather hazards associated with interaction between monsoon system and a tropical cyclone, based on the interpretation of numerical model output and latest observations available and (2) short-range forecasting of track and intensity for land falling tropical cyclone.	2007	Improve operational intensity forecasts by 5%.
1.10.7 Evaluate and improve skills of numerical models in forecasting tropical cyclone formation and intensity changes. Use model validation techniques suitable for 3D high resolution verification for tropical cyclones in the process of extra-tropical transition or land-falling. Also include quality control of wind and rainfall evaluated from the microwave channel dataset (both from satellite and radar), and its climatology to construct conceptual models and validation of numerical models.	2007	Improve operational forecasts by 12% and intensity forecasts by 5%.

1.10.8 Investigate data assimilation of retrieved wind and rainfall from satellite, radar, and aircraft winds for the dynamical prediction of intensity in conjunction with the initialization of tropical cyclone vortex for numerical models	Continuing through 2006	Incorporation of additional remote sensing data with demonstrable improvement in tropical cyclone forecasting accuracy.
1.10.9 Understand the structural change of tropical cyclone using a very high-resolution model (1 km) simulating multi-scale interaction with convective clouds. The interface of atmospheric model with hydrological process and ocean waves and tides need to be further developed. The model inter-comparison is encouraged to stimulate the research.	Continuing through 2007	Improve operational track forecasts by 12% and intensity forecasts by 5%.
1.10.10 Develop improved storm surge guidance models, including guidance on breaking waves and featuring high resolution input and output.	Continuing through 2007	Improve storm surge forecasts by 10%
1.11 Objective 3: *To facilitate the exchange of research results among Members.*		
Action	**Target Dates**	**Success**
1.11.1 Conduct exchange of meteorological experts among Members through the Typhoon Committee Research Fellowship Scheme.	2006	At least 2 by 2006 with the completion of one research paper per exchange.
1.11.2 Disseminate research results and case studies via Internet.	2004 and updated annually	Complete central web site to host research results
1.11.3 Organize workshops on typhoon forecasting research every two years.	2005	At least 2 forecasters from each Member participating.

1.12 Other Important Objectives to Consider.

1.12.1 Study the relationship between ENSO and tropical cyclone activity, formation, timing and impacts. The seasonal prediction of tropical cyclone development in terms of probability and frequency using individual members of the multi-model ensemble prediction data.
1.12.2 Explore the visualization of probability distribution function for track and intensity utilizing the output from the ensemble prediction system.
1.12.3 Quantitatively assess the impact study and development of comprehensive risk management for the mitigation of socio-economic loss from tropical cyclone.
1.12.4 Develop an expanded Best Track database to include storm surge, rainfall, and maximum winds.
1.12.5 Integrate track/intensity forecasts with GIS of inundated areas which are very beneficial for hydrological authorities and DPP management officials.
1.12.6 Attachment - List of Training Requirements (Not in Priority Order)

1. Use of Doppler and non-Doppler radar data in real-time analysis and forecasting of tropical cyclone intensity and structure.
2. Use and Interpretation of ensemble forecast and consensus forecasting technique in operational forecasting. Development of guidelines for the use of multi-model tracks and intensities including systematic approach considering the error mechanism of dynamical models.

3. Use of satellite data in real-time analysis and forecasting of tropical cyclone intensity and structure and use of microwave channel information.
4. 3D/4D data assimilation techniques for numerical prediction of severe weather.
5. Radar and display processing systems maintenance training.
6. Waves and Storm Surge Prediction and Modeling.
7. Severe Weather Forecasting Techniques and Warning Strategies.
8. Intensity Forecasting of Typhoons (guidance and public forecasts such as minimum surface pressure, maximum wind speed, radius of 30 and 50 knots of typhoon).
9. Typhoon Bogussing in Operation Model.
10. Objective Dvorak techniques.
11. Forecast procedures for formation and extra-tropical transition of tropical cyclone.
12. Interpretation and error correction of QuikScat wind
13. Conceptual model and operational procedures for intensity forecasting including wind and rainfall associated with TC including landfall, considering the latest understanding on the interaction of TC with vertical shear, upper troughs, meso-scale convective systems, and air sea interaction.
14. Training in the various techniques, statistical and dynamical for identifying the different stages of tropical storm formation, intensity and movement.
15. Numerical modeling of tropical storms and the possibility of sharing of computer codes.

