UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS THIRTY-SEVENTH SESSION

Shanghai, China
16 – 20 November 2004

CONTENTS

I. ORGANIZATION OF THE SESSION

1. The Thirty-Seventh Session of the ESCAP/WMO Typhoon Committee was held in the Conference Hall of the Shanghai Meteorological Bureau, Shanghai, China, from 16 to 20 November 2004 with three informal pre-sessions on meteorology, hydrology, and disaster prevention and preparedness (DPP) held on 15 November 2004.

Attendance

2. The Session was attended by 67 participants from 11 out of 14 Members of the Typhoon Committee, namely: China; DPR Korea; Hong Kong, China; Japan; Macao, China; Malaysia; Republic of Korea; Singapore; Thailand; the United States of America (USA); and Viet Nam.

3. The Session was also attended by 17 observers representing local Provincial Meteorological Bureaus, UNEP, UN-ISDR, WMO-CAS and ADRC. Representatives from the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO) 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 Dr Xu Xiaofeng, Deputy Administrator of China Meteorological Administration. It was presided over by H.E. Mr Hu Yan Zhao, Deputy-Mayor, Shanghai Municipal Government, and commenced at 0900 hrs on Tuesday, 16 November in the Conference Hall of the Shanghai Meteorological Bureau.

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

- The welcoming address of H.E. Mr Hu Yan Zhao, Deputy-Mayor, Shanghai Municipal Government on behalf of the Shanghai Municipal Government
- The opening statement of Dr Qin Dahe, Administrator of the China Meteorological Administration (CMA)
- The message of Mr.Kim Hak-Su, Executive Secretary of ESCAP, read by Mr. Ti Le-Huu, the representative of ESCAP.
- The address of Mr. Eisa H. Al-Majed, the representative of the WMO Secretariat on behalf of Mr M. Jarraud, Secretary-General of WMO

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

6. After the opening statements, a ceremony was held where the ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award 2004 was presented to the National Meteorological Centre of CMA, China in recognition of its valuable contribution to disaster reduction.

II. ELECTION OF OFFICERS (agenda item 2)

7. Dr Xu Xiaofeng, (China) and Mr. R. Jeffrey LaDouce (USA) were elected Chairman and Vice-Chairman of the Typhoon Committee, respectively. Dr Chow Kok Kee (Malaysia) was elected Chairman of the Drafting Committee.

III. ADOPTION OF THE AGENDA (agenda item 3)

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

IV. THE COMMITTEE'S ACTIVITIES DURING 2004 (agenda item 4)

9. The Committee was informed of activities carried out in 2004, 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 NEP, UN-ISDR, WMO-CAS and ADRC.

(a) Meteorological Component (agenda item 4.1)

10. The Session reviewed the activities of the Members during the past year, details of which are presented in Appendix IV**.**

11. The Committee took note of the report of the pre-session of the TC meteorology which met on Monday, 15 November 2004 (Appendix V).

12. The Committee was informed that arrangements have been intensively carried out for MTSAT-1R, the successor to GMS-5, for its launch at the earliest possible date. Earth imagery of MTSAT-1R will be transmitted with new communication services such as HRIT and LRIT. However, for the convenience of SDUS users in their transition from WEFAX to LRIT, WEFAX broadcasting service will be provided along with LRIT and continued to the end of 2007. Also, HiRID, which is compatible with S-VISSR, will start to be transmitted for MDUS users along with HRIT and will be continued to the end of 2007.

13. The Committee was informed that FY-2C had been successfully launched on 19 October 2004 and ten days later, the first visible image had been received and is now in orbit test period and will be operational in March 2005. FY-2C is the first operational geostationery meteorological satellite of China, which is located at 105^{o} E.

14. The Committee expressed its gratitude to JMA for the exemplary work of the Regional Specialized Meteorological Centre (RSMC) Tokyo - Typhoon Centre and its provision of Numerical Typhoon Prediction Web Site. The Committee noted that the tracks displayed at the site continue to be of great help to their operations. The Committee urged Members who have not yet registered to inform RSMC of their IP addresses. The activities of RSMC-Tokyo in 2004 and implementation plan for the period 2004 to 2008 are contained in Appendix VI.

15. The Committee was informed that 10 Members have not yet sent the data to RSMC Tokyo to be included in the Expanded Best Track Data (EBT) of 1996-2004. The Committee urged the Members to send the data to RSMC Tokyo by March 31, 2005.

Conclusion:

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

- 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, hydrology, training, research and DPP components and agreed to amend and incorporate the changes in the RCPIP as proposed by the pre-session of the TC on meteorology, as shown in Appendix V; and
- The Committee noted the importance of the World Conference on Disaster Reduction (WCDR), which will be organized by the United Nations International Strategy for Disaster Reduction Secretariat in Kobe, Japan, in January 2005, 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 WCDR.

Decisions

17. 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 establish the Working Group on Meteorology (WGM)(see paragraph 46) 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. Muntana Brisksavan (Thailand) as Chair and Vice Chair of WGM, respectively. The Committee requested WGM to submit a report to the 38th session.
- To request the WGM 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; and*

- To adopt the revision of RCPIP proposed by WGM as contained in Appendix V.
- To request the ESCAP, WMO, 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 organize a Regional Workshop on Effective Tropical Cyclone Warning, which is designed to promote the collaboration among three components of meteorology, hydrology and disaster prevention and preparedness for the mitigation of tropical cyclone related disasters with allocation of US$27,400 for the organization of the Workshop.
- To amend to the Typhoon Operation Manual (TOM) as submitted by the Rapporteur, Mr. N. Mannoji (Japan), which is given in Appendix VII and request Japan to continue the services of Mr. Mannoji to update TOM in the TCP homepage and on CD ROM for distribution to Members.
- To authorize the WGM Chair or Vice-Chair to attend the WCDR with financial assistance from TC funds.

(b) Hydrological Component (agenda item 4.2)

18. The Session reviewed the activities of the Members during the past year, details of which are presented in Appendix VIII**.**

19. The Committee took note of the report of the pre-session of the Working Group on Hydrology (WGH) which met on Monday, 15 November 2004 (Appendix IX).

20. The Committee was pleased to note the continuing increase in the number of participants from the TC Members in the Workshop of this year, and in addition, the participation of TC Hydrologists and DPP experts as well as invited meteorologists from TC members. It took note of the fact that the allocation from the TC Trust Fund of US$20,000 for the Workshop had generated over US$96,000 in kind contribution from various parties, consisting of US$25,000 from the Ministry of Land, Infrastructure and Transport of Japan and US$71,000 from the Ministry of Construction and Transportation of Republic of Korea.

21. The Committee took note of important progress made in the implementation of the various RCPIP projects, especially on the guidelines on flood hazard mapping and the guidelines on sediment disaster forecasting and warning of WGH.

22. The Committee 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. It also expressed appreciation to Mr Kenzo Hiroki 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.

23. The Committee expressed its appreciation to the Government of Japan for the financial support extended to selected members of WGH to participate in WCDR and the Government of Republic of Korea for its intention to support selected members of WGH to participate in the international conference of the International Association of Hydraulic Research (IAHR) to be held in Seoul in September 2005.

24. The Committee also expressed sincere appreciation to the Governments of Japan and Republic of Korea for the intention to provide financial support to activities of WGH in 2005.

Conclusion:

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

- The new and inventive format of the 2004 Workshop held in Seoul in September and hosted by MOCT of Republic of Korea, 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.
- It was opportune to adopt the following theme for the next Workshop of TC Hydrologists: “Risk Management Towards Millennium Development Goals and Socio-economic Impact Assessment of Typhoon-Related Disasters” to build on past achievements of activities of the Working Group and to synergize with other TC Working Groups and other international efforts on disaster reduction and integrated water resources management (IWRM). The related international efforts included the plan of the United Nations to review progress towards the Millennium Development Goals and the preparation process of the Fourth World Water Forum (WWF-4), which includes the theme “Risk Management”. In this connection, the Committee noted the interest expressed by Malaysia in hosting the WGH Workshop in 2005.
- The Committee recognized the opportunity offered by the international conference on IWRM in Tokyo in December 2004 for the implementation of the recommendations of the World Summit on Sustainable Development in 2002 on integrated management of water-related disasters, to disseminate the findings of WGH as shown in Annex 2 of Appendix IX on the consolidated recommendations of WGH related to integration of risk management into water resources management.
- The Committee agreed on the priority areas, *inter alia*, enhancing the capacity of forecasting and warning, human resources development and the exchange of experiences and information among Members on equipment and facilities being used

Decisions

26. 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 and Mr Liu Jin-Ping as Chair and Vice Chair of WGH, respectively. The Committee requested WGH to submit a report to the 38th session.

- To organize a workshop with the theme "Risk Management Towards Millennium Development Goals and Socio-economic Impact Assessment of Typhoon-Related Disasters" for the Workshop in 2005 with an allocation of a total of US$20,000 for TC Hydrologists and invite Malaysia to host the Workshop.
- To allocate funds for the TC Chair or Vice Chair and WGH Chair or Vice Chair to participate in WCDR in Kobe in January 2005. It also agreed to endorse the proposal of WGH to invite Dr Hong Il-pyo, the Coordinator of the Workshop of 2004, to present the findings, shown in Annex 2 of Appendix IX to the international conference on IWRM, with no cost to the Committee.

(c) Disaster Prevention and Preparedness Component (agenda item 4.3)

27. The Session reviewed the activities of the Members during the past year, details of which are presented in Appendix X.

28. The Committee took note of the findings of the pre-session on DPP facilitated by the representative of UN/ISDR with sixteen participants from eight Members, namely China; Japan; Macao, China; the Philippines; Republic of Korea; Thailand; United States of America, and Viet Nam on 15 November 2004.

29. The Committee expressed its appreciation to the Infrastructure Development Institute (IDI), Japan for its generous contribution to assist DPP participation from several Members during the Workshop held in Seoul, Republic of Korea in September 2004.

30. The Committee welcomed the intentions of Japan and the Republic of Korea to take active roles in the DPP activities and the willingness of UN-ISDR, UNEP/IETC, ADRC, and IDI to provide further support to the DPP component.

Conclusion:

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

- The Committee recognized the need to implement activities of the Disaster Prevention and Preparedness (DPP) component of RCPIP, which is currently closely associated to the Hydrological Working Group, and agreed to hold a TC workshop in Malaysia in August/September in 2005.
- 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 "community-based disaster risk management" and "enhanced participation of the media in disaster reduction."
- The Committee recognized the need to further enhance cooperation between DPP component and the other two components on meteorology and hydrology.

Decisions

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

- To establish a Working Group on Disaster Prevention and Preparedness (WGDPP) and invite the Members to nominate their respective focal points to participate in the work of WGDPP.
- To invite Members to nominate Chair and Vice-Chair of WGDPP and to provide support to the activities of WGDPP.

- To invite interested international organizations to provide support to WGDPP.

(d) Activities on Training and Research (agenda item 4.4)

33. 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 for the Typhoon Committee Research fellowship scheme and the workshop on effective tropical cyclone warning.

Conclusion:

34. On the basis of the information provided by the Members and the report of TRCG findings of the pre-session on meteorology, 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 Beijing and Kuala Lumpur immediately after the 37th session and urged that the presentation materials be distributed to all Members in the form of CD-ROM after the seminars.
- The Committee encouraged Members to promote research under the TC research fellowship scheme with possible extension to hydrology and DPP components.

Decisions

35. 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) as the Chairman of TRCG.
- To continue the Typhoon Committee research fellowship scheme (Appendix XI) in 2005, 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 2005.
- To postpone the next roving seminar in 2006 instead of 2005.

V. REVIEW OF THE 2004 TYPHOON SEASON/PUBLICATIONS (agenda item 5)

36. The Committee noted that 25 typhoons developed as of 18 November 2004. Ten (10) tropical cyclones with tropical storm intensity or higher hit Japan, and the number of tropical storms that ended at the western-most point was less than normal. The Committee recommended that the research on the typhoon track and intensity should be promoted.

37. The Committee decided to retire the names Pongsona, Maemi, Sudal and Rananim typhoons, and requested the Members to propose new names. It requested TCS to inform the Members of the procedures and timetable for submission of new names for consideration at the 38th Session.

38. The Committee took note of the reports of the Members affected by typhoons as given in Appendix XII.

39. The Committee took note with appreciation of the review of the 2004 typhoon season provided by the RSMC Tokyo-Typhoon Center as given in Appendix XIII.

Publications

40. The Committee took note that the TCS published the 16th issue of the Typhoon Committee Newsletter in July 2004 and the publication of the 2003 Typhoon Committee Annual Review (TCAR) in October 2004 which were disseminated to the Members, ESCAP and WMO in electronic (CD-ROM) format. The Committee reappointed the Chief Editor.

41. The Committee noted with appreciation that the RSMC Tokyo – Typhoon Center published the "Annual Report on Activities of the RSMC Tokyo – Typhoon Center in 2003" in the form of CD-ROM with printed matters in November 2004.

VI. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item 6)

42. The Committee was informed by the representative of the WMO Secretariat that the Third Workshop on South China Sea Storm Surge, Wave and Ocean Circulation Forecasting – *A Hands-on Ocean Forecast Training Laboratory for the South China Sea Region* would be organized in Beijing in July 2005.

43. The Committee noted with satisfaction that two woman forecasters from Hong Kong, China and Malaysia had undertaken very successfully the fourth on-the-job training in typhoon operations at the RSMC Tokyo – Typhoon Center from 28 July to 6 August 2004. It also noted with appreciation that JMA would organize the attachment of two woman-forecasters (each from Macao, China; and Singapore) to the RSMC Tokyo for 10 days in July 2005.

44. The Committee endorsed the following two recommendations of the Second Regional Technical Conference on Tropical Cyclones, Storm Surges and Floods which had been held in Brisbane, Australia from 1 to 3 July 2004 in association with the International Conference on Storms (Brisbane, 5 to 9 July 2004):

- To strengthen the collaboration between meteorological and hydrological departments to develop a coupled model to improve flood forecasting, and in particular, to investigate the "specific-river" flood forecasting system used by China for applicability to other members; and, through cooperation and collaboration among members, promote the use of specific river/area forecasting.

- To promote the capacity building for Cambodia, DPRK and Laos especially by way of training fellowships and attachments to advanced centres, and by upgrading their observation and telecommunication facilities.

VII. PROGRAMME FOR 2005 AND BEYOND (agenda item 7)

Working Group on the Review of Operations and Structure of the Typhoon Committee

45. The Committee took note of the report of the Working Group on the Review of Operations and Structure of the Typhoon Committee (ROSTY) as reported by its Chairman.

46. The Committee expressed its appreciation to the Chairman and the members of ROSTY as well as ESCAP and Thai Meteorological Department for contributing in the preparation of the report and for their organizational support.

47. The Committee noted the important goals of the proposed package in saving lives and mitigation of damage, in enhancing visibility of the Committee based on the results and achievements, and in working together better on the three components in cross-cutting

manners. It also noted the important progress made towards improving the operations of the Committee.

48. After deliberation on various issues related to the proposals for improvement of operations and structure of the Committee, the following conclusions were reached:

- The Committee recognized the advantage of maintaining the current frequency of the Committee sessions, i.e., annually, at the present conditions of cooperation.
- The revised RCPIP needs further improvement and be reformatted into a strategic plan to form a more effective basis for preparation of annual plans.
- The proposed structure with revised Terms of Reference of the Chair, Vice-Chair and Secretary of the Committee as well as those of the Advisory Working Group (AWG), the Working Groups on Meteorology, Hydrology, DPP and TRCG provided a good basis for further improvement in the work of the Committee (Appendix XIV).
- There is no need, at present, to undertake steps to amend the Statute of the Committee. However, it is necessary to update the Rules of Procedure of the Committee to be in line with the Statute and the new situation.
- There is a need to develop an annual work plan, jointly by TCS and AWG in consultation with all Members, as shown in Appendix XV to provide detailed, specific actions/measures to meet Goals and Objectives in RCPIP, to the next Session for all Members to review and comment and to submit the final draft work plan 30 days before each Session to Members.
- There is a need to strengthening the process of seeking and obtaining feedback from Members.
- It recognized the need to further improve TC Website with the objectives: to have a world-class website 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 provided since the last session in hosting the Session documents.
- There is a need to have a more effective and efficient budgetary process to provide a greater role for TC Chairperson and TC Secretary as shown in Appendix XVI.

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

- To continue to meet annually
- To request TCS to reformat the RCPIP into a strategic plan.
- To adopt the structure of the Typhoon Committee and its subsidiary bodies including the Typhoon Committee Secretariat and approve the Terms of Reference of the Chair, Vice Chair and Secretary of the Committee as well as those of the Advisory Working Group (AWG), the Working Groups on Meteorology, Hydrology, DPP and TRCG as shown in Appendix XIV.
- To change the title of the “Coordinator of the Typhoon Committee Secretariat” to “Secretary of the Typhoon Committee ” and appoint Dr Roman L. Kintanar as Interim Secretary until the appointment of the Secretary.
- To invite the Government of the Philippines to nominate candidate(s) for the Secretary of the Committee for confirmation by 38th Session.
- To update the Rules of Procedure of the Committee as shown in Appendix XIV.
- To appoint Dr Chow Kok Kee and Mr James Weyman to be Chair and Vice Chair of AWG.
- To establish the Resource Mobilization Group with Terms of Reference shown in Appendix XVI and appoint Dr Koji Kuroiwa, Japan and Mr Lam Kang Gaik, Singapore as Chair and Vice Chair respectively.
- 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 said work plan three months before the 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 to establish a monitoring mechanism to ensure active participation in TC activities.
- To undertake efforts and allocate resources to further improve TC Website with proper domain names and request Hong Kong, China to further assist in registration of domain names and drawing up a detailed action plan for this purpose.
- To implement the budgetary process proposed in Appendix XVI to provide a greater role for TC Chairperson and TC Secretary and to improve the effectiveness and efficiency of its operations.
- To request AWG to undertake the process of collecting additional information to develop hosting options for sound decision-making, if necessary, to visit the Members concerned for consultation according to the timetable and Terms of Reference shown in Appendix XVII.
- To adopt the updated RCPIP as shown in Appendix XVIII.
- 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.

VIII. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (agenda item 8)

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

50. 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. R. L. Kintanar in his capacity as the TCS Coordinator.

51. The Committee decided on the new Terms of Reference of the Secretariat of the Typhoon Committee and the Secretary of the Typhoon Committee. (See paragraph 49)

(b) Technical Cooperation

52. The Committee expressed its appreciation to ESCAP, WMO and development partners for providing assistance to the Members of the TC.

(c) Typhoon Committee Trust Fund (TCTF)

53. The Committee reviewed the financial statement of TCTF submitted by WMO which covered the period from 01 January 2004 to 30 September 2004 and the balance of the fund as of 30 September 2004 as shown in Appendix XIX.

54. The Committee urged its Members to continue to enhance their contributions to the Trust Fund.

55. The Committee, after careful consideration, agreed to the use of the TCTF for the following specific purposes from l January to 31 December 2005:

1.	Operating costs of TCS, including the support for the Secretary of the TC;	US$	25,000
2.	Publishing the Typhoon Committee Newsletter No. 17;	US$	500

3.	Printing and distribution costs of the publication of the 2004 Typhoon Committee Annual Review (TCAR) (CDs);	US$ 500
4.	Travel cost for TCS staff participation at the thirty-eighth session of the Typhoon Committee;	US$ 4,500
5.	Printing and distribution costs of documents for the thirty-eighth session of the Committee;	US$ 500
6.	Support for the Regional Workshop on "Effective Tropical Cyclone Warning" (tentatively, China, May 2005;	US$ 27,400
7.	Support for attachment of two (2) women typhoon forecasters to RSMC Tokyo Typhoon Centre;	US$ 4,000
8.	Support for the attendance of 5 typhoon experts at the Workshop on Hurricane Forecasting and Warning, and Public Weather Services (Miami, Florida, USA, 11 to 23 April 2005);	US$ 19,000
9.	Support for the Third South China Sea Storm Surge Workshop (Beijing, Chian,25 29 July 2005);	US$ 4,000
10.	Support for the Working Group on the Implementation of the Hydrological Component of RCPIP "Socio-economic Impact Assessment of Typhoon-related Disasters and Risk Assessment towards Millennium Development Goals";	US$ 20,000
11.	Support for attendance of TC representatives at the World Conference on Disaster Reduction (Kobe;Japan, 18 to 22 January 2005)	US$ 6,500
12.	Support for mission of AWG Chair and Vice-chair to TC Members offering to host TC Secretariat	US$ 17,600
13.	Registration of domain name and hire ISP to host the TC website	US$ 1,500
	TOTAL	**US$ 120,600**

Any other emergency expenditures that can be justified for the use of the TCTF requires the concurrence of the 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$120,600.

56. The Committee decided that total actual expenditure for the year 2005 should not exceed US$ 129,000, noting that the support cost to be charged by WMO has not been included in the above budget.

57. 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 2006 onwards to US$100,000.

58. The Committee decided to send an official letter signed by the Chairman of the Typhoon Committee requesting the Secretary-General of WMO to reduce the support cost of TC Trust Fund from 13 per cent to 7 per cent as per WMO Executive Council Resolution 19 (EC-LVI) on WMO Programme-Support Cost Policy, under decides, paragraph (2).

IX. DATE AND PLACE OF THE THIRTY-EIGHTH SESSION (agenda item 9)

59. The Committee welcomed the offer of the delegation of Viet Nam to host the Thirty-Eighth Session in November 2005, subject to the approval of its Government. The meetings of

TC Working Groups on meteorology, hydrology and DPP would be arranged by the Secretariats in consultation with the Chairman and the host country as an integral part of the Session.

X. SCIENTIFIC LECTURES (agenda item 10)

60. The following scientific lectures were presented:

(1) *ADRC's Activities on total disaster risk management, GLobal Unique Disaster IDEntifier Number (GLIDE) and Community-based flood hazard mapping* by Dr. Tomohiko Hatori, ADRC
(2) *Impacts of moisture transportation on intensity change of rainfall and landfalling tropical cyclones* by Dr. Li Ying, China
(3) *The Progress in Operational System of Tropical Cyclone Track and Intensity in Shanghai Typhoon Institute / CMA* by Ms. Yu Hui, China
(4) *Probability Forecasts of High Winds and Warnings Associated with Tropical Cyclones in Hong Kong* by Mr. T. W. Hui, Hong Kong, China
(5) *Storm Surge Prediction in JMA* by Mr. Tetsu Hiraki
(6) *Global 3DVAR and Track Forecasting* by Dr. Woo –Jin Lee
(7) *Seasonal Prediction of Tropical Cyclone Activity* by Dr. Joe Kwon
(8) *Field Experiments and Research Activities on tropical Cyclone Landfalling Process* by Prof. Lianshou Chen (WMO/CAS)
(9) *Assessment of Socio-Economic Impacts of Disasters* by Ti Le Huu, ESCAP

61. The Committee expressed its appreciation to all the lecturers and requested the TCS to disseminate all the lecture papers and to include them in the Typhoon Committee Annual Review for 2004.

XI. ADOPTION OF THE REPORT (agenda item 11)

62. The Committee adopted the report of the Session at 1025 hours, 20 November 2004.

XII. CLOSURE OF THE SESSION

63. The delegates from the Members of the Typhoon Committee, observers, and representatives of ESCAP, WMO and TCS expressed their thanks and appreciation to the Government of China, the Shanghai Municipality, the China Meteorological Administration and its Shanghai Meteorological Bureau for the successful hosting of the 37th session of the Typhoon Committee. They also expressed gratitude to Dr Qin Dahe, Administrator of the China Meteorological Administration, and his staff for the warm hospitality and excellent arrangements made and to the Shanghai Meteorological Bureau for organizing the technical visit and excursion trip to interesting sites in Shanghai.

64. The Session was closed by the Chairman at 1100 hours 20 November 2004.

LIST OF APPENDICES

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (ESCAP)
and
WORLD METEOROLOGICAL ORGANIZATION (WMO)

Typhoon Committee
Thirty-seventh Session
16-20 November 2004
Shanghai, China

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APPENDIX II.a

Speech at the Opening Ceremony of the 37th Annual Session of the WMO/ESCAP Typhoon Committee

By HU Yanzhao, Deputy Mayor, Shanghai Municipal Government
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Ladies and Gentlemen,
Good morning,

The weather of November in Shanghai is very pleasant with a light blue sky and prevailing fresh air. Today, we feel highly honored that the WMO/ESCAP Typhoon Committee holds its 37th annual session in Shanghai. On this occasion, on behalf of the Shanghai Municipal Government, I would like to extend our sincere congratulations on the session and our warmest welcome to all participants.

Situated in west coast of the Pacific and in the midpoint of China's coastline, Shanghai has a subtropical monsoon climate. As it is known for its dense population and forests of high rises, Shanghai is a highly modernized, the largest city in China as well as one of the well-known metropolitans in the world. Shanghai has won the bid for hosting the World Expo 2010. Shanghai will continue to keep a momentum of its rapid social and economic growth in the next 10-20 years. Shanghai attempts to build it an international center of economy, finance, trade and shipping, and to become an economically prosperous, socially civilized and environmentally sound metropolitan. Therefore, we are convinced that by 2010, Shanghai will show a totally new image to the world.

Meanwhile, despite of its superior geographical location and favorable climate conditions, we have also noticed that Shanghai is inevitably impacted by such adverse weather events as typhoon, heavy rain, heat wave and fog. Among others, typhoon is the most severe weather system affecting this city.

Bearing this in mind, the Shanghai Municipal Government adheres to the scientific concept of development and keeps the momentum of sustainable development in Shanghai. We attach great importance to improving the integrated system of disaster prevention and preparedness, especially capacity building against meteorological disasters.

Under the support of the China Meteorological Administration (CMA), and with consistent efforts made by the Shanghai Meteorological Bureau, the meteorological modernization process in Shanghai has been accelerated and the capability to combat weather-induced disasters have been further enhanced. Shanghai Meteorological Bureau has provided effective meteorological service for the social progress and economic development in Shanghai, making an irreplaceable contribution to our society.

In the whole meteorological disaster prevention system, we have always been attaching great importance to the improvement of typhoon research and to the capacity building of typhoon forecasting and early warning. The early warning of typhoon has played a very important role in comprehensive disaster preparedness and mitigation in Shanghai. This year, before typhoon Rananim influenced Shanghai, the Chinese meteorological offices had issued accurate forecasts on its track and intensity, which provided the municipal government with a reliable basis for its decision-making. Owing to the accurate and timely forecasts, appropriate measures were taken, hence a large number of major projects were well protected; the urban traffic ran smoothly; and people's life was stable and in good order. This example fully reflects that the typhoon forecast

and early warning play an important role in the social and economic development in Shanghai. Furthermore, we also highly appreciate CMA for having established the Shanghai Typhoon Institute in this city, which is the sole typhoon research body at the national level. Undoubtedly, this will greatly promote both the basic theoretical study of typhoon and its related application.

This session of the Typhoon Committee holding in Shanghai has provided an excellent opportunity within WMO/ESCAP framework to further enhance the cooperation and academic exchanges between the Chinese meteorologists, especially those in Shanghai, and the typhoon experts from Asia and Pacific regions. It will also improve the typhoon research and its early warning capability.

Dear friends, there is an old saying in China that goes like this: “how happy we are to meet a friend from afar”. The Chinese people have the tradition to cherish friendship. We also hope the participants could make a tour in Shanghai - a coastal city with its own beauty, witnessing the achievements since the reform and opening-up to the outside world, enjoying the hospitality and friendship of people in Shanghai, bringing our good wishes back to your countries.

Finally, I wish the session a complete success, and I wish you a pleasant stay and good health. Thank you all.

APPENDIX II.b

Speech at the Opening Ceremony of the 37th Session of the Typhoon Committee

By Dr. Qin Dahe, Administrator of the China Meteorological Administration
(16 November 2004)

Distinguished ……,
Distinguished delegates,
Ladies and Gentlemen,

Good morning!

First of all, on behalf of the China Meteorological Administration, I wish to express my warmest welcome to you.

As we are aware, tropical cyclone is the most destructive weather system in atmosphere. The Asia and Pacific is one of the regions in the world that is prone to tropical cyclone. The persistent effort to reduce casualties and heavy property losses arising from tropical cyclone is one of the important tasks facing various governments and is also the mission of the ESCAP/WMO Typhoon Committee.

Over many years, the Typhoon Committee has been playing an important role in promoting cooperation among the Committee members, improving typhoon forecasting and warning, and minimizing losses resulting from disasters of typhoon in the region.

Following the successful implementation of the TOPEX in 1980's and the SPECTRUM in 1990's, the Typhoon Committee has done a lot of work in strengthening cooperation among the Committee members, particularly in the field of scientific research of typhoon in recent years. The Northwest pacific and South China Sea tropical cyclone naming program that began to be implemented in 2000 has achieved success, expanding the visibility of the Committee. The cooperative research program and roving seminar program of the Typhoon Committee implemented in recent years have achieved encouraging progress, strongly pushing forward the cooperation in training and research among the Committee members.

We appreciate the progress made by the Typhoon Committee, and call on the Committee, while continuing the implementation of the available programs, to assist the developing countries in strengthening the tropical cyclone forecasting and warning system by giving priority to the RCPIP program and the members' capacity building. It is possible to further improve members' performance in providing better forecasting and more effective warnings of tropical cyclones by sponsoring training activities for forecasters and making available guidance materials.

Recently, we have just finished the study on the meteorological development strategy in China. The study put forward the vision, strategic goals and tasks of the Chinese meteorological service, and described clearly its blueprint, laying a foundation for the meteorological development. Such research outcomes will surely have a great and far-reaching impact on the meteorological development in China, and greatly contribute to the disaster prevention and mitigation.

China, with vast territory and huge population, is one of the countries in Asia and Pacific region that is most frequently hit by typhoon. The greater development of economy and society coincides with greater damages by typhoon. There are 6 tropical storms this year, landing on the Chinese coastal region for 10 times. In particular the typhoon Rananim, being of great intensity,

extensive impact and strong destructiveness, brought about a heavy loss to Zhejiang Province. The Chinese government attaches great importance to the typhoon preparedness. Thanks to the careful organization, right decision-making and proper arrangement, the causalities and property losses caused by the typhoon were reduced to the minimum.

Since the reform and opening-up to the outside world, we have always forged ahead with the meteorological and hydrological modernization drive through science and technology, greatly improving the monitoring and warning in meteorology and hydrology. The meteorological and hydrological services in China have made positive contribution to the preparedness against typhoon, flood and drought. China has always been actively participating in the activities of the Typhoon Committee. We will still do so as actively as ever before so as to enhance the effectiveness of the Committee.

I wish you a good health and a happy stay in Shanghai.

I wish the session a complete success.

Thank you all.

APPENDIX II.c

MESSAGE FROM MR. KIM HAK-SU

Executive Secretary, United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

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

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

These regional efforts are necessary to mitigate impact of these 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 forced dislocation of households and communities. The economic cost of natural disasters, especially those resulted from tropical cyclones, has continued to increase during the past decade in the region. In 2004, the number of typhoons has apparently been higher than in the previous years. These tropical cyclones and resulting water-related disasters have caused serious socio-economic impacts to many countries in the region, especially in China, Japan, the Philippines and Republic of Korea. This increase of economic impacts continues to threaten the good progress made in most part of the region in recent years. The losses are particularly damaging when depriving countries of resources, which could otherwise be used for economic and social development. This forms one of the most important challenges to "environmentally sustainable economic growth" in the region, the theme expected to be discussed at the Fifth Ministerial Conference on Environment and Sustainable Development in Asia and the Pacific, to be held in Seoul in March 2005.

In this connection, I am pleased to inform the Committee that the United Nations Economic and Social Commission for Asia and the Pacific, at its sixtieth session held also in this beautiful city of China in April 2004, noted with appreciation the increase in the cooperation activities and achievements and progress of work by the Committee and its members in 2003. I wish to particularly commend the Committee for the continuing strenuous efforts and eagerness to implement the new Regional Cooperation Programme Implementation Plan (RCPIP) and would like to extend my sincere support to the Committee to its efforts to reform its structure and operations. Please rest assured of our commitment in collaborating with the Committee in the common efforts to improve disaster preparedness in the region for a better living with risk, as stipulated in the Johannesburg Plan of Implementation (JPOI) of the World Summit on Sustainable Development (WSSD) in September 2002: "*An integrated, multi-hazard, inclusive approach to address vulnerability, risk assessment and disaster management, including prevention, mitigation, preparedness, response and recovery, is an essential element of a safer world in the twenty-first century*." The Committee may wish to note that the JPOI also called for action at all levels to "*support the establishment of effective regional, subregional and national strategies and scientific and technical institutional support for disaster management.*" It is in this context hoped that thirty-seventh session would set a definitive and new direction for the continuing efforts on institutional strengthening of the Committee.

I am pleased to note the continuing increase in support of the Ministry of Land, Infrastructure and Transport of Japan and the Infrastructure Development Institute-Japan in the implementation of the new RCPIP, the increasing support of the Ministry of Construction and Transportation of the Republic of Korea and also the intention of several other Typhoon Committee Members, such as

China; Macao, China; Malaysia; and the Philippines to support in these common endeavours. I wish to particularly note 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 continuing support of the Government of the Philippines in providing the services of the Typhoon Committee Secretariat during the past 24 years.

I should like to assure you of UNESCAP's continuing support in 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 continuing 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.

APPENDIX II.d

WMO STATEMENT AT THE OPENING OF THE THIRTY-SEVENTH SESSION OF THE ESCAP/WMO TYPHOON COMMITTEE

(Shanghai, China 15 to 20 November 2004)

Distinguished Mr Hu Yan Zhao, Vice-mayor, People's Government of the Shanghai Municipality,

Dr Qin Dahe, Administrator of the China Meteorological Administration and Permanent Representative of China with WMO,

Dr Xu Xiaofeng, Deputy Administrator of the China Administration,

Mr Le Huu Ti, the Representative of the Executive Secretary of ESCAP,

Mr Sheng Jiarong, Director-General, Shanghai Meteorological Bureau,

Dr Roman Kintnar, Coordinator of the Typhoon Committee Secretariat,

Distinguished Delegates and Guests,

Ladies and Gentlemen,

It gives me great pleasure, on behalf of Mr M. Jarraud, the Secretary-General of the World Meteorological Organization (WMO), in welcoming you all to the thirty-seventh session of the ESCAP/WMO Typhoon Committee. I would like to express the deep appreciation of the Secretary-General and WMO to the Government of Peoples' Republic of China and the People's Government of Shanghai Municipality for hosting this session. I wish to thank Dr Qin Dahe, Administrator of China Meteorological Administration and Permanent Representative of China with WMO, and the Director-General of Shanghai Meteorological Bureau and his staff for the excellent arrangements made to ensure the success of the session. I also wish to thank Dr Roman L. Kintanar, the Typhoon Committee Coordinator and the staff of the Typhoon Committee Secretariat for their administrative support.

I would like to thank the Government of the Philippines for its support to the Typhoon Committee, by hosting its Secretariat and providing the services of a coordinator, a meteorologist and support staff. I would further like to take this opportunity to extend the thanks of WMO to ESCAP, for its long-standing close cooperation with WMO as our organizations jointly provide support to the activities of the Committee.

Our sincere thanks also go to Mr Chow Kok Kee, the Chairman of the Typhoon Committee and the members of for their valuable services. I would like to take also this opportunity to express WMO's appreciation to all those countries that hosted meetings or training events for the Committee.

During this session, the participants will discuss and agree on a number of very important issues that are expected to further strengthen and advance the work of the Typhoon Committee, in particular, when considering the Report of the Meeting of the Working Group on the Review of the Operations and Structure of the Typhoon Committee (ROSRY). In this regard, I wish to express our gratitude to the chairman of the Working Group Mr James Weyman and the members of the group for their efforts and hard work in the preparation of the report, which you will consider during the course of the meeting.

It is quiet important to strengthen the work of the Typhoon Committee and to enhance further the various activities of each of the five components of the Committee. In this connection, you are all aware that the Committee made significant achievements throughout the years however, there is still a lot to be done. Members in the Region are highly vulnerable to natural disaster such as floods, droughts, typhoons, tropical cyclones, and associated storm surges, claims lives and cause damages to property. This year (2004) as from early June, heavy rains stroked Eastern and Southern Asia resulting in widespread flooding in many countries including Bangladesh, China, India, Japan, the Korea Peninsula, Nepal, the Philippines, and Viet Nam. China experienced more than 8 widespread torrential rains that affected most parts of the country. The most recent typhoons "Ma-on" and "Tokage" in October hit Japan, which were the most destructive storms in more than a decade in Japan. These storms caused flash floods and triggered several mudslides in many areas already waterlogged by a series of deadly typhoons, which resulted in lost of life and left enormous damage to Japanese economy. In an other region, in August and September this year, four hurricanes struck the Caribbean and the United States killing more than three thousand people and causing damages worth billions of dollars. It was the first time that USA had been hit by four destructive hurricanes in such rapid succession since 1950.

In this connection, we recognize the considerable efforts of the Governments concerned to mitigate the impacts of tropical cyclones including typhoons and the increasing sever seasonal floods on human life. It is important to stress that the loss figures could be higher without pre-disaster efforts, particularly early warnings. They contribute significantly to disaster preparedness, particularly in reducing loss of life and property. As a partner to the implementation of the Millennium Development Goals, WMO is committed to the protection of life and property and sustainable social and economic development. WMO's target is to reduce by 50 per cent of the associated ten-year average fatality of 1995-2004 over the decade 2010-2019. WMO and NMHSs to promote a culture of prevention and pre-disaster strategies as part of national and regional disaster preparedness and to build upon an improved knowledge base, strong institutions and public outreach and education. Therefore, WMO will continue to provide the necessary support to Tropical Cyclone Programme, and activities for coordinated actions to upgrade forecasts and warning services. These will enhance improvements already underway in the early warning capabilities of the NMHSs through the designated Regional Specialized Meteorological Centres. Furthermore, WMO will continue to give high priority to the implementation of Natural Disaster Prevention and Mitigation Programme which aims to promote collaboration among related programmes and the notion that a shift in the disaster management approach from relief and rehabilitation to preventive and pro-active strategies, has the potential of reducing venerability of communities in a cost effective manner. Furthermore, WMO will work together with international, regional and national partners on key initiatives to address these goals. In this regards, WMO is working closely with the Secretariat for the International Strategy for Disaster Reduction (ISDR) in preparing for the World Conference on Disaster Reduction to be held in Kobe, Japan, from 18 to 22 January 2005.

It is very necessary to continue enhancing the NMHSs capacity building by utilizing new technology in observing and monitoring as well as in communications and data processing. In this connection, Members are called upon to facilitate the transfer of the latest forecasting and analysis techniques and to develop and organize training courses. We would like to assure you that WMO will continue to assist NMHSs in their development plans through, among others, the mobilization of resources for the implementation of national and regional projects.

WMO will continue making every effort to support the Typhoon Committee's work, to the extent possible. Finally, I would like to express once again the appreciation of WMO to the Government of the People's Republic of China for hosting the session. I wish you every success in your deliberations and a pleasant stay.