2. **HYDROLOGY. Broad Goal.** To produce, disseminate, and share accurate and timely flood-related forecasts and warnings; assessments of the disaster risk; and hydrological data in accordance with WMO Resolution 20 of Congress 13 to assist in mitigating the negative impacts and enhance the beneficial effects of tropical cyclones.

2.1 Objective 1*: To improve real-time meteorological/hydrological networks and exchange of data among Members.*		
Action	**Target Dates**	**Success**
2.1.1 Establish pilot project for data sharing between TC Members to enhance flood forecasting accuracy.	2005	Two regional pilot projects on data sharing completed and information disseminated to all Members.
2.1.2 Evaluate and improve hydrological instruments and telecommunications equipment.	2006	Three documented improvements to hydrological instruments and telecommunications equipment and shared with all Members
2.1.3 Develop and implement plans which include each Member's meteorological/ hydrological data requirements from other Members and methods to receive these required data.	2004 Develop Plan 2006 Implement Plan	Interested Members will complete and implement plan through bilateral or multilateral cooperation or agreements.
2.1.4 Exchange experts and information to provide technical guidance on methods to evaluate and improve real-time meteorological/hydrological data collection networks.	2004	All Members will meet 75% of their identified goal in the improvement of real-time data collection networks.
2.2 Objective 2*: To extend and improve flood-related forecasts and warnings for, plus assessments of disaster risks from tropical cyclones.*		

Action	Target Dates	Success
2.2.1 Implement on-the-job training on flood forecasting between TC members.	2007	All Members have participated in the on-the-job training either as a provider or receiver.
2.2.2 Extend flood forecasting system to selected rivers.	2005/2007	All Members will have extended flood forecasting to one additional river by 2005 and one additional by 2007.
2.2.3 Develop an integrated hazard map of inundation and water-related hazards/disasters for a pilot project area in cooperation with disaster prevention and preparedness component and spread to other areas.	2004 for Pilot 2006 Spread to other areas.	One completed pilot project in each Member's area by 2004 and spread to other areas by 2006.
2.2.4 Evaluate and improve operational flood forecasting/warning models.	2006	Demonstrated improvement of 10% in operational flood models performance.
2.2.5 Establish a community-based flood observation and forecasting system in a pilot project area in cooperation with DPP component.	2006	One community-based flood observation and forecasting system pilot project completed by each Member.
2.2.6 Establish a flash flood and sediment disaster forecasting/warning system in a pilot project area in cooperation with DPP component and spread to other areas.	2005/2007	Flash flood and sediment forecasting /warning pilot project completed by each member by 2005 and spread to other areas by 2007.
2.2.7 Establish, evaluate, and improve the accuracy of operational flood forecasts and warnings and exchange this information among all Members.	2004/2007	Establish and evaluate baseline accuracy by 2004 and improve accuracy by 20% by 2007
2.2.8 Disseminate through meetings, conferences, and papers the lessons-learned and the basis for the integrated hazard map from the pilot project area.	2004/2006	Well-develop network on sharing information by 2004 and one person from each Member attend one meeting per year on sharing information.

***2.3 Objective 3**: To improve forecasts, products, services, and presentations to meet various users' requirements.*

Action	Target Dates	Success
2.3.1 Develop guidelines for dam operations in relationship to flood forecasting.	2005	Established and disseminated guidelines for dam operations.
2.3.2 Exchange experiences and examples of how to organize meetings to collect and understand users' requirements and methods to prepare questionnaires/surveys to send to users.	2004/2005	All Members will collect and prepare a document of users' requirements.
2.3.3 Implement changes or additions to forecasts, products, services, and presentations based upon the documented users' requirements.	2005/2006	All Members will implement 30-50% of documented users' requirements.

2.3.4 Develop and extend activities between forecasting agencies and user groups of flood forecasting information in cooperation with disaster prevention and preparedness component.	2005/2006	All Members will meet with users group once per year.

2.4 Other Important Objectives to Consider.

2.4.1 Exchange the information on comprehensive countermeasures for flood disaster including the management structure River Basin Management Committee at regional level, provincial level, and local level.

TRAINING

***2.5. Objective 1**: To facilitate the transfer of the latest forecasting and analysis techniques among Members.*		
Action	**Target Dates**	**Success**
2.5.1 Exchange of experts and fellowships programme under Typhoon Committee Research Fellowship Scheme.	2006	Each interested Member will have at least one exchange of experts or fellowship.
***2.6 Objective 2**: To facilitate group training courses in meteorology, hydrology, and disaster prevention and preparedness to improve forecasts and warnings.*		
Action	**Target Dates**	**Success**
2.6.1 Attend training course on Meteorology, River and Dam Engineering, and Disaster Mitigation and Restoration System for Infrastructure.	Annually through 2006	Highest priority Members requiring the training will have at least one participant attend the training.
2.6.2 Conduct training and roving seminars to effectively build capacity of Members.	Annually through 2007	Highest priority Members requiring the training for capacity building will have at least seminar in their area.
***2.7 Objective 3**: To develop, organize, and conduct meteorological and hydrology training courses to meet Members requirements.*		
Action	**Target Dates**	**Success**
2.7.1 Prepare a list of training requirements for meteorology and hydrology and circulate among members (see attached recommended list, not in priority order).	2004	Finalized list distributed to all Members.
2.7.2 Determine sources of the required training.	2006	Completion of at least one high priority training course annually from finalized list.

3. DISASTER PREVENTION AND PREPAREDNESS. Broad Goal. To strengthen, in cooperation with Typhoon Committee Members, media, and other bodies concerned, programmes on tropical cyclone-related disaster mitigation to maximize public safety and minimize negative social and economic impacts on the sustainable development process.

3.1 Objective 1: *To strengthen the disaster preparedness and prevention capacity of people at local level and encourage local level participation.*		
Action	**Target Dates**	**Success**
3.1.1 Provide Community Based Disaster Management (CBDM) training for every flood prone area.	2006	All Members conduct training for at least 3 flood prone areas.
3.1.2Provide the necessary equipment and training for observing and notification of local flood conditions, forecasts, and/or warnings.	2006	All Members provide the necessary equipment and training for local system to at least 3 communities.
3.2 Objective 2: *To improve public awareness of the impacts of tropical cyclones and options for mitigation and response actions.*		
Action	**Target Dates**	**Success**
3.2.1 Maintain effective communications with the media prior to, during, and after tropical cyclones occurrences.	2004 and After	Demonstrated long-term average decrease in the amount of damage and number of casualties.
3.2.2 Maintain effective communications between meteorological/ hydrological services and emergency management/disaster response agencies and participate in integrated preparedness programs.	2004 and After	Demonstrated long-term average decrease in the amount of damage and number of casualties.
3.2.3 Establish and maintain a closer working relationship/partnership with non-governmental organizations which play a crucial role in education, mitigation, and response activities.	2004 and After	Demonstrated long-term average decrease in the amount of damage and number of casualties.
3.3 Objective 3: *To increase availability and dissemination of disaster preparedness and mitigation information*		
Action	**Target Dates**	**Success**
3.3.1 Disseminate disaster preparedness and mitigation information via Internet.	2005	Make information available on a central server
3.3.2 Enhance list of Internet web sites which Members can access for disaster preparedness and prevention information.	2004	Enhanced list of applicable web sites distributed.
3.3.3 Exchange relevant tropical cyclone resistant actions which Members have found effective and Members' building codes.	2005	Completion of exchange among all Members.
3.3.4 Ensure terminology used by meteorologists and hydrologists can be clearly understood by disaster preparedness and prevention agencies and the public.	2006	Seventy percent of the people in a test group(s) understand terminology used.
3.3.5 Investigate the availability of amateur radio, HF, FM, and EMWIN networks and implement procedures for their use to report significant weather events and as backup communications/dissemination systems.	2005	Interested Members implement one additional network and reporting procedures

3.3.6 Exchange ideas on current and future communications systems in use or planned for warning dissemination.	2005	Reduction in time for warning dissemination and relief operations communications.