Thank you for your attention

APPENDIX III

AGENDA

1. Opening of the Session
2. Election of the Officers
3. Adoption of the Agenda
4. The Committee's Activities during 2004
   - 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 2004 typhoon season/annual publications
6. Coordination with other Activities of the WMO Tropical Cyclone Programme
7. Programme for 2005 and beyond
8. Support required for the Committee's programme
9. Date and Place of the Thirty-eighth session
10. Scientific lectures
11. Adoption of the report

APPENDIX IV

SUMMARY OF THE REPORTS OF THE TYPHOON COMMITTEE MEMBERS ON THEIR ACTIVITIES RELATED TO THE METEOROLOGICAL COMPONENT

The delegate from **China** reported that China successfully launched FY-2C, its first operational Geostationary Meteorological Satellite, on October 19, 2004. Located in 105°E, FY-2C is the first satellite for the second FY-2 group, which consisted of three satellites and planned to be in operational service from 2004-2012. The FY-2C will start operation in March 2005.

Under to the upgraded plan, the China New Generation Doppler Radar Network will consist of 158 new-generation CINRAD doppler radars. 64 CINRAD radars have already been installed and successfully used in observing hail & rainstorm and monitoring typhoons. By the end of 2004, 93 CINRAD radars will be installed in Mainland China and 29 more additional CINRAD radars in2005.

Five hundred eighty-two (582) Automatic Weather Stations (AWSes) became operational from Jan. 1, 2004 which were established under the *Automatic Atmosphere Monitoring System* project. A total of 1606 AWSes are presently operational. At the same time, the new Surface Meteorological Observing Practice was implemented at all surface observing stations operated by the China Meteorological Administration (CMA), which is applicable not only to automatic observation but also to manual observation. In compliance with the new practice, the new Operational Software of Surface Meteorological Observation (OSSMO) has also been developed. The new OSSMO version has been tested and will become operational in 2005.

The capability building of upper air sounding network in China was continuously enhanced in 2004. 10 sets of L-band secondary wind-finding radar & digital sonde system have been put into operation as of August 1, resulting in improved quality of sounding data at sites.

The Beijing–Tokyo GTS circuit was upgraded in February 2004. The upgraded link is connected to the RMDCN of RA VI by using the Frame Relay service provided by EQUANT, which has a CIR of 48Kbps. TCP sockets are adopted to exchange data on the link.

Significant enhancement to CMA's high performance computing power was achieved in 2004. Based on extensive application benchmarking and competitive international bidding procedures, an IBM supercomputer was chosen by CMA in June 2004. The new supercomputer, composed of 376 computing nodes, with a total of 3152 Power4 CPUs and a peak performance of 21 TFLOPS (Trillion floating-point operations per second), has been installed at CMA's National Meteorological Information Center to be used for CMA's operational NWP and short term climate simulation.

The Global Model for Typhoon Track Prediction (GMTTP) has been used into operational tropical cyclones forecasting instead of former Regional Model for Typhoon Track Prediction (RMTTP), which produces tropical cyclone track and intensity prediction over the western North Pacific and South China Sea when NMC/CMA numbers tropical cyclones. Its products are transmitted through GTS twice a day (00, 12UTC), which gained relatively better results. During the typhoon season, consensus tropical cyclone track prediction issued by Shanghai Typhoon Institute has also has been submitted to forecasting center of CMA.

The research work carried out in the past year focused on the aspects which include tropical cyclone structure, intensity change, sustaining and decaying mechanism over land,

extra-tropical transition (ET), track forecasting techniques, application of GRAPES model and climate statistics.

The Global/Regional Assimilation and Prediction System (GRAPES), based on three dimension and four dimension variational assimilation technique, is being developed by the Chinese Meteorological Administration. Based on the GRAPES, the Shanghai Typhoon Institute developed a tropical cyclone numerical prediction system (GRAPES_TCM). The result from the experiment for the year 2002 and 2003, the average 24h and 48h errors of TC track forecasting, were 130km and 252km, respectively. This indicates GRAPES_TCM have a good performance for the track prediction. GRAPES_TCM is prepared for the quasi-operational in the next tropical cyclone season.

Dynamical and diagnostic analyses were made with composite data of two sets of landfall typhoons (quick dissipation and longer sustention). The results exhibited that the lower layer moisture channel connected with a landing tropical cyclone and moving toward north, gains the baroclinic energy from the mid-latitude trough as well as the upper level envelope of the cyclone linking with a mid-latitude jet to enhance the upper level out flow towards northeast which would be favorable to sustaining of the tropical cyclone over land.

An air-sea coupled model for tropical cyclone study was proposed with MM5V3 the atmospheric part and multi-level POM the oceanic part. Idealized experiments demonstrated the model's capability in simulating tropical cyclone and reflecting the interaction between ocean and tropical cyclone. Using the air-sea coupled model, a series of experiments were carried out to study the effect of changes in the ocean on tropical cyclone intensity and track

Six (6) training courses on Doppler weather radar were held in CMA Training Center in 2004, with a total of 300 participants. Some lectures in the training focused on the use of radar to locate the center of typhoon, estimate the intensity (wind speed) and the typhoon precipitation and on warning techniques of severe convective weather associated with typhoon spiral rain band.

A training course on weather satellite imagery interpretation in weather forecasting was held in CMA Training Center in 2004 with 60 participants. Locating typhoons, intensity estimation and the interaction between typhoons and mid-latitude weather systems were discussed in the course.

HONG KONG, CHINA

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

1a. Hardware and Software Progress

In Hong Kong, China, between October 2003 and September 2004, the total page view of the World Meteorological Organization (WMO) Severe Weather Information Centre (SWIC) pilot website reached 5.2 million, a growth of more than 57% compared with the previous 12 months. In addition to tropical cyclone information and warnings, a global heavy rain page was introduced to SWIC in July 2004.

SWIC together with its sister site World Weather Information Service (WWIS) won the Certificate of Merit for Best of eGovernment and Services in the Asia Pacific Information and Communication Technology Award in December 2003.

A pamphlet was published at the end of 2003 to publicize these two websites (available online at http://severe.worldweather.org/new.html).

1b. Implications for Operational Progress

Nil.

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

In February 2004, meteorologists from Guangdong, Hong Kong and Macao celebrated 20 years of cooperation in setting up automatic weather stations (AWS) in the Pearl River Estuary area. In the past 20 years, six AWS were jointly established at Huangmao Zhou (1985), Tuoning Liedao (1996), Neilingding Dao (1996), Wailingding Dao (1997), Wanshan Dao (1997) and Gaolan Dao (1997). Beaming weather data round-the-clock, these stations provided early detection and alerting capability of severe weather, especially for tropical cyclones approaching the Pearl River Estuary from the sea.

The 1996 to 2003 Expanded Best Track data in respect of Hong Kong, China was compiled and communicated to the Regional Specialized Meteorological Centre (RSMC), Tokyo in June 2004.

1d. Training progress

The Hong Kong leg of the Typhoon Committee Roving Seminar on Tropical Cyclones was held in October 2003.

1e. Research Progress

A research fellow from the Shanghai Typhoon Institute visited HKO's Open Laboratory in October 2004 under the Typhoon Committee Research Fellowship Scheme to work on tropical cyclone bogussing.

The following papers were presented by HKO staff at the 18th Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology held in Hong Kong in February 2004:

(a) Case Studies on the Application of Composite Radar in Mesoscale Numerical Models for the Prediction of Tropical Cyclones.

(b) Verification of Intensity Forecast of Numerical Models for Tropical Cyclones in the Western North Pacific.

(c) Severe Turbulence during the passage of T. Imbudo (0307).

1f. Other Cooperative/RCPIP Progress

The scope of services presently offered by SWIC and WWIS will be expanded.

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

2a. Hardware and Software Progress

A new ground reception system for receiving MODerate resolution Imaging Spectroradiometer (MODIS) direct broadcast data from the Earth Observing System (EOS) series of satellites was implemented in mid-2004, A true colour image of Kompasu approaching Hong Kong in July 2004, captured by the MODIS ground reception system, is shown in Figure 2.

A web-based tool for dealiasing Doppler velocity and estimating the gale radii of tropical cyclones from single Doppler velocity fields was developed.

The infrared Doppler Light Detection and Ranging (LIDAR) system at the Hong Kong International Airport (HKIA) was declared operational in May 2004. It proved to be effective in monitoring winds shear under rain-free conditions including those occurring between the rainbands of tropical cyclones. Algorithms were being developed to automate the alerting of windshear based on LIDAR data to complement the warnings generated by the Terminal Doppler Weather radar which worked best in rainy conditions.

Enhancements of the Observatory's website included the display of animated radar images and numerical weather prediction products at 12-hour intervals up to 72-hours ahead based on the Observatory's Operational Regional Spectral Model (ORSM). Through ORSM's products, the public could follow the evolution and movements of tropical cyclones.

At HKIA, the latest tropical cyclone forecasts became available to aviation users through the web-based, fully automatic Aviation Meteorological Information Dissemination System (AMIDS) which also disseminated the tropical cyclone warnings issued by the Tropical Cyclone Advisory Centre (TCAC) Tokyo and other centers.

2b. Implications for Operational Progress

Enhancements to the Observatory's tropical cyclone forecasting and warning services in 2004 included:

(a) Provision of tropical cyclone intensity forecasts up to 72 hours ahead in tropical cyclone warnings for shipping. This service was also made available to Typhoon Committee Members via the GTS.

(b) Introduction of the Chinese version of the Tropical Cyclone Warning for Shipping.

(c) Addition of tropical cyclone intensity information for the general public.

(d) Updating of the tropical cyclone forecast track on the HKO's website every hour instead of every three hour when the Tropical Cyclone Signal No. 3 or above was in force.

In respect of techniques development, a software tool for estimating tropical cyclone intensity was put into operational trial. Guidance on the probability of occurrence of strong winds or gales in the Hong Kong harbour area during tropical cyclone passage was also made available to forecasters.

TC-LAPS, a tropical cyclone specific application of the Local Analysis and Prediction System (LAPS) adapted from the Forecast Systems Laboratory of the National Oceanic and Atmospheric Administration (NOAA), was enhanced in 2004 to generate time series of wind speed, wind direction and mean-sea-level pressure at specific locations along a given track.

An algorithm based on the European Centre for Medium Range Forecasting's (ECMWF) ensemble prediction system (EPS), made available to the Observatory by ECMWF in April 2004, was developed to let forecasters assess the maximum winds likely to occur over Hong Kong during the passage of tropical cyclones.

Furthermore, a 5-km horizontal resolution Non-hydrostatic Model (NHM) adapted from the Japan Meteorological Agency (JMA) was put into semi-operational trial in late April 2004 to

provide 12-hour forecasts twice daily. Case studies showed that the tropical cyclone wind and convection were better simulated by this model which would also be used forecast heavy rain associated with mesoscale convective systems.

Assessment of the performance of ECMWF global models in forecasting tropical cyclone intensity over the western North Pacific was carried out. The MPI-RSM 4DVAR data assimilation system adapted from JMA was being tested to study the impact of local observations and analysis schemes on tropical cyclone forecasts.

The possibility of using spectral width data from the two wind profilers near HKIA to indicate the occurrence of turbulence in the vicinity of HKIA under tropical cyclone situations was being explored. This was suggested by the good correlation between spectra width and turbulence reports from aircraft obtained during the approach of tropical cyclones.

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

The following joint research with local tertiary institutions were completed or in progress:

(a) A joint project with the Hong Kong University on "Tropical Cyclone Eye Fix" was completed. The resulting software was put into operational trial. A related paper was presented at the 17th International Conference on Pattern Recognition held in Cambridge, UK in August 2004.

(b) A joint project with the City University of Hong Kong on "Model Validation of Tropical Cyclone Wind Structure" was in progress. The objective was to evaluate the performance of JMA and the 20-km ORSM model forecasts of tropical cyclone wind strength and maximum wind and strong/gale/storm wind radii against QuikSCAT data.

2d. Training progress

Four HKO officers attended overseas training courses or seminars related to tropical cyclones between October 2003 and September 2004.

Professor C. P. Chang of the Naval Postgraduate School gave a lecture on Typhoon Vamei on 20 October 2003. Professor Johnny Chan of the City University of Hong Kong also delivered a lecture on tropical cyclones on 25 November 2003.

2e. Research Progress

In addition to the papers mentioned in sub-paragraph 1e of Section I, the following tropical cyclone studies were completed:

(a) The climatology of tropical cyclone intensity change in the western North Pacific.
(b) The impact of ENSO events on tropical cyclone activity in the western North Pacific.

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

2f. Other Cooperative/RCPIP progress

Further to the exchange of radar imageries, the exchange of raw radar data with Macao, China began in 2004. The objective was to enable the generation of dual-Doppler winds.

3. Opportunities for further Enhancement of Regional Co-operation

A lightning location network covering the Pearl River Estuary will be installed in collaboration with the meteorological services in neighbouring Guangdong and Macao.

The delegate from **Japan** reported that record-breaking ten TCs made landfall over Japan as of the end of October 2004 and that number was nearly four times as many as the annual average. The Japan Meteorological Agency (JMA), as the National Meteorological Service of Japan, made its utmost efforts to minimize damage from TCs, by providing the general public with timely forecasts and warnings on TCs.

The satellite observations over the western Pacific have been carried out with GOES-9 in cooperation with NOAA/NESDIS of the United States since 22 May 2003. Arrangement has been intensively carried out for MTSAT-1R, the successor to GMS-5, for a successful launch at the earliest possible date. Earth imagery will be transmitted with new communication services such as HRIT (High Rate Information Transmission) and LRIT (Low Rate Information Transmission). However, for the convenience of SDUS users in their transition from WEFAX to LRIT, WEFAX broadcasting service will be provided along with LRIT and continued up to end of 2007. For the same purpose, HiRID (High Resolution Image Data), which is compatible with S-VISSR will start to be transmitted for MDUS users along with HRIT and will be continued up to the end of 2007 like with WEFAX. These services will therefore allow both SDUS and MDUS users to continue to receive satellite imageries without any modification to their ground facilities until 2007. Further, provision of the image data (IR1 channel) to NMHSs through the Internet, which has currently been performed as a backup dissemination service of the direct broadcast service from the satellite, will be continued in the form of HRIT for the time being for the users receiving HRIT from MTSAT-1R. A detailed schedule of these services will be announced in due course.

JMA has officially launched the Numerical Typhoon Prediction (NTP) Website on 1 October 2004. The NTP Web site offers numerical predictions of tropical cyclone tracks performed by major NWP centers to assist the NMHSs of the Typhoon Committee (TC) Members in better tropical cyclone forecasting and warning services. The website includes lists of positional data of predicted tracks and several useful functions such as deriving an ensemble mean from any combination of the centers' predictions of a user's choosing. The NTP Web Site is expected to contribute to the improvement of the disaster prevention activities related to Tropical Cyclones by TC members not only as a quick reference for the numerical predictions of typhoons by the leading centers, but also as an effctive tool for making the most of those valuable products through ensemble averaging.

The assimilation of Moderate Resolution Imaging Spectrometer (MODIS) polar winds data over the Arctic region was started in May 2004. Before the operational use of these data, some assimilation experiments were performed for July 2003 and January 2004 using the JMA global 3D-Var data assimilation system. The MODIS polar winds from Terra and Aqua satellites in the Arctic were assimilated in the experiments. The results of the experiments demonstrated positive impacts of the MODIS polar winds on short- and medium-range forecasts. Large improvements were found in the Northern Hemisphere in geopotential height fields as well as wind fields. In addition, typhoon track predictions were also ameliorated, especially for typhoons moving toward mid-latitude. The data over the Antarctic has also been used in the JMA global assimilation since September 2004.

JMA is now developing a new version of GSM with a resolution of 20km. The comparative experiments between the new and currently operational GSM with a resolution of 60km have been made and the results showed significant improvement in typhoon intensity forecast in the new GSM. The new version of GSM is planned to be operational in 2007 after the introduction

of the new Numerical Analysis and Prediction System of JMA scheduled in 2006. The new version of GSM will be used for typhoon track and intensity forecasts replacing the current TYM.

In accordance with the Improvement Plan for MTN and RMTN of WMO, JMA upgraded Tokyo-Manila GTS circuit to TCP/IP. As a result, the upgrade of all the nine GTS circuits connected to JMA was successfully completed.

MACAO, CHINA,

Highlight of Progress in Macao's Regional Co-operation and Selected RCPIP Goals and Objectives in related to Meteorological Component.

- Under the initiative of SMG in cooperation with the Institute of Meteorology of Portugal and with the support of Hong Kong Observatory, Macao launched on March 23 2004, the Portuguese Version of web site World Weather Information Service (WWIS)
- Composite radar products from both Guangdong Meteorological Bureau and Hong Kong Observatory are shared for download thus enhancing the monitoring and alerting capability for severe weather such as tropical cyclone thunderstorm and rainstorm.
- A new Meteorological Information System (MIS) was developed to integrate the advantages of C++ and GRADs and NCAR NCL. Users feel comfortable and easy to browse meteorological charts, radar or satellite images in various area chosen by themselves. Function for severe weather system or tropical cyclone position and tracking were also provided.
- A brand-new meteorological briefing and bulletin editing system was developed which provides friendly interface, more easy, convenient and efficient way for all forecasters to brief their analysis and prediction of weather and thus produce meteorological reports as well as disseminate them. Besides, the system uses three languages in Chinese, Portuguese and English which characterize Macao as the international and tourist city.
- New radar processing and display software: To improve the availability and to prepare future data exchange, SMG invested on the Iris radar processing software and the acquisition procedure started in May 2004. Currently, SMG is working on the installation.
- The new rainstorm and thunderstorm warning system started operation on 1st of July. A live introductive television program as well as some lectures in school about the new system were held for interpretation and promotion. New users to receive warnings were added to dissemination system.
- Storm surge models, such as the trail version of JMA Storm Surge Model and the IIT Model, with horizontal resolution of 2' X 2' , were adapted and under study phase. With input of tropical cyclone data and prediction as it approaches Macao, hourly storm surge can be calculated. Result of model help forecasters to assess probability of storm surge during the passage of tropical cyclones as well as the issuing of flooding warning for low area .
- Due to collaboration with the local media, new public weather service in television program was renewed to provide more enhanced meteorological information and products.
- In cooperation with the local mobile telecommunication company, mobile phone users can use the "Cell Broadcast" weather information service to receive the weather information, including weather forecast and instant severe weather warning if issued.
- In collaboration with Hong Kong Observatory, a Lightning Detection Network is

under installation and planned to start operation at the end of this year. The network includes five detecting sensors located at different sites, one in Sanshui of China; three in Hong Kong and one in Macao, which formed a network to cover the Pearl River Delta region with its highest detection accuracy performance up to 500meters.

- In order to reinforce better service and easiness of the exchange of meteorological information, all monthly and annual publication including Meteorological Observation Report, Air Quality Monitoring Report and Annual Tropical Cyclone Report are now available in electronic format (PDF format). More users can now download the e-publication through the website (http://www.smg.gov.mo).

Training and Research

- A total of 17 overseas training Opportunities/Courses/Seminars/Workshops were attended by 38 SMG personnel from Oct 2003-Oct 2004.
- 4 research papers were presented in the 18th Guangdong-Hong Kong-Macao Seminar on Meteorological Science and Technology held in Hong Kong Feb 2004. While 3 other research papers on monsoon and global climate change at Late Seventies and its Impact on the Dryness of northern China were also presented in the "4th International Symposium on Asian Monsoon System (ISAM4)" held in Kunming, China and the "80th Anniversary and Annual Conference" of China Meteorological Society.
- In cooperation with "China Meteorological Press", SMG plans to publish a book in English version end of 2004. The book entitled "Asia Summer Monsoon and Mesoscale Numerical Simulation" Vol.1 , mainly consisted of collected research papers from 1998-2001, edited by Macao Meteorological and Geophysical Bureau.
- Meteorological research in collaboration with Department of Atmospheric Physics of Sun Yat-sen University, Guangzhou, China continued. Eleven research papers were published in different scientific journals and proceedings from Nov. 2003 to Oct. 2004.
- In collaboration with Macao Polytechnic Institute, a 3.5 years higher diploma degree course in meteorology started in September 2003. Eight colleagues from SMG bureau attended the course.
- Version 2.0 of "100-Year of Macao Climate" CD-ROM was also published. It is the follow-up of the launching of Version 1.0 last year, but enriched with more meteorological parameters, tabulated and graphical analyses information. Monthly and annual climate data as well as 100-year or 48-year daily average climate data are available in the CD-ROM.