3.4 Other Important Objectives to Consider.

3.4.1 Establish safety shelters in risk villages for emergency evacuation.
3.4.2 Establish and maintain effective operation and maintenance procedures for flood protection structures and facilities.
3.4.3 Implement flood proofing activities to avoid the loss of human life and reduce the disruption to normal activities before, during, and after flooding.
3.4.4 Facilitate the production and exchange of educational videos for tropical cyclone preparedness.

TRAINING

3.5 Objective 1*: To facilitate the transfer of the latest forecasting and analysis techniques among Members.*		
Action	**Target Dates**	**Success**
3.5.1 Exchange of experts and fellowships programme under Typhoon Committee Research Fellowship Scheme.	2006	Each interested Member will have at least one exchange of experts or fellowship.
3.6 Objective 2*: To facilitate group training courses in meteorology, hydrology, and disaster prevention and preparedness to improve forecasts and warnings.*		
Action	**Target Dates**	**Success**
3.6.1 Attend training course on Meteorology, River and Dam Engineering, and Disaster Mitigation and Restoration System for Infrastructure.	Annually through 2006	Highest priority Members requiring the training will have at least one participant attend the training.
3.6.2 Conduct training and roving seminars to effectively build capacity of Members.	Annually through 2007	Highest priority Members requiring the training for capacity building will have at least seminar in their area.

APPENDIX XVIII

TERMS OF REFERENCE OF THE WORKING GROUP ON HYDROLOGY

In order to coordinate efforts on the implementation of various activities under the Hydrological Component to better support the socio-economic development process in the Typhoon Committee Area, the Typhoon Committee has established the Working Group on Hydrology (WGH) with the following Terms of Reference and operational modalities.

Terms of Reference

The WGH will promote cooperation among the Members in the implementation of activities under the Hydrological Component of the Committee's RCPIP with the aim to support the socio-economic development process and enhance cooperation among the Members in all the five components. Towards this end, the WGH is expected to advise and assist the Committee in:

- Identifying priority issues and areas of cooperation in the Hydrological Component;
- Facilitating the exchange of experiences and knowledge on latest developments and techniques related to the above issues and areas;
- Undertaking priority activities and programmes of the Committee aiming at strengthening capacity of the Members in hydrology and water resources;
- Mobilizing resources to carry out priority activities of the Committee related to the Hydrological Component;
- Reporting overall progress in the implementation of the hydrological component of the RCPIP; and
- Recommending to the Committee priority areas, programmes and activities for cooperation in research by related experts of the Members.

Membership

The WGH will consist of the following members:

- Mr Katsuhito Miyake, Japan as Chairman
- Dr Hong Il-Pyo, Republic of Korea as Vice Chairman
- Dr Liu Zhi-yu, China as Secretary

The Committee also requested other interested Members to take part in the Working Group and invited ESCAP, WMO and TCS Hydrologist to involve in this Working Group. The term in service of the WGH is one year subject to extension authorized by the Committee.

Operation modalities

In view of the limited financial resources of the TC Trust Fund, the WGH is expected to communicate through email and other means which require no financial resources from the Trust Fund.

Reporting requirements

The Chairman of the WGH is required to submit an annual report to the Committee session for its consideration through the TCS on activities in all the three technical areas of the Committee work and recommendations related to priority research activities to be undertaken in the coming years.

APPENDIX XX

TERMS OF REFERENCE OF THE TYPHOON RESEARCH COORDINATION GROUP (T R C G)

In order to coordinate efforts on various areas of research on tropical cyclones and their impacts on the socio-economic development process in the Typhoon Committee Area, the Typhoon Committee has established the Typhoon Research Coordination Group (TRCG) with the following Terms of Reference and operational modalities.

Terms of Reference

The TRCG is to promote research activities on various aspects of tropical cyclones analysis, forecasting and assessment of tropical cyclones and their impacts on the socio-economic development process and encourage cooperation of efforts among the Members. Towards this end, the TRCG is expected to assist in:

- Identifying scientific and technical problems in the analysis and forecasting of tropical cyclones and their impacts on water resources and measures for disaster prevention and preparedness;
- Facilitating the exchange of experiences and knowledge on latest development and techniques related to the above problems;
- Initiating activities and programmes aiming at improving the related products and services to better serve the people in the region; and
- Recommending to the Committee priority areas, programmes and activities for cooperation in research by related experts of the Members.

Membership

The TRCG will consist of a focal point of all the Members. The Director of the RSMC and all the Chairmen of the TC Working Groups can take part in the deliberations of the TRCG in their ex-officio capacity. The current Chairman of the TRCG is Dr. Woo-Jin Lee of Republic of Korea. The term in service of the TRCG is one year subject to extension authorized by the Committee.

Operation modalities

In view of the limited financial resources of the TC Trust Fund, the TRCG is expected to communicate through email and other means which require no financial resources from the Trust Fund. All submission for consideration by TRCG will have to be made through the focal point of each Member or through the Chairmen of the Working Groups established by the Committee. The TCS is requested to transmit all materials related to TRCG to the Working Group Chairman.

Reporting requirements

The Chairman of the TRCG is required to submit an annual report to the Committee session for its consideration through the TCS on activities in all the three technical areas of the Committee work and recommendations related to priority research activities to be undertaken in the coming years.

APPENDIX XXI

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND
INTERIM STATEMENT OF ACCOUNT
as at 31 October 2005

			$	$
Balance of fund at 1 January 2004			558,454	
Contributions Received			246,000	
Adjustments to Opening Balances			**30,615**	
Interest Income			7,715	
Total revenue (Cash in bank)				**842,784**
Less: Expenditure	Liquidated	Unliquidated	Total	
Roving Seminars (MF 37045/2004) *Approved amount is $ 10,000*	11,907	-	11,907	
Travel for TCS staff (3) to TC-37 (MF33120) *Double entry (?) see below MF 37044 $ 4545*	-	4,500	4,500	
Bank charges	45	-	45	
Publication of reports (Newsletter No. 16 & TCAR 2003) *Entry in last statement is 1,015 (difference of $101)*	1,116	-	1,116	
Publication of reports (2005 transfer) *Were the supporting documents for the expenses in the exacr amount of $ 1,500*	1,500	-	1,500	
Postage	91	-	91	
Support to host Typhoon Committee Website	1,500	-	1,500	
Transfer to MF 30841 (Intl Conf on Storms, Brisbane)	22,400	-	22,400	
Operating costs of TCS *Approved amount is $ 25,000 per year*	48,061	39,004	87,065	
Support for two women forecasters, RSMC Tokyo (MF30842/2004)	4,000	-	4,000	
Support for two women forecasters RSMC Tokyo (MF30843/2005)	4,000	-	4,000	
Worskhop Socie-eco Impacts ... MF30844 *Approved amount is $ 20,000*	9,916	170	10,086	
WG ROSTY Meeting, Bangkok, April 2004 MF 37036	8,252	-	8,252	
Support for local costs and printing ,Seoul Hydro Wkshop (MF37041/2004)	3,017	-	3,017	
Mission travel Seoul Hydro Workshop MF 37041/2004	13,608	-	13,608	
37th Session of the Typhoon Cttee MF37044	4,545	-	4,545	
World Conference on Disaster Reduction MF 34035	6,524	-	6,524	
Mission travel TAWWWA032864 (Sep 2003 for Jang Yon Chol) *What particular activity?*	1,093	-	1,093	
MF 30733/2005: Typhoon Committee Workshop on “Effective Tropical Cyclone Warning” (Shanghai, China, 24 to 28 April 2005)	27,400			
MF 32181/2005: RA IV Workshop on Hurricane Forecasting and Warning, and Public Weather Services (Miami, FL, USA, 11 to 23 April 2005)	19,000			
MF 30791/2005: Third Regional Workshop on Storm Surge and Wave Forecasting – A Hands-on Forecast Training Laboratory (Beijing, China, 25 to 29 July 2005)	4,000			
Memo: AWG Rosty mission (Support for mission of AWG Chair and Vice-chair to TC Members offering to host TC Secretariat)	17,600			

Sub-total expenditure	141,575	43,674	185,249	
Support costs 13% *Reduction to 7% was requested*	18,405	5,678	24,083	
	159,980	49,352	209,332	
Total expenditure				209,332
Balance at 31 October 2005				633,452