The delegate from **Malaysia** reported that the Malaysian Radar Network has been enhanced with the building of another new radar station at Alor Star, Kedah. This S-band EEC WSR 8500S radar at Alor Star will cover the northwestern sector of Peninsular Malaysia. At the same time, the existing S-band Vitro MR-781S MkII radar at Kluang is also being replaced with the S-band EEC WSR8500S. The radar equipment had been delivered and installation will be completed by March 2005.

Communication links between the radar data center at the Head Office of the Malaysian Meteorological Service (MMS) with all the radars in Peninsular Malaysia as well as the links between the radar center at the Kuching Forecast Office in Sarawak with all the radars in East Malaysia are in the process of upgrading from 14.4 kbps to 64 kbps. This upgrading exercise is scheduled to be completed by December 2004.

The satellite receiving system has been upgraded to receive GOES-9 imageries. At the same time, the satellite receiving system for polar orbiting satellites has also been upgraded to produce more products in support of forecasting activities. These products include categorization of clouds based on cloud height, delineation of haze, cloud particle size

distribution analysis, Normalized Differential Vegetation Index (NDVI) and sea surface temperature.

MMS is currently installing a network of 10 coastal stations (AWS - temperature, pressure, wind and rainfall) and 5 port stations (AWS and RDCP – wave, current, tide, and sea temperature). Data from these stations will be sent to the Head Office of MMS on an hourly basis. This system will help to improve accuracy and timely issuance of weather forecast and severe weather and storm warnings. This project is schedule to be completed by Nov 2004.

Operational test run of the MMS Regional Analysis and Prediction System (RAPS) started at the end of 2002 with the help of the China Meteorological Administration (CMA). This numerical weather prediction (NWP) system runs twice daily to produce 48-hour regional forecast. The initialization data is obtained near real-time from the regional observation system, whereas the first-guess field and the lateral boundary data is obtained from the output of the Aviation Model of the National Center for Environmental Prediction (NCEP) USA. Evaluation of forecasting skill and its sensitivity to topography, seasonal variation, boundary conditions and empirical coefficients is on going to improve system performance.

In research, a study on the relationship between ENSO and the South China Sea SST has been completed. This study shows a strong positive correlation between the South China Sea SST and the SST in the Nino region in the eastern Pacific but a negative correlation with the Southern Oscillation Index at different lags. Further analysis is being carried out currently to study the air-sea interaction in the South China Sea at this inter-annual time scale to examine their impact on Malaysian weather. Simultaneously, the role of the SST distribution in the South China Sea in the formation and maintenance of cyclonic disturbances in the southern South China Sea is being examined. This is aimed at improving the seasonal forecast of the monsoons. Another area of major concern is the impact of the winter monsoon cold surges on Malaysian weather, which often leads to widespread flooding. A study to understand the intra-seasonal characteristics of these cold surges is underway. The study will focus on the onset, intensity and the time lag between the heavy rain episode over the Malaysian/South China Sea region and the first sign of the intensification of the Siberian high. Estimation of rainfall from geo-stationary meteorological satellite is also being pursued to provide a better coverage of the rainfall distribution particularly over regions where it is data sparse and is beyond radar coverage. A study on the trends in extreme climatic events has being completed.

Several meteorologists from MMS had participated actively in the following training events:

- 10th Session of the Asia-Pacific Regional Space Forum (APRSAF-10), Chiang Mai, Thailand, 14-16 Jan 2004
- Workshop on the Satellite Utilization for Water Cycle in Asia, Tokyo, Japan, 2-6 Feb, 2004
- International Training Seminar on Typhoon Monitoring and Forecasting in the Western North Pacific, Tokyo, Japan, 12-27 Feb 2004
- WMO VCP Training Course on Provision of Weather Service via the internet, Hong Kong, China, 8-12 Mac 2004
- 2nd Regional Technical Conference on Tropical Cyclones, Storm Surges and Floods and International Conference on Storms, Brisbane, Australia, 1-9 Jul 2004
- Regional Workshop on Climate and Media Building Partnerships, Bangkok, Thailand, 26-27 Jul 2004
- Fourth Typhoon Operational Forecasting Training, Tokyo, Japan, 28 Jul – 6 Aug 2004

The delegate from the **Philippines** reported that PAGASA GTS Message Switching System, circuit between RTH Tokyo and Manila is now upgraded from low speed telegraph line (200bps) to 64kbps digital Frame Relay circuit. The new Message Switching System, which is a JICA Grant, is connected to the GTS circuit of RTH Tokyo with TCP/IP socket protocol via PLDT (Philippine side) and KDDI (Japan side).

The new MSS is an IBM X-series Server using Windows 2000 Server Operating System with high performance designed to handle and control GTS communications for meteorological information and switching messages according to the recommendation of WMO standard TCP/IP socket protocol (Receptions and Transmissions). The processing and routing functions use RDBMS technique. The software was designed to keep it simple while allowing flexibility for growth and changes as systems worldwide move toward the Internet Communication Model.

Based on the configuration, one IBM Server serves as the GTS Server, which is connected, to the 64k/FR-PVC to GTS Tokyo. Manual Input Machine is connected to this Server for the data preparation and entry from our domestic meteorological reports. The other Server serves as the Local Server and Database. Data Viewer is connected to this machine that serves as the Data Terminal for Manual Plotting and Data Retriever for viewing Meteorological information transmitted from GTS. The PAGASA Local Area Network is also connected to the Local Server via Ethernet broadband router.

Aside from Traditional Alphanumeric Codes, the new MSS can also receive Binary data like GRIB, BUFR and GSM data, which is to commence middle of October 2004.

The Regional Climate Model version 3 (RegCM3) originally developed in NCAR and currently released by the Abdus Salam International Centre for Theoretical Physics (ICTP) was adapted in a PC compatible computer. Several runs have been conducted to determine the effect of choice of domain size, resolution, cumulus parameterization scheme, driving fields and ocean flux schemes on the summer rainfall. The former three cases used only one monsoon season of ECMWF reanalyzed datasets as initial and boundary conditions while the latter two used 5-year monsoon seasons from ERA40 and NNRP2. The resolution used is 30x30 km. The spin up period is 36 days and analyses were confined in June, July and August rainfall. The RegCM ability to simulate the spatial patterns and the magnitude of monsoon precipitation was demonstrated, both in response to the prominent large scale circulations over the region and to the local forcing by the physiographical features of the Philippines islands. This provides encouraging indications concerning the development of a regional climate modeling system for the Philippines region.

Another model being tested is the ETA model. This model, ICTP version, was adapted in a PC using a 0.25 x 0.25 degree resolution. The initial and boundary conditions were derived from the Japan Global spectral model. The model is run for research purposes and plans are underway to make it part of the forecasting process using the newer parallel version and when PAGASA will obtain a PC cluster.

In the Philippines, through the Climatology and Agrometeorology Branch of PAGASA continued the weather and climate monitoring activities continued. As an off-shoot of intensified information campaign on El Niño and La Niña, a project entitled Climate Monitoring and Prediction Services was launched. This Project, which is being spearheaded by the Climatology and Agro-meteorology Branch (CAB) of PAGASA, is a component of the Philippine Government's implementation of the Climate Information and Prediction System (CLIPS), a project of the World Meteorological Organization (WMO).

Activities included in the project consist of:

- Collection of various global climate indicators for socio-economic applications
- Preparation and issuances of the following products
- Maintenance of historical and present records
    a. Monthly Weather Situation and Outlook
    b. Seasonal Climate Outlook
    c. Drought/La Nina Advisories
    d. Press releases
    e. Specialized climate forecasts for specific client needs Provided resource persons on scientific briefing and interviews

In the Philippines, several research and development studies were carried out for the period, hereunder:

- A Subjective Analysis of Tropical Cyclones Originating over South China Sea – This is an observational study of the movement, behavior, and other characteristics of tropical cyclones originating from South China Sea.

- Abnormal Gravitational Effects of Co-linearity on Tropical Cyclone Intensity - The study will use the meteorological observations on the following tropical cyclones, which resulted to great damages to life, property and economy of the country.
    - Typhoon Gading (1998)
    - Tropical Storm Uring (1991) caused the flooding in Ormoc, Leyte
    - Typhoon Iliang (1998)

- Analysis of Heavy Rainfall Events Associated with Flash Floods – The study included the analysis and evaluation of meteorological conditions that produced and prolonged devastating flash floods.

- Movement of Tropical Cyclones Near Philippines using Water Vapor Imagery - Study on the use of water vapor imagery as a forecasting tool in tropical cyclone tracks predictions in the Philippines.

- Spatial and Temporal Variability of Daily Rainfall in Luzon Synoptic Stations – The study is developing statistical description of rainfall variability and its dynamic properties on temporal and spatial patterns with the consideration of physiology factors like topography and coastal influence

- Study of Storm Surges Affecting Western Philippine Seas - Application of numerical forecasting method for combined flooding due to tidal effects and storm surges in small bays.

The following international and national training activities were carried out:

a.) International Training, Conferences and Courses Attended

Field/Course	Date	Venue
Asia Pacific Network/ South- east Asian Regional Research Information Network (APN/SEARRIN)	28 – 31 Aug 03	Viet Nam
2nd Scoping Meeting for the 4th Inter-governmental Panel on Climate Change (IPCC) Assessment Report	01 – 04 Sep 03	Germany
Meeting of the Interim Working Group on Regional Cooperation Program Implementation Plan (RCPIP)	16 – 18 Sep 03	Japan
2nd Workshop on South China Sea Storm surge, Wave	15 – 19 Sep 03	Malaysia

Field/Course	Date	Venue
and Ocean Circulation Forecasting		
Workshop on Implementation of the Hydrological component of the New Regional Cooperation Programme Implementation Plan of the Committee (RCPIP)	22 – 26 Sep 03	China (PROC)
Seminar of the Development & Application of Isotope Tracer Diagnostics in Regional Climate Models	22 – 26 Sep 03	Italy
GTC in Meteorology	16 Sep – 20 Dec 03	Japan
Climate Data Management Data Rescue Seminar in RA V	13 – 17 Oct 03	Malaysia
2nd Roving Seminar of the Typhoon Research Coordination Group	22 – 24 Oct 03	Hong Kong
Physico-Mathematical Problems Related to Climate Modelling & Prediction	20 – 31 Oct 03	China
Seminar on French Technologies Solutions & Suppliers in Meteorology	20 – 24 Oct 03	France
Workshop on Mobilizing Solutions for Adaptation: Enhancing Resilience	28 – 30 Oct 03	USA
United nations Framework Convention on Climate change (UNFCCC) Expert Workshop on Local Coping Strategies & Technologies for Adaptation	12 – 13 Nov 03	India
Trng Crse on Stengthening of Flood forecasting & Warning Administration	24 Nov – 12 Dec 03	Japan
Trng Wshop on Climate System Monitoring, Diagnosis and Prediction in the Asia-Pacific Region	25 – 28 Nov 03	Japan
Asia-Pacific Environmental Innovation Strategy Project (APEIS) – Second APEIS Capacity Bldg Wshop on Integrated Environmental Monitoring of Asia-pacific Region	27 – 28 Nov 03	Australia
Regional Sem on Cost Recovery & Administration in RA V (South-West Pacific)	01 – 05 Dec 03	Vava'u, Tonga

Singapore

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

1a. ASEAN Specialised Meteorological Centre (ASMC)

Singapore hosts the ASMC to provide specialised meteorological services to ASEAN members, particularly in the environmental surveillance of forest fires and haze in the region. Access to the ASMC Intranet was previously restricted but recently opened to the public. Users can access daily updates on hotspot distribution and haze situation in the region, as determined from satellite remote sensing, as well as other climate related forecast and products related to environmental monitoring on the ASMC Intranet at http://intranet.mssinet.gov.sg/asmc/asmc.html.

1b. Rainfall Estimation for Monitoring of High Risk Fire Areas in Southeast Asia

This ASEAN project, funded by Japan-ASEAN General Exchange (JAGEF), used GMS-5 satellite data to estimate rainfall amount in the Southeast Asia region (Domain 15°S-20°N, 90° -130°E) to monitor high risk forest fire areas. As GMS-5 has been discontinued, JMA has

agreed to extend the project and adapt the existing system to make use of MTSAT when it is launched to replace GMS-5.

1c. Capacity Building in Seasonal Climate Prediction in ASEAN

To sustain efforts to build up the seasonal climate prediction capability in the region, the ASMC will host a Workshop on Regional Climate Forecast Methodology in 2005 for ASEAN members. The workshop will train participants in the validation of the ASEAN Regional Climate Model and the use and applications of model-derived predictions and tools in ASEAN. Support from the US has been secured to fund ASEAN participants.

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

2a. Hardware and Software Progress

With the discontinuation of GMS-5 and the deployment of GOES-9 in place of the former, the Meteorological Services Division of National Environment Agency, Singapore (MSD) implemented a new system to receive GOES-9 direct broadcast data and posted GOES-9 imagery on its website and Intranet. MSD is also in the process of implementing a project to extensively upgrade its imaging and reception systems. This project is targeted to complete by March 2005. Its MTSAT Subsystem will capture both HiRID data (later HRIT) for the high-resolution information as well as the LRIT data simultaneously. In addition, the current FY-2B Reception System will be enhanced to receive data from the recently launched FY-2C.

2b. Implications for Operational Progress

The upgrade should enhance MSD's capability to track weather systems including tropical storms, so as to better serve the aviation and shipping communities. High-resolution data including satellite cloud grid information data (SCGID) should improve MSD's hotspot detection capability for transboundary pollution monitoring.

2c. Training progress

Overseas training courses or seminars related to tropical cyclones between October 2003 and November 2004:

1. <u>Tropical Cyclone Related Training Overseas Attended by Officers from Meteorological Services Division, National Environment Agency, Singapore</u>
   a. First Roving Seminar of the Typhoon Committee Typhoon Research Co-ordination Group Visiting Lecturer Programme, Seoul, Republic of Korea, 20 – 21 October 2003. One officer participated.
   b. Second Technical Conference on Tropical Cyclones, Storm Surges & Floods, 1 – 3 July 2004. Two officers participated.
   c. International Conference on Storms, Brisbane, Australia, 4 – 12 Jul 2004. Two officers participated.

Professor Hock Lim from the National University of Singapore provided a series of lectures in August and September 2004 on numerical weather prediction with particular focus in the implementation of COAMPS.

2d. Research Progress

As part of the regional efforts to address the transboundary haze pollution problem in the South East Asia, particularly during exceptionally dry seasons, the ASMC uses satellite data to detect forest fires. However, the detection of fires has at times been difficult due to the

presence of sun-glint and clouds. Currently, research work is being carried out to improve the fire detection capability using better algorithms. One promising area is the use of MODIS data in conjunction with the existing detection algorithms developed based on NOAA data. Some initial improvements have already been realized but the full implementation of the new processing is scheduled next year.

The Research Section is also working on operationalising the US-Navy mesoscale NWP model, COAMPS. After that the main tasks would be to do model verification on our regional meteorological phenomena such as monsoon surges, Sumatra squall lines, and diurnal cycles. The end product would be guidance rules on any systematic errors of the model in different seasons. The intent is to develop a verification framework for application on other NWP models as well.

Republic of Korea

1. Research on Extratropical Transition of Tropical Cyclone under Typhoon Committee Research Fellowship Scheme

In 2004, the Korean Meteorological Administration (KMA) invited Dr. Vicente Malano from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) under the Typhoon Committee Fellowship Scheme, funded by KMA for 3 months from May 31 to August 28 2004. During his stay at KMA, he worked on the research on extratropical transition of tropical cyclone. He simulated three tropical cyclone events in 2003, No.2 Kujira, No. 3 Chan-Hom and No. 15 Choi-Wan, using the Moving Nest Typhoon Model (MTM), and onset and completion of the extratropical transition was examined. His result was presented on the seminar held in KMA and a final research report is expected to be submitted to the Typhoon Committee for publication in the Typhoon Committee Annual Review (TCAR).

2. New Barotropic Typhoon Model of KMA

KMA's new barotropic typhoon model, DBAR (Double Fourier Series BARotropic Typhoon Model), which was developed in 2002, was verified during 2003 and 2004 typhoon seasons. The result showed that DBAR has better capability in typhoon forecast than other model, BATS (Barotropic Adaptive-grid Typhoon Simulation Model). In particular, DBAR predicts the typhoon track more accurately than BATS when typhoon is at or after directional turning.
DBAR has been operational since September 2004 and products have been on the web to share them with TC members. It runs four times a day.

3. Introduction of the Communication, Ocean and Meteorological Satellite (COMS) Program

The National Space Program of the Republic of Korea, to lunch a multi-purpose geostationary satellite in 2008, named the Communication, Ocean and Meteorological Satellite (COMS) with ocean and meteorological sensors and a communication payload, has been well in progress in 2004 as scheduled. In particular, a series of works for the selection of a satellite manufacturer, such as bidding, have been successfully conducted.

The major meteorological missions are real-time monitoring of the atmospheric condition, including early detecting of severe weather phenomena like typhoon. The products retrieved data as well as image data from the COMS and are expected to be provided to worldwide users, including TC members, in accordance to LRIT/HRIT global specification of WMO.

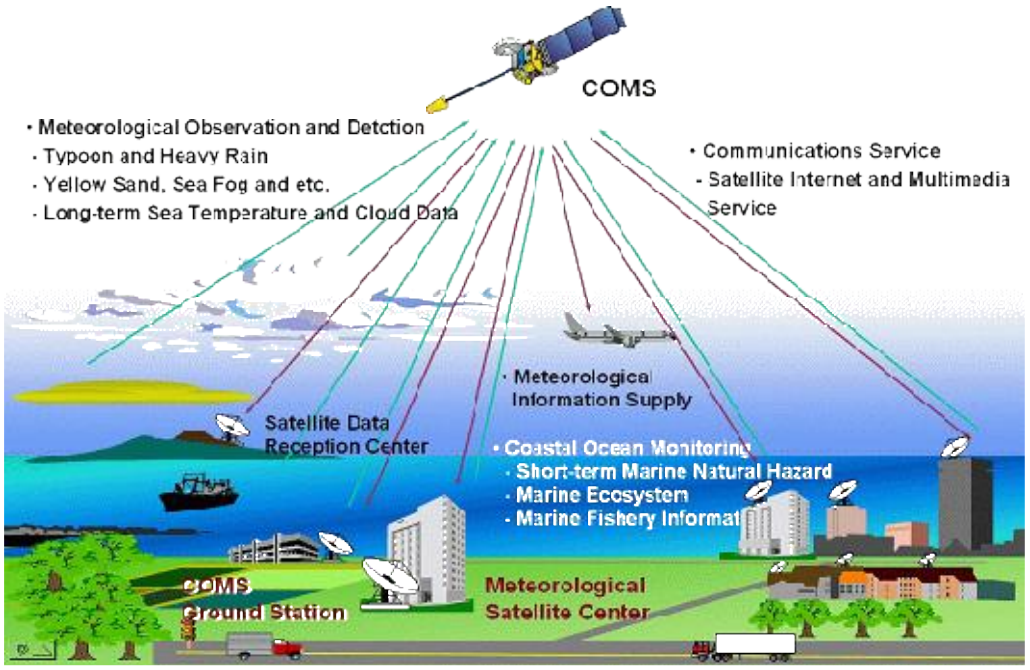


Figure 1. *Application plan of communication, ocean and meteorological satellite(COMS)*

Thailand

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

1a. Hardware and/or Software Progress

+ Three additional C-band radars were purchased by the Thai Meteorological Department (TMD). One is being set up together with a radar tower and related equipment at the Krabi Airport in Krabi Province. The other 2 are assigned to replace the old ones in 2 provinces of Phuket and Rayong. Besides, an S-band radar in Klystron system was also put into position together with a set of satellite workstation in Khao Khiew District, Nakhon Nayok Province. Furthermore, a portable Doppler C-band weather radar was purchased for the Department's mission as well.

+ The speed of the link between the TMD and the Internet Service Provider (ISP) has been upgraded from 256 Kbps to 2 Mbps since November 2003 in order that the needed information and services can be provided to users with higher efficiency.

1b. Implications to Operational Progress

Nil

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

The TMD has participated 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.

1d. Training Progress

Nil

1e. Research Progress

Researches done by the staffs of the TMD are listed below:

- Jet Streams and Jets
- The Basic Analysis and Interpretation of Radar Image from Doppler Radar
- The Satellite Image Analysis by ENVI Program
- Correlation between Tropical Storms in the South China Sea and Wind Speed in the Gulf of Thailand
- Correlation between Tropical Storms in the South China Sea and Wind Speed in the Gulf of Thailand

1f. Other Cooperative/RCPIP Progress

Nil

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

2a. Hardware and/or Software Progress

+ The Fifth-Generation NCAR/Penn State Mesoscale Model or the MM5 software has been applied in both the medium-ranged and the long-ranged weather forecasting tasks of the TMD. Such model is run by the Linux cluster and can generate weather forecast to cover the period of next 10 days.

+ A set of software had been developed to use for data management in META and TAFOR news gathering task of the Bureau of Meteorology for Transportation of the TMD.

+ The Software in the web server and the proxy of the Bureau of Meteorology for Transportation had been updated.

+ Three sets of software have been developed and used in the data base of the marine meteorological tasks of the TMD:
  (1) "MGDR" for accessing the wave height as well as other relevant data from the TOPEX Satellite,
  (2) "GTS_SHIP Translation" for conversing synoptic raw data observed from the sea surrounding Thailand (collected by the GTS_SHIP) into the literate form of the data, and
  (3) "Platform Program" for conversing synoptic raw data (obtained from the UNOCAL) into the literate form of the marine meteorological data.

+ Two computer programmes have been under test at TMD in 2004 to be used as tools to record meteorological elements observed at the synoptic, agrometeorological, and hydrometeorological stations countrywide. Both programmes also contain a mode that allows them to automatically print the report in weekly, 10 days, or the monthly interval. They are expected to save time in data recording, processing, and reporting procedure. Moreover, they are expected to help the Department to reduce the expenses for printing materials as well as distributing them to the users. They both are planned to be officially operated in 2005.

+ A new Automatic Weather Observation System (AWOS) has been assembled at the meteorological station in Mae Hong Son Province while another device of this kind at the Hat Yai Airport was upgraded recently.

+ A new Wind Shear Alert System (WSAS) is being set up to replace an old one at the Southern Meteorological Center (West Coast).

+ A meteorological project has being established at the second International Airport in Bangkok (the Suvarnabhumi Airport). This project is planned to comprise 4 main components: Main Meteorological Operation Office, Aeronautical Meteorological Station, Meteorological Field Station in Runway, and Meteorological Briefing Office.

(1) *Main Meteorological Operation Office* is located on the 6th floor at the ATC Complex building. The office monitors weather conditions, issues warnings whenever necessary, and provides weather maps as well as documents concerning aeronautical meteorological information before distributing them to other internal units and organizations. The meteorological data will be recorded and stored here too.

(2) *Aeronautical Meteorological Station* is fixed to be in the southeastern part of the airport. It will be the site where weather observation can be conducted on regular basis as well as when severe weather takes place. The observation will be practiced by means of the Automatic Weather Observation System (AWOS) together with conventional meteorological instruments and the Doppler S-Band Weather Radar.

(3) *Meteorological Field Station in Runway* is the area where automatic weather equipment and Low Level Wind Shear Alert System (LLWAS) will be installed.

(4) *Meteorological Briefing Office* will be available on the 4th floor at the Passenger Terminal Complex the Main Terminal Building. It is designed to be the place where weather briefing activities will be held and flight documentation will be distributed to airline companies.

+ A radar tower had been constructed before a weather radar was installed at the Hat Yai International Airport in Hat Yai, Songkhla.

+ The NWP Model has been run at TMD with a number of domains: the global (100 km resolution), the Southeast Asia (48 km resolution), and the Bangkok (5 km resolution). The Global, the Southeast Asia, and the Thailand Models are used in the Department's operation (to supply the outputs to the weather forecasting procedure) while the Bangkok Model is used for research purposes only.

+ A marine meteorological research has been carried out by means of soft computing technique at the TMD.

2b. Implications to Operational Progress

+ The communication system at the Northern Meteorological Center has been changed from the IP system into the Virtual Public Network (VPN) with the speed of 256 Mb.

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

+ The data base of marine meteorology has been created in a certain format in which the users can pick any grids in their interests (with the grid system of 0.25 degree x 0.25 degree) to access the marine meteorological data in the chosen grids.

+ The Thai language version in the website: www.aeromet.tmd.go.th, provided by the Bureau of Meteorology for Transportation has been made available. In addition, the weather prediction, satellite images as well as radar and any relevant data have been added in the website. The users can access all needed information from either personal computers at their offices or workstations provided at the Bureau of Meteorology for Transportation.

+ An ocean wave model has been run for ocean wave forecasts in both the Gulf of Thailand and the Andaman Sea on regular basis to add the model outputs in 2 websites: www.tmd.go.th/~marine and www.marinemet.com.

+ 2 websites (www.tmd.go.th/~marine and www.marinemet.com) have been provided to share knowledge on marine meteorology and ocean wave forecasts in both Thai and English to users.

+ The Southern Meteorological Center (East Coast) has improved its website (www.songkhla-met.org) by adding the GIS in it and updating the data as well as information all the time.

2d. Training Progress

Local Training

From 1 October 2003 to 30 September 2004, the TMD has provided training courses to its staff on regularly basis in order to enhance their potentials and to prepare them to cope with advanced technology and recent academic development. The courses provided are shown in table below:

The list of local training courses provided by TMD for its staffs:

No.	Course Title	Duration	No. of Participants
1	Workshop on Aeronautical Meteorology	24-28 Nov. 2003	30
2	Workshop on MM5	15-19, 22-26 Dec. 2003	30
3	Workshop on Meteorological Strategy in ICT Age.	7 Jan. 2004	296
4	English for Communication	10 Feb.-23 Mar. 2004	20
5	Workshop on Meteorological Services in New Millennium	11 Mar. 2004	71
6	Webpage Design	7-11, 14-18 Jun. 2004	60
7	Meteorological Database Construction	20-24 Sep. 2004	29

Besides, the Southern Meteorological Center (East Coast) had provided exhibitions, training courses, and special lecture sessions on correct meteorological knowledge to the public, students and staffs of other related organizations.

Overseas Training

During 1 Oct 2003 – 30 September 2004, the staff of TMD had joined overseas training as shown in table below.

Overseas training courses attended by TMD staff:

No.	Course Title (s)	Duration	Country (-ies)	No. of participant(s)
1	EANET Training on Acid Deposition Monitoring	6 – 13 Oct 2003	Japan	1
2	The 2nd Training Course on Space Technology and Remote Sensing Applications of AP-MCSTA	18 Oct – 16 Nov 2003	China	1
3	Training Workshop on Climate System Monitoring, Diagnosis and Prediction in the Asia-Pacific Region	25 – 28 Nov 2003	Japan	1
4	RA V/RAII Regional Training Seminar on Data Processing and Forecasting System and Improvement of Public Weather Services (PWS)	8 – 19 Dec 2003	Brunei Darussalam	1
5	International Training Seminar on Typhoon Monitoring and Forecasting in the Western North Pacific	12 – 27 Feb 2004	Japan	1
6	Regional Training Workshop on the ASEAN Compendium of Climate Statistics	26 – 28 Feb 2004	Malaysia	2
7	Training Course on Provision of Weather Services via Internet	8 – 12 Mar 2004	Hong Kong China	1
8	RA II/V Training Seminar on Table Driven Code Forms	28 Jun – 2 Jul 2004	Malaysia	1
9	Training Class for GSN/IRIS Station Operators	13 – 17 Sep 2004	U.S.A.	1

The NWP project system has been operated at TMD since 2001. Recently, it has been found that the usage of such model is still limited. Consequently, it is essential for all country members to share expertise related to both NWP Model and researches on tropical cyclones. The TMD has realized that the NWP Model training courses for meteorologists as well as technical training courses, including data assimilation, are needed to ensure that TMD will be able to get the highest advantage from such model. TMD looks to JMS as the ideal organization that can provide such help.

2e. Research Progress

The topics of researches conducted by the staff of TMD are listed below:

- Statistics Analysis Flood Magnitude in Yom River Basin
- Assessment of Radiation for Potential Evapotranspiration
- Track of Tropical Storms move across the Southern Thailand
- Factor of High Waves behind Samui Island
- Prediction of Rainfalls by Relative Vorticity
- The Comparison of Studying and Analysis Result for Forecasting the Dense Fog
- The Comparison of Studying and Analysis Result for Forecasting the Thunderstorm
- Study of Rainfall Intensity-Duration-Frequency Relationship for Hydrometeorological Station
- Study of Location of Peak Rainfall Intensity in Bangkok
- Education Relation of Cold Air Penetrate with Thunderstorms at Donmuang Airport
- Occasions of Poor Visibility at Donmuang Airport
- Influence of Southwest Monsoon on Rain Developed Over the Upper Part of Thailand
- Minimum Temperature Forecasting in the Northern Part of Thailand
- A Statistical Analysis on the Occurrence of Fog at Donmuang Airport
- Verification of Route Forecasts
- Intensity of Drought in Thailand
- The Variations of Rainfall and Temperature over Thailand
- The Analysis of the Parameters Causing Hailstones over Northern and Central Thailand during 11 to 14 January 2002

Additionally, a research concerning an ocean wave model has been conducted with the aim to use it for both statistic and numerical ocean wave forecasts.

2f. Other Cooperative/RCPIP Progress

Nil

3. Opportunities for Further Enhancement of Regional Cooperation

+ The TMD cooperated with the ESCAP to host the Meeting of Working Group on Review of Operations and Structure of the Typhoon Committee (ROSTY) during 20 – 22 April, 2004.

+ The Department had provided an on the job training for 4 meteorologists from Bhutan for 10 days during 3 – 14 May 2004.

+ The Department had provided the attachment of a meteorologist from the Bureau of Meteorology, Australia to learn about tropical cyclone forecasting techniques during 7 – 12 June, 2004.

+ A staff of the Department had an opportunity to join the International Conference on Storms and the Annual National Conferences of the Australian Meteorological and Oceanographic Society (AMOS) and the Meteorological Society of New Zealand (MSNZ) in Australia during 5 – 9 July 2004.

+ Another on the job training had been arranged at the TMD for a meteorologist as well as a meteorological officer from Cambodia for 10 days during 19 – 30 July 2004.

The delegate from the **United States of America** reported that 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.

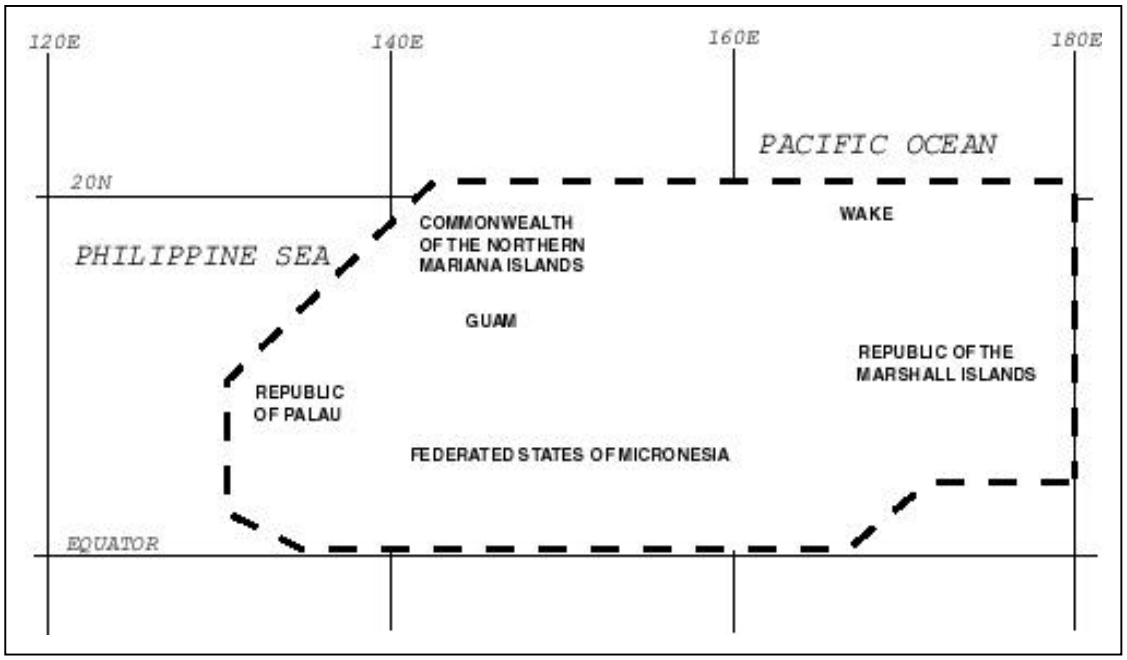


Figure 1. *WFO Guam's area of responsibility (AOR). Within this AOR, WFO Guam issues tropical cyclone watch, warning and advisory products based on JTWC tropical cyclone forecasts.*

When tropical cyclones occur, WFO Guam is the interface between the JTWC and the civilian sectors in Micronesia. The Office uses track, intensity and wind distribution guidance provided by JTWC to produce forecast products that inform the general public and governmental agencies of impending severe weather and its potential impacts.

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

The Interactive Forecast Preparation System (IFPS) became official in the U.S. Pacific Region on 15 October 2004. With this system, meteorologists prepare and manipulate grids of data for several meteorological and oceanographic parameters such as maximum and minimum temperature, wind speed and direction, temperature, dew point, sky cover, weather, visibility, probability of precipitation, combined seas and swells, out to as far as 7 days (see Figure 2). From the grids, formatters and other smart tools create worded forecasts. Grids from all 122 U.S. WFOs are combined into a National Digital Forecast Database (NDFD), which is available to all users/customers. As the paradigm for producing text products begins to shift

from the forecaster to IFPS text formatters, the focus of the meteorologist will, in turn, be directed to better representing the weather as grid-point data and providing quality control for the derived text products. Meteorologists will be able to concentrate on the meteorological/hydrological aspects of the forecast and not so much on the formatting of the words used. As a result, customers/users can then integrate the grids into tailored software for their specific needs.

WFO Guam installed the model 200-2201 NovaVane Wind speed and direction sensor at the facility. This sensor is capable of withstanding typhoon-force winds greater than 100 kt and satisfies one of the recommendations from the Typhoon Pongsona (December 2002) NWS Service Assessment. Despite the many tropical cyclones in the region this year, the new anemometer has yet to be tested with winds in the 100-kt or stronger wind range.

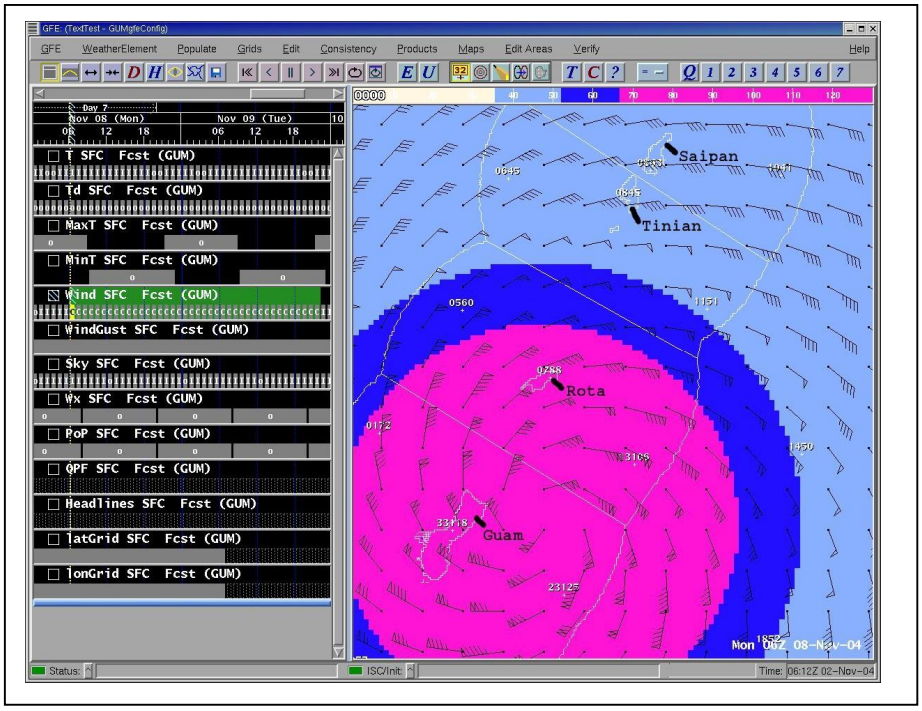


Figure 2. *Screen shot of the IFPS image depicting a typhoon approaching Guam.*

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

The number of island stations for which WFO Guam issues tropical cyclone watches and warnings was increased from 31 to 37. The island governments requested eight new warning sites, while two island sites were discontinued since they were no longer inhabited.

Many of the remote observing systems around Micronesia have become inoperative. Logistics problems associated with the maintenance and replacement of several of the systems has necessitated that these sites be replaced by manned synoptic sites. Eight new synoptic sites are in the process of being activated.

3. Opportunities for Further Enhancement of Regional Cooperation

A WFO Guam Senior Forecaster attended the Working Group on Hydrology meeting in Korea and provided a presentation on landslide/mudslide and flood hazards in Micronesia. The workshop focused on Living with Risk: Dealing with Typhoon-related Disasters as part of Integrated Water Resources Management.

The **U.S. NWS' RSMC Honolulu** – Hurricane Center and Weather Forecast Office (WFO) Honolulu, which is part of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), provides weather forecasts, watches, warnings and advisories within its area of responsibility (AOR). In addition, WFO Honolulu provides public and marine (surf and coastal) products for the State of Hawaii; Terminal Aerodrome Forecasts for 11 locations which include Hawaii (9), Midway Atoll (1), and American Samoa (1); international offshore forecasts within 240 nm of Hawaii, and high seas forecasts, for north central Pacific (140W to 160E and Equator to 30N) and south central Pacific (120W to 160E and Equator to 25S); international SIGMETs for approximately 140W to 130E and Equator to 30N; aviation route forecasts across most of the Pacific; and AIRMETs for Hawaii. The warnings, forecasts, and other products issued by this office are designed to meet the needs of the general public, agriculture, domestic and international aviation, mariners, and other commercial and industrial interests in the State of Hawaii and in the Central North and South Pacific. Communications connect the office to national and international data sources and automated data exchange centers.

When tropical cyclones occur in the central Pacific, RSMC Honolulu provides track, intensity and wind distribution forecast information and uses this information to produce forecast products informing the general public and governmental agencies of impending severe weather.