Contriibutions received	in 2004	in 2005	Total
China	12,000	12,000	24,000
Hong Kong, China	12,000	12,000	24,000
Japan	-	12,000	12,000
Macau, China	12,000	12,000	24,000
Malaysia (amount received in 2004 is for 2003 and 2004)	24,000	12,000	36,000
Philippines	6,000	-	6,000
Republic of Korea	12,000	12,000	24,000
Singapore	12,000	12,000	24,000
Thailand	12,000	12,000	24,000
USA*	12,000	24,000	36,000
Vietnam	12,000	-	12,000
	126,000	120,000	246,000

*The amount received in 2004 is for the year 2003, and
the amount received in 2005 is for the years 2004-2005

<u>Questions:</u>

1. WHAT IS: Adjustments to opening balance $ 30,615

2. ROVING SEMINARS (MF37045/2004) $ 11,907 (approved=$ 10,000) ?

3. PUBLICATION OF REPORTS (2005 Transfer) $ 1,500

Is the $ 1,500 for: Publishing the Typhoon Committee Newsletter No. 17 $ 500
Printing and distribution costs of the publication of the 2004 Typhoon Committee Annual Review (TCAR) (CDs) $ 500
Printing and distribution costs of documents for the thirty-eighth session of the Committee $ 500

PLEASE CONFIRM

4. MISSING ENTRIES (approved expenses in 2005 but not in the statement)

$ 27,400 MF 30733/2005: Typhoon Committee Workshop on “Effective Tropical Cyclone Warning” (Shanghai, China, 24 to 28 April 2005)

$ 19,000 MF 32181/2005: RA IV Workshop on Hurricane Forecasting and Warning, and Public Weather Services (Miami, FL, USA, 11 to 23 April 2005)

$ 4,000 MF 30791/2005: Third Regional Workshop on Storm Surge and Wave Forecasting – A Hands-on Forecast Training Laboratory (Beijing, China, 25 to 29 July 2005)

$ 17,600 Memo: AWG Rosty mission (Support for mission of AWG Chair and Vice-chair to TC Members offering to host TC Secretariat)

5. 37th session of the Typhoon Cttee (MF37044) $ 4,545 ?

(Is this travel for TCS staff? If it is what is the entry: Travel for TCS staff (3) to TC-37 (MF33120) $ 4,500 ?

Could this be a double entry?

6. Operating cost of TCS Question: why is the total $ 87,065 when only $ 25,000 was approved for 2004 and $ 25,000 for 2005?

7. Worskhop Socie-eco Impacts ... MF30844 $ 9,916 $ 170 **$ 10,086**

Question: $ 20,000 was approved for this: MF30844/2005: Workshop on the Socio-economic Impact Assessment of Typhoon-related Disasters and Risk Management towards Millennium Development Goals (Kuala Lumpur, Malaysia, 5 to 8 September 2005)

8. Mission travel: TAWWWA032864 (Sep 2003 for Jang Yon Chol) **What particular meeting?**

9. Publication of reports (Newsletter No. 16 & TCAR 2003) $ 1,116 (in last year's statement it was $ 1,015
Question: Why the $101 difference? **NOT INCLUDED IN FIRST MESSAGE**

<u>Appendix XXII</u>

DPP ROADMAP

Typhoon Committee Roadmap on Early Warning Systems (EWS)

	Focus	**2005**	**2006**	**2007**	**2008 and**	**beyond**	
		TC-38	TC-39	TC-40	TC-41	and beyond	
Meteorology	TC EWS	- Consultation with DPP members - Preparation of the roadmap	- Inventory of TC/HY EWS - Expert Meeting on EWS to review & identify gaps & needs, esp. w.r.t. information landing (e.g. hardware, technology, communication, observations and outreach)	- Expert mission (on request) to help Members, esp. LDCs, to improve/develop their EWS (esp. on dissemination, observation, forecast technology, and outreach) - Workshop on EWS operation	- Workshop on Integration of EWS into Disaster Risk Management - Expert meeting on Met/Hyd/DPP to explore development of multi-hazard EWS	- Explore feasibility of cross-border exchange of warnings - Development of multi-hazard EWS	- Dissemination of integrated information on EWS to the public
Hydrology	HY EWS						
DPP	-Coordination -Integration -Capacity Building -Communication & outreach						