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

Emergency Managers Weather Information Network (EMWIN). This is a communications system for weather data being broadcasted by GOES 10 and GOES 7 over the Pacific and into east Asia. For a low initial cost and the availability of a computer, any location within the footprint of the satellites can receive these data for no recurring cost. The US is in the process of tailoring the GOES 7 broadcast specifically for the Pacific with added data and graphics. This should be completed in the next 6-12 months.

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

Central Pacific Hurricane Outlook. The Director of RSMC Honolulu - Hurricane Center presented the 2004 hurricane season outlook for the Central Pacific at a press briefing held at the National Weather Service Forecast Office in Honolulu Monday, May 17, 2004 with over 40 persons in attendance. Building on the theme, Be Aware, Be Prepared, he and members of the Honolulu Forecast Office staff provided information on lessons learned from past storms and on new tools for use in future tropical events, including the use of graphical forecasts in tropical events. Speakers included Karen Armes, Acting Director FEMA Region IX, Paul Epstein, Honolulu Police Department Civil Defense Coordinator, and Ed Texiera, Vice Director for Hawaii State Civil Defense. A proclamation from the Governor of Hawaii was presented declaring Hurricane Awareness Week in Hawaii. The press briefing generated extensive local TV and radio coverage. The hurricane outlook was featured on some national media outlets.

Hurricane Charley Service Assessment Team. Jim Weyman, Director RSMC Honolulu - Hurricane Center was selected as the team leader of the 9-member Hurricane Charley Service Assessment Team. The US National Weather Service conducts assessments of its service after large scale weather events. The team went to the affected areas and gathered data from August 24 to September 1, 2004 in southern and central Florida areas. As part of the data gathering were interviews with Emergency Management Personnel, the media, and the general public. The report of this assessment will be published in early 2005.

3. Opportunities for Further Enhancement of Regional Cooperation.

International Pacific Desk Internship. This is a 6 week, one-on-one training on meteorology, tropical cyclones, satellite, etc. which is provided by RSMC Honolulu through the World Meteorological Organization. It is currently targeted for WMO Regional Association V members in the south Pacific, but on a case by case basis could include a select few from east and southeast Asia.

Viet Nam

A. METEOROLOGICAL COMPONENT

- Successfully installed and put into operation 6 automatic air environment observational stations (MCSAM-6-VB) at Lang (48820), Cuc Phuong (Ninh Binh province), Phu Lien (48826), Da Nang (48855), Nha Be (Ho Chi Minh City) and Pleiku (48866).
- Installed 3 new environmental laboratories at Ha Noi, Da Nang and Ho Chi Minh City.
- Installed and put into operation a PCVSAT system (for data collecting and processing).
- Put into operational a nested barotropic model with vortex initialization scheme for the prediction of TC movement in the South China Sea. The model is from Bureau of Meteorology (Australia) and University of Munich (Germany). Global forecast fields at the boundaries are taken from JMA global model (horizontal resolution 1.25°) and/or from BoM GASP model (horizontal resolution 1.5°).

Meteorological Research

- To study and choose a suitable vortex initialization scheme and optimal “steering wind” flow for TC track barotropic model WBAR.

- To run modified HRM model (called HRMVN model, originally developed by DWD) with combined initial and boundary data of global models GME(DWD) and GSM(JMA) for the cases of tropical cyclones and heavy rains.

Training

- Staff of Viet Nam NHMS participated in the following training activities which took place outside Viet Nam:

    1. Two officers attended the Advanced forecasters course in Melbourne, Australia from 13 - 24 October 2003.

    2. One officer attended the Typhoon Committee Roving Seminar in Hong Kong, China from 22-24 October 2003.

    3. One officer attended the training on forecasting, data processing and public weather service system in Brunei from 8 - 12 December 2003.

    4. One officer attended the International training seminar on Typhoon monitoring and forecasting in the western north Pacific, Tokyo, Japan from 12 - 27 February 2004.

5. Two officers attended the training on weather forecast for meteorologists in Seoul, Republic of Korea from 5 - 30 April 2004.

6. One officer attended the International Training Course on Satellite Meteorology in Nanjing, China from 10 June to 9 July 2004.

7. Two officers attended the Second Regional Technical Workshop on Tropical storms, storm surge and flood, 1 - 3 July 2004, Brisbane, Australia and the WMO/AMOS International Workshop on storms, 5 - 9 July 2004, Brisbane, Australia.

8. One officer attended the first High-resolution Regional Model (HRM) workshop in Rio de Janeiro, Brazil, from 6 – 11 September 2004.

9. Two officers attended the International Training course on the detection of severe convective storms by weather Doppler radar at CMA Training Center (CMATC), Beijing, China from 17 to 23 September 2004.

- The following activities were carried out:

1. The VI Chino - Viet Nam seminar on severe weather, Ha Noi, from 23 - 30 November 2003.

2. Seminar on forecasting and forecasting management conducted by an expert from NOAA, from 23 - 27 August 2004 in Ha Noi.

APPENDIX V

REPORT OF THE PRE-SESSION OF THE WORKING GROUP ON METEOROLOGY

(Conference Hall, Shanghai Meteorological Bureau, China, 15 November 2004)

1. The Typhoon Committee held an informal meeting on Monday 15 November 2004 at 0900 a.m. and discussed the organization of the session and its subsidiary bodies. Mr Chow Kok Kee, Chairman of the Typhoon Committee, chaired informal meeting. The meeting agreed to hold three parallel pre-sessions on Meteorology, on Disaster Prevention and Preparedness and Hydrology as decided by the Committee at the 36th session. Furthermore, it was agreed that these pre-sessions address the research and training issues as appropriate.

2. The pre-session Meeting on Meteorology elected Mr Wang Bangzhong (China) as Chairman. Thirty-five participants from China; D.P.R. Korea; Japan; Macao, China; Republic of Korea; Thailand USA; Viet Nam and from ADRC, ISDR Secretariat; UNEP and WMO observers attended the Pre-Session on meteorology.

3. Pre-Session Meeting on Meteorology was the first to be held and therefore there was no agenda prepared in advance. The participants had brainstorming and exchanged views on the best way to proceed. The Meeting agreed to have provisional agenda for its future meetings and requested the TCS to prepare an agenda for its next meeting after consultation with the Chairman of the Working Group on Meteorology when established and WMO.

4. At the beginning of the Meeting a number of issues were raised such as:

   a. The activities that should be addressed and coordinated;
   b. The level of advancement and capacity of various National Meteorological and Hydrological Services (NMHSs);
   c. Sharing the experiences among the Members,
   d. Linkages with requirements and activities of other TC Working Groups, training and research.
   e. The needs to strengthen the NMHSs of some of TC Members in particular, Cambodia; Lao, PDR and D.P.R, Korea.

   The Meeting exchanged views on the above issues and agreed to address them further under various agenda items of the Committee.

5. The Meeting agreed that the priority areas among others, raising the capacity of forecasting and warnings, human resources development and the exchange of experience on equipment and facilities.

6. The Meeting agreed that the 3 components (meteorology, hydrology and DPP) to be well coordinated, Members were encouraged to increase the linkages within their institutions.

7. The Meeting encouraged the Members to work in a coordinated manner on the implementation of the various activities in particular, in observation networks, forecasting and warnings, communication and training. This would lead to better achieving the related goals and objectives of meteorology component in the RCPIP.

8. The Meeting noted with appreciation that WMO has launched its Natural Disaster Mitigation and Prevention Programme and the WMO's target to reduce, by 50 per cent over the decade 2010-2019 the associated ten-year average fatalities of 1995-2004 for natural disasters of meteorological, hydrological and climatic origin. WMO and NMHSs are promoting a culture of prevention and pre-disaster strategies as part of national and regional disaster preparedness plans, building upon an improved knowledge base, strong institutions and public outreach and education. The Meeting recommended that this issue should be considered by the Typhoon Committee to adopt the strategy which should be included in the RCPIP.

9. The meeting considered the proposal submitted by Dr. Woo-Jin Lee, chairman TRCG on organizing a Regional Workshop on Effective Tropical Cyclone Warning, which could be held in conjunction with WMO training seminar on ensemble prediction system for region II, and V around May 2005. The meeting noted that the proposed workshop is designed to promote the collaboration among three components of meteorology, hydrology and disaster prevention and preparedness for the mitigation of tropical cyclone related disasters. The meeting supports the proposed workshop, and recommends that necessary arrangements be made for the successful implementation of the workshop in consultation with the working groups in the committee.

10. The Meeting reviewed Meteorological and Disaster Prevention and Preparedness components including training as highlighted in document WRD/TC.37/4, November 2004 on the Progress Made in the Implementation of the RCPIP. The Meeting proposed that the target dates in paragraph 1.1.2, 1.1.6 and 1.2.2 to read 2005 instead of 2004 and paragraph 1.2.1 to read 2007 instead of 2006 and paragraph 1.2.4 to read 2006 instead of 2005. It noted that the action in 1.2.5 was completed and therefore should be deleted. The Meeting agreed to add new paragraph 1.3.5 to reflect the proposal mentioned in paragraph 8 mentioned above. In this regard, the Meeting requested the Secretariat to incorporate them in the RCPIP.

11. The Meeting noted with appreciation the activities of ESCAP, ISDR Secretariat, UNEP, WMO and TCS in the preparation of the World Conference on Distaste Reduction (WCDR), which will be held in Kobe in January 2005. In view of the importance of the Conference to enhance the visibility of the TC, the Meeting encouraged the NMHSs to participate, if possible as members of national delegation and that effort to be made in mobilizing resources to enable active TC Members in meteorology to participate in WCDR. The Meeting recommended that the Chairman of the Working Group on Meteorology when established, attend the WCDR and financial support may be provided from TC Trust Fund.

12. The Meeting recommended that TC to establish a Working Group on Meteorology and to assign a chairman and a vice chairman. The WGM could convene its pre-session meeting prior to the next TC session.

13. The Meeting expressed its appreciation to Mr Wang Bangzhong for his manner of conducting the meeting. The Meeting closed at 17:00hrs on 15 November 2004.

APPENDIX VI

RSMC ACTIVITIES IN 2004 AND IMPLEMENTATION PLAN FOR 2004-2008

1. Provision of RSMC Products

The RSMC Tokyo - Typhoon 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. The Center terminated the provision of prognostic charts of 850-hPa and 200-hPa streamline (FUXT852/202, FUXT854/204: JMH) on 25 March 2004, because numerical weather prediction (NWP) products such as Grid Point Values (GPVs) and observational data, which are needed to make the charts, are available through the RSMC Data Serving System (RSMC-DSS) operated by JMA. Table 1 shows the total numbers of the products issued by the Center in 2004 (as of 30 September).

2. Track Forecast

Operational track forecasts for 21 tropical cyclones which attained TS intensity or higher in 2004 (as of 30 September) were verified against best track data prepared by 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 123 km (120km in 2003) for 24-hour forecast, 239 km (222km) for 48-hour forecast and 361 km (349km) for 72-hour forecast. The annual mean position errors for 24-hour forecast in 2004 are smallest after those in 2003. Position error statistics of 24-, 48- and 72-hour forecasts for each tropical cyclone are shown in Table 2.

From 1 June 2004, JMA introduced smaller probability circles* than before in the tropical cyclone (TC) track forecast. After the introduction (from Conson (0404) to Meari (0421)), the mean radii of probalility circles in 24-, 48-, 72-hour forecasts are 161km (189km in 2003), 281km (342km), and 421km (502km), respectively and their hitting ratios are 76%, 70%, and 69%, respectively.

*A circular range into which the tropical cyclone is expected to move with the probability of 70% at each validation time

3. Intensity Forecast

Table 3 gives root mean square errors (RMSEs) of 24-, 48- and 72-hour intensity forecasts for each tropical cyclone in 2004 (as of 30 September 2004). The annual mean RMSEs of central pressure forecasts were 11.1 hPa (11.0 hPa in 2003), 15.6 hPa (15.3 hPa), and 18.8 hPa (18.5 hPa) for 24-, 48- and 72-hours, respectively, while those of maximum wind speed forecasts for 24 hours were 5.1 m/s (4.9 m/s in 2003), 7.0 m/s (6.5 m/s) and 8.3 m/s (7.6 m/s), respectively. The overall performance of intensity forecasts in 2004 was a little worse than in 2003.

4. RSMC Data Serving System

JMA operates the RSMC Data Serving System (RSMC-DSS) that allows TC Members to retrieve NWP products such as GPVs and observational data through the Internet. RSMC-DSS is serving nine user countries/territories through the Internet as of 30 September 2004. 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 launched the Numerical Typhoon Prediction (NTP) Web Site on 1 October 2004. The NTP Web site offers predictions of tropical cyclone tracks performed by the

model 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.

At the request of TC members during the thirty-third session of TC held in Macao, China in December 2000, JMA set up the Web site in September 2002 on a trial base. After a series of improvement of the site contents, on 1 October 2004, the Web site made a full-fledged start with cooperation of eight NWP centers; BOM (Australia), CMC (Canada), DWD (Germany), ECMWF, KMA (Republic of Korea), NCEP (USA), UKMO (UK) and JMA.

The contents of the Site includes:

1) a data table and a chart of the latest predicted positional data of the pariticpating NWPcenters 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
2) maps of the NWP models of the participating NWP centers.

An example of the chart of predicted positional data is shown in Figure 2.

The NTP Web Site is expected to contribute to the improvement of the disaster prevention activities related to Tropical Cyclones by TC members not only as a quick reference for the numerical predictions of typhoons by the leading NWP centers, but also as an effective tool for making the most of those valuable products through ensemble averaging.

6. Questionaire on the 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, who provides the Members with SAREP and RADOB, sent a questionnaire to the Members to collect information on the Members' current status of the use of SAREP and RADOB and their views on the migration of RADOB and SAREP to BUFR.

Six Members returned the questionnaire. Five out of them can not receive the BUFR format currently. Four out of the five Members intend to receive the BUFR format in two to four year. Two Members answered that they will participate in the validation test.

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

6. Publication

The Center published:

1) "Technical Review (No.7)" in March 2004 that contains the following papers

   - Improvement to the JMA Typhoon Model by using new physical processes
   - Development of a cumulus parameterization scheme for the operational global model at JMA
   - Operational use of ATOVS radiance in global data assimilation at JMA

- Assimilation of QuikSCAT/SeaWinds ocean surface wing data into the JMA Global Data Assimilation System

2) “Annual Report on Activities of the RSMC Tokyo-Typhoon Center in 2003” in November 2004. (soon be available at the web page of JMA/RSMC Tokyo Typhoon Center)

7. Training

<International seminar>

The “International Training Seminar on Typhoon Monitoring and Forecasting in the Western North Pacific” was held from 12-27 February 2004 in Tokyo with participation of four experts from four countries; Malaysia, Palau, Thailand and Vietnam. 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.

<Attachment to RSMC>

Two forecasters from Hong Kong, China and Malaysia stayed at the Center from 28 July to 6 August 2004 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 were experienced the analysis and forecasts for a typhoon TY DIANMU (0406) in reference to the operational procedures of the Center.

< Group Training Course in Meteorology>

JMA conducts the Group Training Course in Meteorology every year. The Training Course focuses on "Utilization of satellite data including nephanalysis", "Application of numerical predictions", and "Application of climate information", which are increasingly essential to developing countries for their operational forecasting. In September, the Training Course for 2004 started with eight participants from eight countries, including Cambodia and Laos.

<Typhoon Roving Seminar>

Typhoon Roving Seminars will be held in Beijing, China, from 22 to 24 November 2004, and Kuala Lumpur, Malaysia, from 25 to 27 November 2004 with the support of WMO in response to the proposal approved at the thirty-sixth session of the Typhoon Committee. Head of National Typhoon Center is going to give lectures on overview of RSMC Tokyo, analysis and forecast of typhoon at RSMC Tokyo, Numerical Weather Prediction (NWP) Models of JMA, ensemble forecast of typhoon tracks, and the Numerical Typhoon Prediction (NTP) Web Site formally inaugurated by JMA as of 1 October 2004.

8. Implementation Plan

Table 5 shows the implementation plan of the RSMC Tokyo-Typhoon Center for the period from 2004 to 2008.

Table 1 Monthly and annual total numbers of products issued by the RSMC Tokyo - Typhoon Center in 2004 (as of 30 September)

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TCNA20	0	0	0	46	41	111	61	163	87				**509**
TCNA21	0	10	1	46	43	119	68	178	95				**560**
WTPQ20-25	0	20	2	95	91	241	138	364	190				**1141**
WTPQ30-35	0	4	1	24	22	59	36	94	48				**288**
FXPQ20-25	0	15	1	70	68	178	100	259	140				**831**
FKPQ30-35	0	10	1	48	44	120	68	179	94				**564**
AXPQ20	0	0	0	0	1	2	4	2	7				**16**
AUXT85 **AUXT20**	62	58	48										**168**
FUXT852 **FUXT854**	62	58	48										**168**
FUXT202 **FUXT204**	62	58	48										**168**

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

- via the JMH Meteorological Radio Facsimile -

Analysis of 850 and 200 hPa Streamline	AUXT85/AUXT20
Prognosis of 850 hPa Streamline	FUXT852/FUXT854
Prognosis of 200 hPa Streamline	FUXT202/FUXT204

Table 2 Mean Position Errors of 24-, 48- and 72-hour Operational Forecasts in 2004 (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 (%)
TY	SUDAL	(0401)	107	52	42	60	236	74	38	53	343	107	34	44
TY	NIDA	(0402)	96	52	24	40	197	145	20	28	274	185	16	22
STS	OMAIS	(0403)	245	83	9	85	219	71	5	33	443	-	1	-
TY	CONSON	(0404)	229	110	15	138	780	273	10	137	1498	430	6	144
STS	CHANTHU	(0405)	236	48	6	140	361	32	2	-	-	-	0	-
TY	DIANMU	(0406)	119	65	29	49	182	85	25	32	244	173	21	29
TY	MINDULLE	(0407)	130	84	39	60	228	152	35	50	281	194	31	36
TY	TINGTING	(0408)	100	50	29	46	188	96	25	34	333	128	21	33
TS	KOMPASU	(0409)	152	133	6	19	476	137	2	-	-	-	0	-
TY	NAMTHEUN	(0410)	76	46	27	45	142	93	22	38	189	75	17	39
TS	MALOU	(0411)	-	-	0	-	-	-	0	-	-	-	0	-
TY	MERANTI	(0412)	166	86	15	108	372	153	11	135	608	152	7	226
TY	RANANIM	(0413)	140	106	14	71	333	283	10	68	580	247	6	92
TS	MALAKAS	(0414)	122	56	7	37	267	89	3	28	-	-	0	-
TY	MEGI	(0415)	183	104	13	30	320	194	9	20	1148	516	5	43
TY	CHABA	(0416)	110	70	43	55	173	114	39	42	248	178	35	42
TY	AERE	(0417)	111	85	21	65	175	144	17	42	326	169	13	51
TY	SONGDA	(0418)	117	60	40	56	254	162	36	58	376	288	32	60
STS	SARIKA	(0419)	124	46	6	97	85	-	1	-	-	-	0	-
TS	HAIMA	(0420)	62	32	4	40	-	-	0	-	-	-	0	-
TY	MEARI	(0421)	98	50	33	46	251	149	29	54	382	297	25	54
Mean(Total)			123	80	422	56	239	178	339	48	361	308	270	46

EO/EP indicates the ratio of EO (mean position error of operational forecasts) to EP (mean posi
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 2004 (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
TY	SUDAL	(0401)	8.9	3.9	42	10.1	4.1	38	13.1	5.1	34
TY	NIDA	(0402)	11.9	5.8	24	21.5	9.7	20	26.3	11.7	16
STS	OMAIS	(0403)	8.1	5.4	9	0.9	1.6	5	6.0	5.1	1
TY	CONSON	(0404)	11.0	6.1	15	16.0	8.9	10	17.8	10.1	6
STS	CHANTHU	(0405)	10.0	6.0	6	11.9	7.5	2	-	-	0
TY	DIANMU	(0406)	12.6	4.1	29	18.2	6.0	25	16.1	5.7	21
TY	MINDULLE	(0407)	9.6	4.7	39	14.2	6.8	35	13.6	7.2	31
TY	TINGTING	(0408)	11.8	3.4	29	12.7	4.3	25	12.8	4.4	21
TS	KOMPASU	(0409)	3.3	2.3	6	5.1	16.5	2	-	-	0
TY	NAMTHEUN	(0410)	17.2	8.0	27	20.3	8.8	22	16.1	8.3	17
TS	MALOU	(0411)	-	-	0	-	-	0	-	-	0
TY	MERANTI	(0412)	15.1	7.8	15	17.8	9.5	11	22.0	11.6	7
TY	RANANIM	(0413)	7.7	4.5	14	10.6	7.3	10	14.6	10.0	6
TS	MALAKAS	(0414)	2.4	1.4	7	6.2	3.6	3	-	-	0
TY	MEGI	(0415)	5.9	3.6	13	12.5	7.9	9	12.7	9.4	5
TY	CHABA	(0416)	13.4	7.0	43	22.2	9.9	39	31.3	13.3	35
TY	AERE	(0417)	5.5	3.4	21	5.8	2.2	17	8.1	5.0	13
TY	SONGDA	(0418)	12.7	4.3	40	12.3	4.4	36	16.0	5.1	32
STS	SARIKA	(0419)	7.1	3.9	6	0.0	2.6	1	-	-	0
TS	HAIMA	(0420)	5.7	5.0	4	-	-	0	-	-	0
TY	MEARI	(0421)	8.5	4.3	33	14.4	6.5	29	18.9	8.4	25
Mean(Total)			11.1	5.1	422	15.6	7.0	339	18.8	8.3	270

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,ζ) 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*,ζ) 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,Cl) 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, ζ) 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:
CI : cloud cover (total)
RH :relative humidity
U : u-component of wind
ζ : relative vorticity
ω : vertical velocity
P : pressure reduced to MSL
T : temperature
V : v-component of wind
χ : velocity potential
R : total precipitation
TTd : dew point depression
Z : geopotential height
ψ : stream function

Products/ Data	Satellite data	Typhoon Information	Global Wave Model (GRIB)	Observational data
Contents	(a) GOES-9 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 (2004-2008)

PRODUCT	2004	2005	2006	2007	2008	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),
						20 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, SATOB)	———	———	———			4-8 times/day Dvorak intensity***
SAREP (for tropical cyclones, BUFR)			----	———	———	(estimation included)
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	2004	2005	2006	2007	2008	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 September 2004)

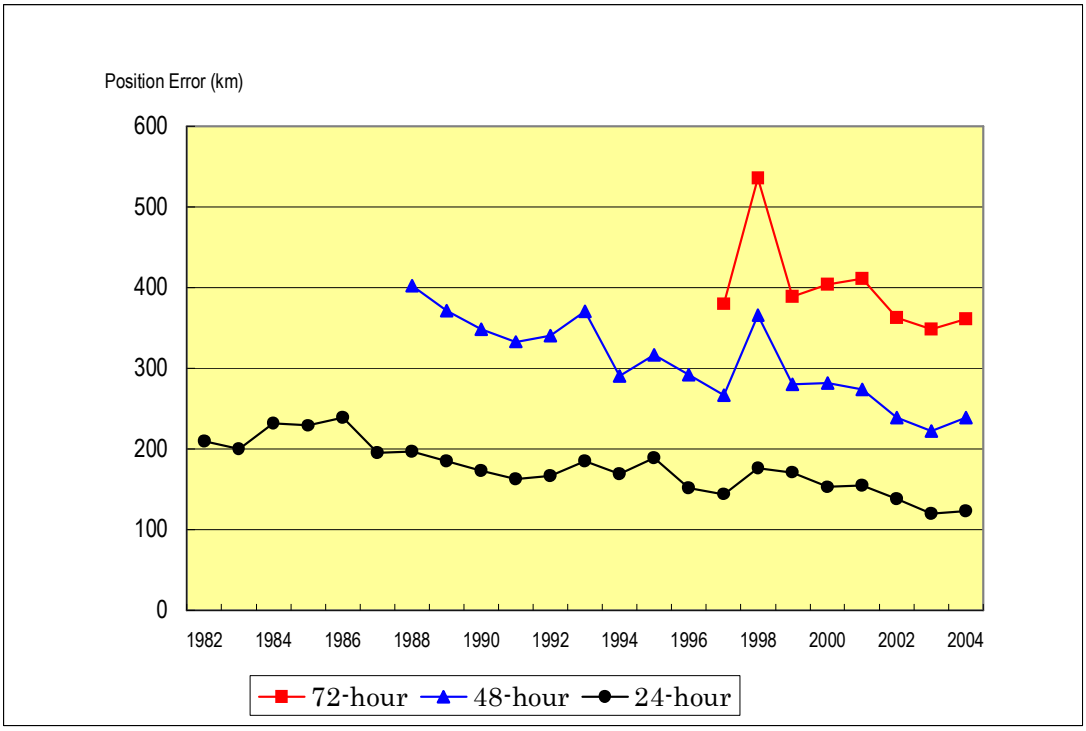
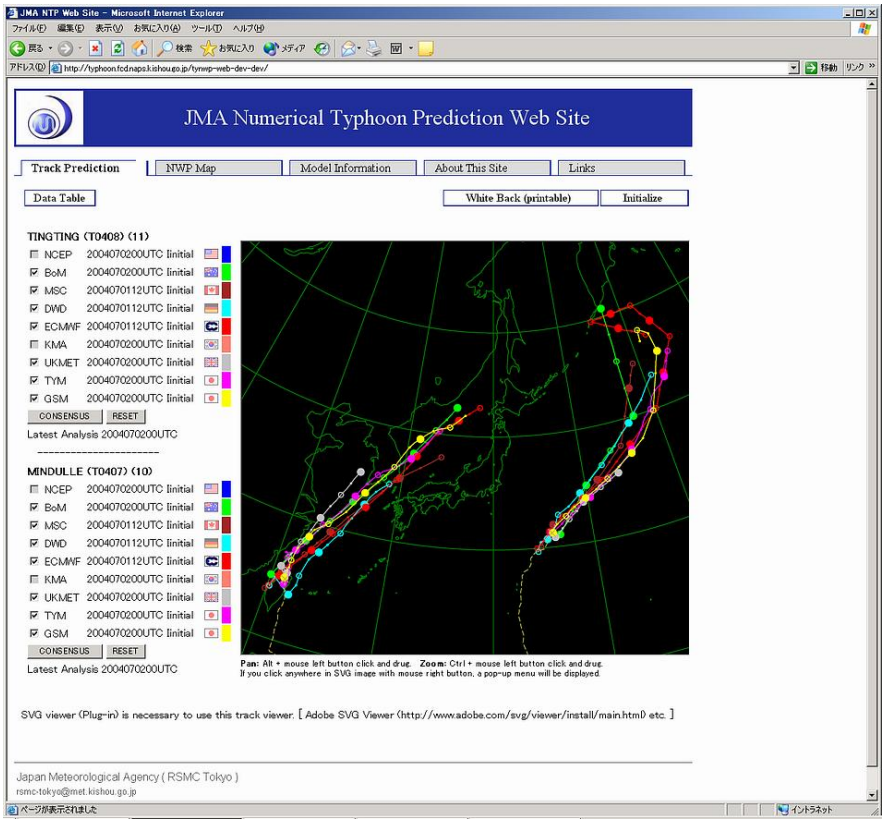


Figure 2 A chart of track predictions of MINDULLE (0407) and TINGTING (0408) at 00UTC, 2 July 2004 on the NTP Web site.



APPENDIX VII

REPORT ON AMENDMENTS TO THE TYPHOON COMMITTEE OPERATIONAL MANUAL

Introduction

1. The Typhoon Committee Operational Manual - Meteorological Component (TOM) has been reviewed and updated every year since the first issue in 1987. The 2004 edition of TOM was published in February 2004 in accordance with the approval of amendments to the previous issue of TOM at the thirty-sixth session of the Typhoon Committee (15 to 20 December 2003, Kuala Lumpur, Malaysia) as proposed by the rapporteur.

2. At the thirty-sixth session, the Committee decided that a rapporteur of the Japan Meteorological Agency (JMA) would continue the services for updating TOM. On 1 July 2004, 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 2004, proposals were submitted by the seven focal points of Hong Kong/China, Malaysia, Japan, Republic of Korea, Singapore, Thailand and Viet Nam.

4. Major points of the proposed amendments are as follows:

   - Amendment to Chapter 2 to add newly-developed upper-air synoptic observations including wind profiler observations.

   - Amendment to Chapter 5 to update the table and figure due to the addition of a regional circuit between Hong Kong and Macao, the development of MTN between Beijing and Tokyo and a inter-regional circuit between Tokyo and Manila, and a regional circuit between Beijing and Hanoi.

   - Amendment to Appendix 2-A and 2-B to add a surface observing station and an upper-air observing station in Thailand.

   - Amendment to Appendix 2-D to amend the technical specifications of radars of Thailand, to add new radar stations of Republic of Korea and Viet Nam and to change radar stations of Malaysia.

   - 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 of Japan, Malaysia, Republic of Korea, Singapore, and Thailand.

   - Amendment to Appendix 3-B and 3-D to update operational tropical cyclone track forecast method of Republic of Korea.

   - Amendment to Appendix 3-B and Appendix 3-D to update operational tropical cyclone track forecast method of Viet Nam.

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				
				<< to be added after line 40.>>
7			→	In addition to the upper-air synoptic observations, newly developed obsevations such as wind profiler observations should be carried out when possible and the data should be made available to the Typhoon Committee Members.
CHAPTER 3				
10	23	GMS data	→	GOES data
15	12	*Table 3.3*		*<< to be replaced.>>*
		GOES data (a) Digital data (GRIB) Cloud amount Convective cloud amount Equivalent blackbody temperature (b) Satellite-derived high density cloud motion vectors (BUFR) (a) 4 times a day (00,06,12 and 18UTC) (b) Once a day (04UTC)	→	Satellite data GOES-9 data (GRIB) Equivalent black body temperature 4 times a day (00, 06, 12 and 18UTC)
15	12	*Forecast hours of the Global Wave Model in Table 3.3*		*<< to be replaced.>>*
		……. 54, 60, 72, 78, ……	→	…… 54, 60, 66, 72, 78, ……..
CHAPTER 5				
				<< to be replaced.>>
22	4	Figure 5.1	→	*new figure (see **Attachment C5-1**)*
23	1	Table 5.1	→	*new table (see **Attachment C5-2**)*
Appendix 1-B				
				<< to be added between line 23 and 24.>>
1			→	MTSAT Multi-functional Transport Satellite
Appendix 2-A				
				<< to be replaced.>>
		Thailand		
2		…… 432, 456, ……	→	…… 432, 455, 456, ……..
Appendix 2-B				
				<< to be replaced.>>
		Thailand		
2		…… 551, 568	→	…… 551, 565, 568

Page Line	Present Description	Proposed Amendment
Appendix 2-C		
		<< to be replaced.>>
	station number in the figure	
1	474937	→ 47937
Appendix 2-D		
		<< to be replaced.>>
9-10	*(Name of Member Malaysia)*	→ *new table (see **Attachment A2D-1**)*
13	*(Name of Member Republic of Korea)*	→ *new table (see **Attachment A2D-2**)*
15-18	*(Name of Member Thailand)*	→ *new table (see **Attachment A2D-3**)*
		<< to be added after page 19.>>
		→ *(Name of Member Viet Nam)*
		*new table (see **Attachment A2D-4**)*
Appendix 2-E		
		<< to be replaced.>>
		→ *new document (see **Attachment A2E**)*
Appendix 2-F		
		<< to be replaced.>>
		→ *new table (see **Attachment A2F**)*
Appendix 3-B		
		<< to be replaced.>>
16	*(Name of the Member Republic of Korea)*	→ *new table (see **Attachment A3B-1**)*
23	*(Name of the Member Viet Nam)*	→ *new table (see **Attachment A3B-2**)*
Appendix 3-D		
		<< to be replaced>>
		→ *new text (see **Attachment A3D**)*
Appendix 3-E		
		<< to be replaced>>
		→ *new text (see **Attachment A3E**)*
Appendix 5-A		
1 21	*Hong Kong, China*	*<< to be replaced>>*
	(Attn. S.T. Lai)	→ (Attn: Mrs. Hilda Lam)
	E-mail: stlai@hko.gov.hk	→ E-mail: hildalam@hko.gov.hk
	Malaysia	*<< to be replaced>>*
2 10	Tel.: (+60)(3) 7956 9697	→ Tel.: (+60)(3) 7957 8116
		<< to be added after line 13>>
		→ E-mail: cfo@kjc.gov.my
	Thailand	*<< to be replaced>>*
32	Director-General: Dr. Parapansak Buranaprapa	→ Director-General: Mr. Anant Thensathit
40	Director: Pairat Sangsnit	→ Director: Dr. Somsri Huntrakul

5.4 Meteorological telecommunication network for the Typhoon Committee region

The network is shown in Fig. 5.1 and its present status is summarized in Table 5.1.

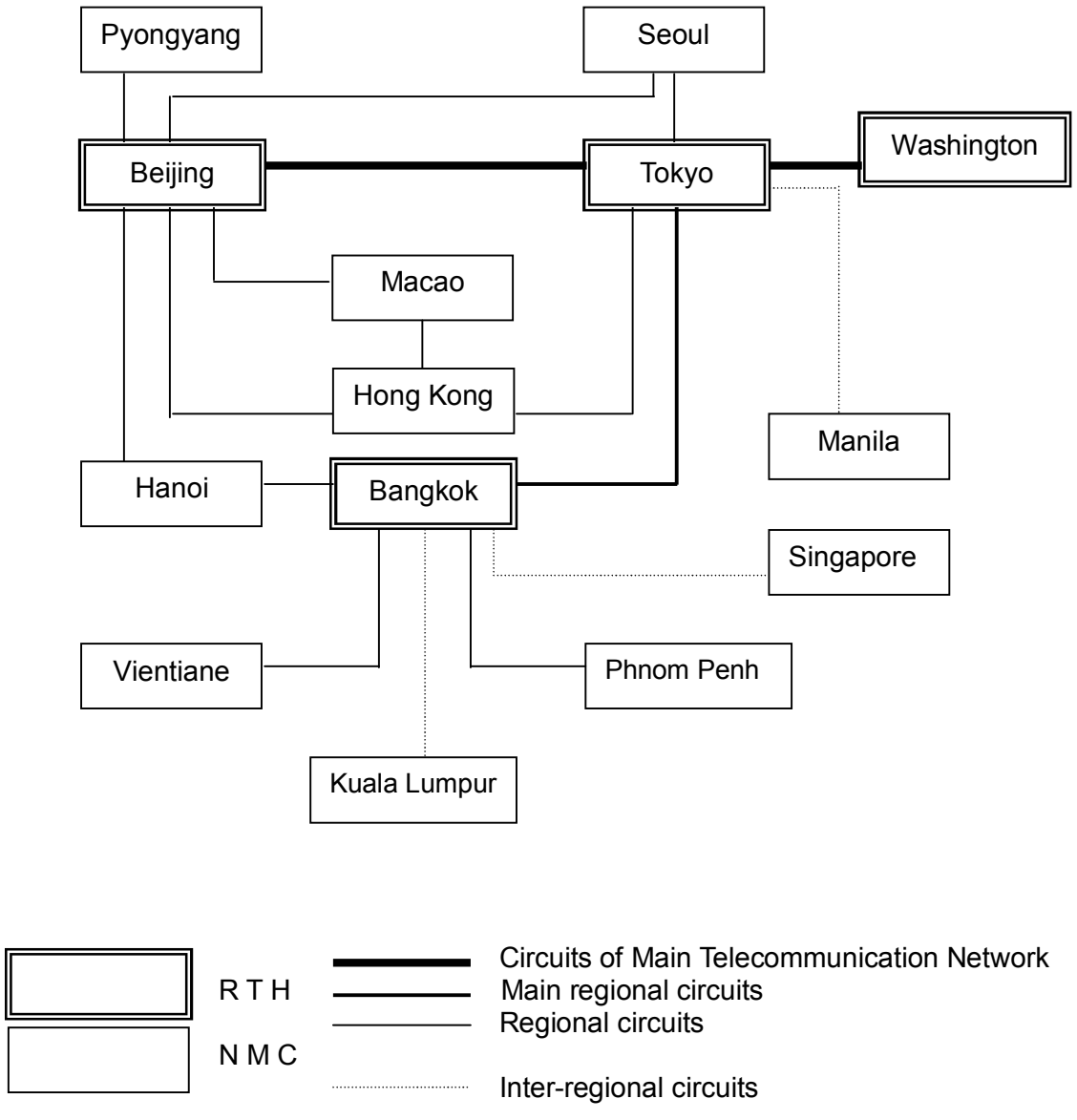


Fig. 5.1: Meteorological telecommunication network for the Typhoon Committee

Table 5.1: Present operational status of the meteorological telecommunication network for the Typhoon Committee region

1.	Main Telecommunication Network	Present Operational Status
	Beijing - Tokyo	Cable (FR), 48 Kbps (CIR) TCP/IP
	Washington - Tokyo	Cable (FR), 32 Kbps from Tokyo / 768 Kbps from Washington (CIR) TCP/IP
2.	Main regional circuit	
	Tokyo - Bangkok	Cable (FR), 16 Kbps (CIR) TCP/IP
3.	Regional circuits	
	Bangkok - Beijing	Cable, 9600 bit/s X.25
	Bangkok - Hanoi	Cable, 1200 bauds
	Bangkok - Phnom Penh	Fax
	Bangkok - Vientiane	DDN, 64Kbps, FTP Protocol
	Beijing - Hanoi	Cable, 75 bauds PC VSAT (Satellite broadcast)
	Beijing - Hong Kong	Cable, 64 Kbit/s TCP/IP
	Beijing - Macao	ISDN 64 Kbit/s IP connection
	Beijing - Pyongyang	Cable, 75 bauds; PC VSAT (Satellite broadcast)
	Beijing - Seoul	Cable (FR), 32 Kbit/s (CIR) TCP/IP
	Hong Kong – Macao	ISDN, 128Kbit/s, TCP/IP
	Tokyo - Hong Kong	Cable (FR), 16 Kbit/s (CIR) TCP/IP
	Tokyo - Seoul	Cable (FR), 16 Kbit/s (CIR) TCP/IP

4. Inter-regional circuits

Bangkok - Kuala Lumpur	Cable, 16Kbps, Frame Relay
Tokyo - Manila	Cable, 16Kbit/s (CIR) TCP/IP
Bangkok - Singapore	Cable, 2400 bit/s

5. RTH radio broadcast

Bangkok	1 FAX
Beijing	1 FAX (Shanghai)
Tokyo	1 FAX

6. Satellite broadcast

Operated by China: Asiasat-2 (100.5°E)	Operational data, fax and image distribution
Operated by Japan: GMS-5 (140°E)	Operational satellite image distribution

5.5 Addresses, telex/cable and telephone numbers of the tropical cyclone warning centres

A list of addresses of the tropical cyclone warning centres of the Typhoon Committee Members, together with their telex/cable and telephone numbers, is given in Appendix 5-A.

5.6 Abbreviated headings of tropical cyclone advisories and warnings

The abbreviated headings of meteorological messages containing tropical cyclone advisories issued by the RSMC Tokyo - Typhoon Center shall be:

(i) analysis and forecast - WTPQ20 RJTD through WTPQ25 RJTD;

(ii) prognostic reasoning - WTPQ30 RJTD through WTPQ35 RJTD;

(iii) numerical prediction - FXPQ20 RJTD through FXPQ25 RJTD.

The abbreviated headings of meteorological bulletins used for the exchange of tropical cyclone warnings by the Typhoon Committee Members are given in Appendix 5-B.

5.7 Exchange of information related to tropical cyclones

Collection and dissemination of observational and processed data plus warnings related to tropical cyclones at Regional Telecommunication Hubs (RTHs) and National Meteorological Centres (NMCs) are summarized in Appendix 5-C.

The meanings of the symbols used in abbreviated headings in the meteorological messages transmitted to the GTS are listed in Appendix 5-D. The details are described in the Manual on the Global Telecommunication System (WMO Publication No. 386) and Weather Reporting Volume C - Transmissions, Chapter I Catalogue of Meteorological Bulletins (WMO Publication No. 9).

_____

Name of the Member **Malaysia - 1**

NAME OF STATION		Alor Star	Kota Bharu	Kuala Lumpur (Sepang)	Kuala Lumpur (Subang)	Kluang
SPECIFICATIONS						
Index number		48603	48615	48650	48647	48672
Location of station		6° 11´ N 100° 24´ E	6° 10´ N 102° 17´ E	2° 51´ N 101° 40´ E	3° 07´ N 103° 13´ E	2° 01´ N 103° 19´E
Antenna elevation	m	24	33	25	32	113
Wave length	cm	10	10	10	10	10
Peak power of transmitter	kW	650	650	750	650	650
Pulse length	μ s	0.8 and 2	2	1 and 3	2	0.8 and 2
Sensitivity minimum of receiver	dBm	-110 (.8 μs) -113 (2 μs)	-113	-110 (.8 μs) -115 (3 μs)	-113	-110 (.8 μs) -113 (2 μs)
Beam width (Width of over -3dB antenna gain of maximum)	deg	2	2	1	2	2
Detection range	km	400	400	400	400	400
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		1	1	1	1	1
DATA PROCESSING						
MTI processing 1.Yes, 2.No		2	2	2	2	2
Doppler processing 1.Yes, 2.No		2	2	1	2	2
Display 1.Digital, 2.Analog		1	1	1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		3 (every 10 mins)	3 (every 10 mins)	3 (every 5 mins)	3 (every 10 mins)	3 (every 10 mins)
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1 (from Mar 2005)	1	1	1	1 (from Mar 2005)

Name of the Member **Malaysia - 2**

NAME OF STATION		Kuantan	Butterworth	Kuching	Bintulu	Kota Kinabalu
SPECIFICATIONS						
Index number		48657	48602	96413	96441	96471
Location of station		3° 47´ N 103° 13´ E	5° 28´ N 100° 23´ E	1° 29´ N 110° 20´ E	3° 13´ N 113° 04´ E	5° 56´ N 116° 03´E
Antenna elevation	m	32	20	57	151	27
Wave length	cm	10	10	5	5	5
Peak power of transmitter	kW	650	650	250	250	250
Pulse length	μ s	2	2	2	2	2
Sensitivity minimum of receiver	dBm	-113	-113	-113	-113	-113
Beam width (Width of over -3dB antenna gain of maximum)	deg	2	2	1.6	1.6	1.6
Detection range	km	400	400	250	250	250
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		1	1	1	1	1
DATA PROCESSING						
MTI processing 1.Yes, 2.No		2	2	2	2	2
Doppler processing 1.Yes, 2.No		2	2	2	2	2
Display 1.Digital, 2.Analog		1	1	1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		3 (every 10 mins)	3 (every 10 mins)	3 (every 10 mins)	3 (every 10 mins)	3 (every 10 mins)
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1	1	1	1	1

Name of the Member **Malaysia - 3**

NAME OF STATION		Sandakan				
SPECIFICATIONS						
Index number		96491				
Location of station		5° 54´ N 118° 04´ E				
Antenna elevation	m	28				
Wave length	cm	5				
Peak power of transmitter	kW	250				
Pulse length	μ s	2				
Sensitivity minimum of receiver	dBm	-113				
Beam width (Width of over -3dB antenna gain of maximum)	deg	1.6				
Detection range	km	250				
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		1				
DATA PROCESSING						
MTI processing 1.Yes, 2.No		2				
Doppler processing 1.Yes, 2.No		2				
Display 1.Digital, 2.Analog		1				
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		3 (every 10 mins)				
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1				

Name of the Member **Republic of Korea - 1**

NAME OF STATION		Gwanaksan	Gosan	Busan	Donghae	Gunsan
SPECIFICATIONS	Unit					
Index number		47116	47185	47160	47106	47144
Location of station		37° 26′ N 126° 58′ E	33° 17′ N 126° 10′ E	35° 07′ N 129° 00′ E	37° 30′ N 129° 08′ E	36° 01′ N 126° 47E
Antenna elevation	m	637	81	532	53	227
Wave length	cm	5.6	5.6	5.6	5.6	5.6
Peak power of transmitter	kW	250	250	250	250	250
Pulse length	μ s	2/0.5	2/0.8	2/0.8	2/0.8	2/0.8
Sensitivity minimum of receiver	dBm	- 108	- 108	- 108	- 108	- 108
Beam width (Width of over -3dB antenna gain of maximum)	deg	1.2	1.2	1.2	1.2	1.2
Detection range	km	240km (volume scan) 480km (the lowest tilt)	240km (volume scan) 480km (the lowest tilt)	240km (volume scan) 480km (the lowest tilt)	240km (volume scan) 480km (the lowest tilt)	240km (volume scan) 480km (the lowest tilt)
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		2, 3	2, 3	2, 3	2, 3	2, 3
DATA PROCESSING						
MTI processing 1.Yes, 2.No		2	2	2	2	2
Doppler processing 1.Yes, 2.No		1	1	1	1	1
Display 1.Digital, 2.Analog		1	1	1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		3 (continuous)	3 (continuous)	3 (continuous)	3 (continuous)	3 (continuous)
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1	1	1	1	1

Name of the Member **Republic of Korea - 2**

NAME OF STATION		Baengyeongdo	Jindo	Gwangdeoksan		
SPECIFICATIONS	Unit					
Index number		47102	47175	47094		
Location of station		37°56´N 124°40´E	34°28´N 126°19´E	38°12´N 127°43´E		
Antenna elevation	m	185	494	1,066		
Wave length	cm	5.6	10.4	10.4		
Peak power of transmitter	kW	250	750	750		
Pulse length	μ s	2-10/1.0	2.5/0.85	4.5/1.0		
Sensitivity minimum of receiver	dBm	-108	-110	-114		
Beam width (Width of over -3dB antenna gain of maximum)	deg	0.95	1.0	0.97		
Detection range	km	240km (volume scan) 512km (the lowest tilt)	240km (volume scan) 480km (the lowest tilt)	240km (volume scan) 480km (the lowest tilt)		
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		2, 3	2, 3	2,3		
DATA PROCESSING						
MTI processing 1.Yes, 2.No		2	2	2		
Doppler processing 1.Yes, 2.No		1	1	1		
Display 1.Digital, 2.Analog		1	1	1		
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		3 (continuous)	3 (continuous)	3 (continuous)		
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1	1	1		

Name of the Member **Thailand - 1**

NAME OF STATION		Hua Hin	Rayong	Chumpom	Ranong	Surat Thani
SPECIFICATIONS	Unit	s-band	Temporary closed	c-band	x-band	s-band
Index number		48475	48478	48517	48532	48551
Location of station		12° 35´ N 99° 57´ E	12° 38´ N 101° 20´ E	10° 29´ N 99° 11´ E	9° 47´ N 98° 36´ E	9° 08´ N 99° 09´ E
Antenna elevation	m	27		34	45	35
Wave length	cm	10		5	3	10
Peak power of transmitter	kW	500		250	200	500
Pulse length	μ s	0.8&2		0.8&2	0.5&1	0.8&2
Sensitivity minimum of receiver	dBm	-106		-108	-108	-106
Beam width (Width of over -3dB antenna gain of maximum)	deg	2.1		1.1	2	1.2
Detection range	km	240		240	120	240
Scan mode in observation elevation 1.Fixed 2.CAPPI 3.Manually controlled		2, 3		2, 3	2, 3	2, 3
DATA PROCESSING						
MTI processing 1.Yes, 2.No		1		1	1	1
Doppler processing 1.Yes, 2.No		1		1	1	1
Display 1.Digital, 2.Analog		1		1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		1, 3		1, 3	1, 3	1, 3
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1		1	1	1

Name of the Member **Thailand - 2**

NAME OF STATION		Khon Khaen	Ubol	Surin	Bangkok	Donmuang
SPECIFICATIONS	Unit	s-band	c-band	s-band	x-band	s-band
Index number		48381	48407	48432	48455	48456
Location of station		16° 16´ N 102° 28´ E	15° 14´ N 105° 02´ E	14° 53´ N 103° 29´ E	13° 23´ N 100° 36´ E	13° 55´ N 100° 36´ E
Antenna elevation	m	196	153	175	60	45
Wave length	cm	10	5	10	3	10
Peak power of transmitter	kW	500	250	500	25	500
Pulse length	μ s	0.8&2	0.8&2	0.8&2	0.5&1	0.8&2
Sensitivity minimum of receiver	dBm	-106	-108	-106	-108	-106
Beam width (Width of over -3dB antenna gain of maximum)	deg	1.2	1.1	2.1	2.5	1.2
Detection range	km	240	240	240	120	240
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		2, 3	2, 3	2, 3	2, 3	2, 3
DATA PROCESSING						
MTI processing 1.Yes, 2.No		1	1	1	1	1
Doppler processing 1.Yes, 2.No		1	1	1	1	1
Display 1.Digital, 2.Analog		1	1	1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		1, 3	1, 3	1, 3	1, 3	1, 3
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1	1	2	1	1

Name of the Member **Thailand - 3**

NAME OF STATION		Mahong Son	Chiang Rai	Chiang Mai	Sakol Nakon	Phitsanulok
SPECIFICATIONS	Unit	x-band	c-band	c-band	c-band	c-band
Index number		48300	48303	48327	48356	48378
Location of station		19° 18´ N 97° 50´ E	19° 58´ N 99° 53´ E	18° 47´ N 98° 59´ E	17° 09´ N 104° 08´ E	16° 47´ N 100° 16´ E
Antenna elevation	m	292	420	342	201	75
Wave length	cm	3	5	5	5	5
Peak power of transmitter	kW	200	250	250	250	250
Pulse length	μ s	0.5&1	0.8&2	0.8&2	0.8&2	0.8&2
Sensitivity minimum of receiver	dBm	-108	-108	-106	-108	-106
Beam width (Width of over -3dB antenna gain of maximum)	deg	2	1.1	1.1	1.1	1.1
Detection range	km	120	240	240	240	240
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		2, 3	2, 3	2, 3	2,3	2, 3
DATA PROCESSING						
MTI processing 1.Yes, 2.No		1	1	1	1	1
Doppler processing 1.Yes, 2.No		1	1	1	1	1
Display 1.Digital, 2.Analog		1	1	1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		1, 3	1, 3	1, 3	1, 3	1, 3
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1	1	1	1	1

Name of the Member **Thailand - 4**

NAME OF STATION		Phuket	Trang	Sathing Pra (songkla)	Narathiwat	
SPECIFICATIONS	Unit	Temporary closed	x-band	c-band	x-band	
Index number		48565	48567	48568	48583	
Location of station		8° 08´ N 98° 20´ E	7° 31´ N 99° 37´ E	7° 26´ N 100° 27´ E	6° 25´ N 101° 49´ E	
Antenna elevation	m		40	33	29	
Wave length	cm		3	5	3	
Peak power of transmitter	kW		200	250	200	
Pulse length	μ s		0.5&1	0.8&2	0.5&1	
Sensitivity minimum of receiver	dBm		-108	-106	-108	
Beam width (Width of over -3dB antenna gain of maximum)	deg		2	1.1	2	
Detection range	km		120	240	120	
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled			2, 3	2, 3	2, 3	
DATA PROCESSING						
MTI processing 1.Yes, 2.No			1	1	1	
Doppler processing 1.Yes, 2.No			1	1	1	
Display 1.Digital, 2.Analog			1	1	1	
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others			1, 3	1, 3	1, 3	
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)			1	1	1	

Attachment A2D-4

Name of the Member **Viet Nam**

NAME OF STATION		Phu Lien	Viet Tri	Vinh	Tam Ky	Nha Trang
SPECIFICATIONS	Unit					
Index number		48826	48813	48845	48833	48877
Location of station		20.48 °N 106.38 °E	21.18 °N 105.25 °E	18.40 °N 105.41 °E	15.34 °N 108.28 °E	12.13 °N 109.12 °E
Antenna elevation	m	140	56	27	40	52
Wave length	cm	5.3	5.3	6.3	5.6	5.6
Peak power of transmitter	kW	250	250	250	250	250
Pulse length	μ s	2	2	2	0.8;2.0	0.8;2.0
Sensitivity minimum of receiver	dBm	-110	-110	-110	-113	-113
Beam width (Width of over -3dB antenna gain of maximum)	deg	1.1	1.1	1.1	1	1
Detection range	km	384	384	384	480	480
Scan mode in observation 1.Fixed elevation 2.CAPPI 3.Manually controlled		1,3	1,3	1,3	1,2,3	1,2,3
DATA PROCESSING						
MTI processing 1.Yes, 2.No		1	1	1	1	1
Doppler processing 1.Yes, 2.No		2	2	2	1	1
Display 1.Digital, 2.Analog		1	1	1	1	1
OPERATION MODE (When tropical cyclone is within range of detection) 1.Hourly 2.3-hourly 3.Others		1, 3	1, 3	1, 3	1, 3	1, 3
PRESENT STATUS 1.Operational 2.Not operational(for research etc.)		1	1	1	1	1

SCHEDULE OF MTSAT OBSERVATIONS AND DISSEMINATIONS

1. IMAGER observations

IMAGER observations are as follows:

(a) full-disk observations are made hourly;
(b) half-disk observations of northern hemisphere are made hourly in addition to the full-disk observations;
(c) successive observations for Atmospheric Motion Vector (AMV) extraction are made six-hourly.

2. Dissemination Services for Medium-scale Data Utilization Station (MDUS) Users

High Resolution Imager Data (HiRID) and High Rate Information Transmission (HRIT) are available as dissemination services for MDUS. Data for all the IMAGER observations are disseminated on both services.

HiRID is designed to handle with some of additional and extended data of MTSAT and to have compatibility with S-VISSR to minimize the impact on MDUS users. The HiRID service will be ceased in a certain period.

HRIT is the successor to S-VISSR and is newly designed to have a standardized data format among the geostationary meteorological satellite operators.

During the transition period to HRIT, both services are available on the same radio frequency on a time-shared broadcasting schedule.

3. Dissemination Services for Small-scale Data Utilization Stations (SDUS) Users

Weather Facsimile (WEFAX) and Low Rate Information Transmission (LRIT) are available as dissemination services for SDUS.

LRIT is the successor to WEFAX and is newly designed to have a standardized data format among the geostationary meteorological satellite operators.

The WEFAX service will be ceased in a certain period. During the transition period to LRIT, both services are available on the same radio frequency on a time-shared broadcasting schedule.

(a) WEFAX

- Four-sectionalized full disk

Images A, B, C and D (IR1) : 00, 03, … and 21 UTC
Images K, L, M and N (IR3) : 00 and 12 UTC

- Polar stereographic projection

Image H (IR1) : hourly
Image I (VIS) or J (enhanced IR1) : hourly

(b) LRIT

- Full earth's disk of normalized geostationary projection

Images (IR1) : hourly
Images (IR3) : 00, 06, 12 and 18 UTC

- Polar stereographic projection

Images : hourly

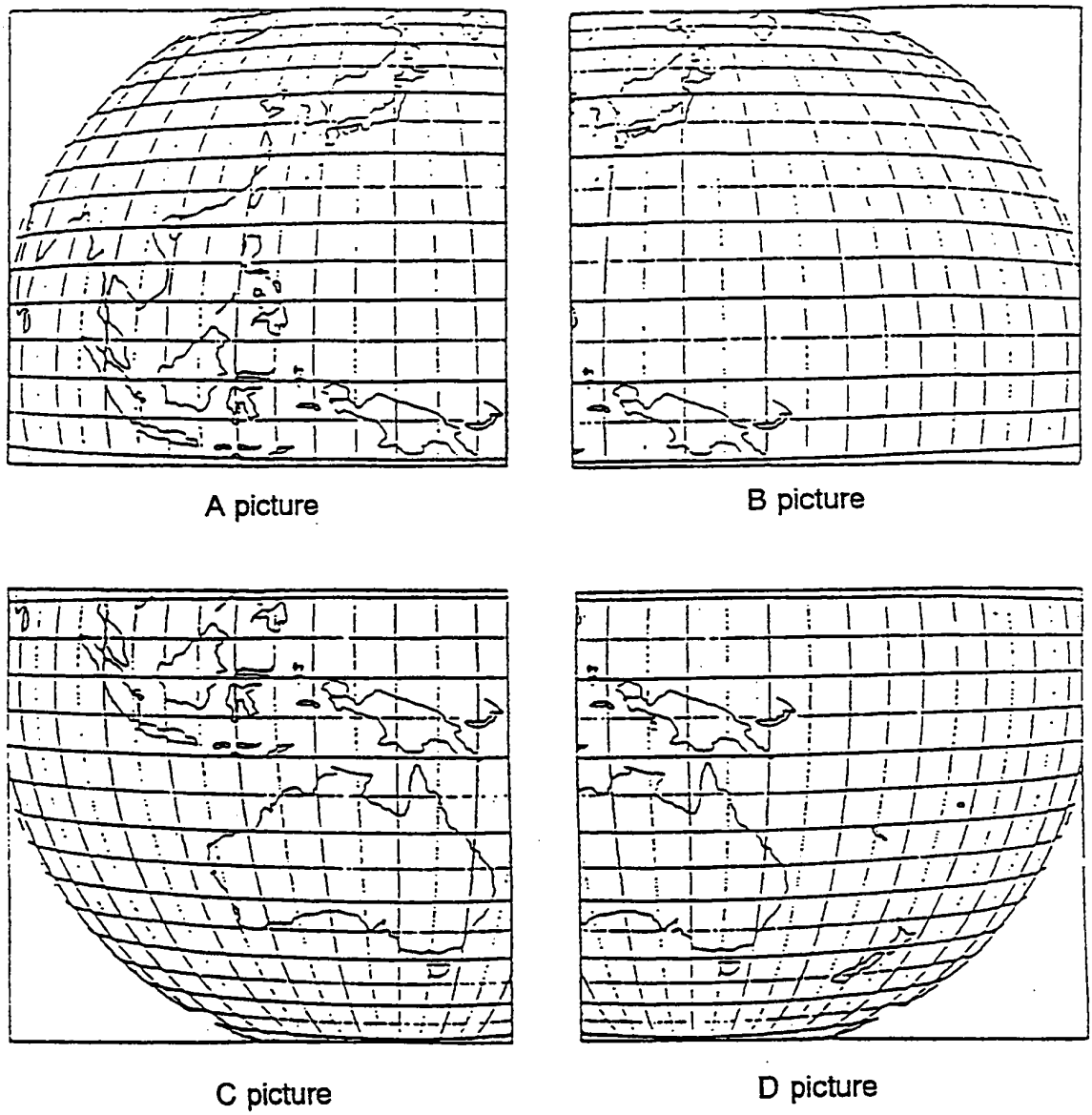


Fig. 2-E. 1 WEFAX IR-1 four- sectionalized full disk image “A”, “B”, “C” and “D”

NOTE: “K”, “L”, “M” and “N” images are of the same size as IR-3 four- sectionalized image

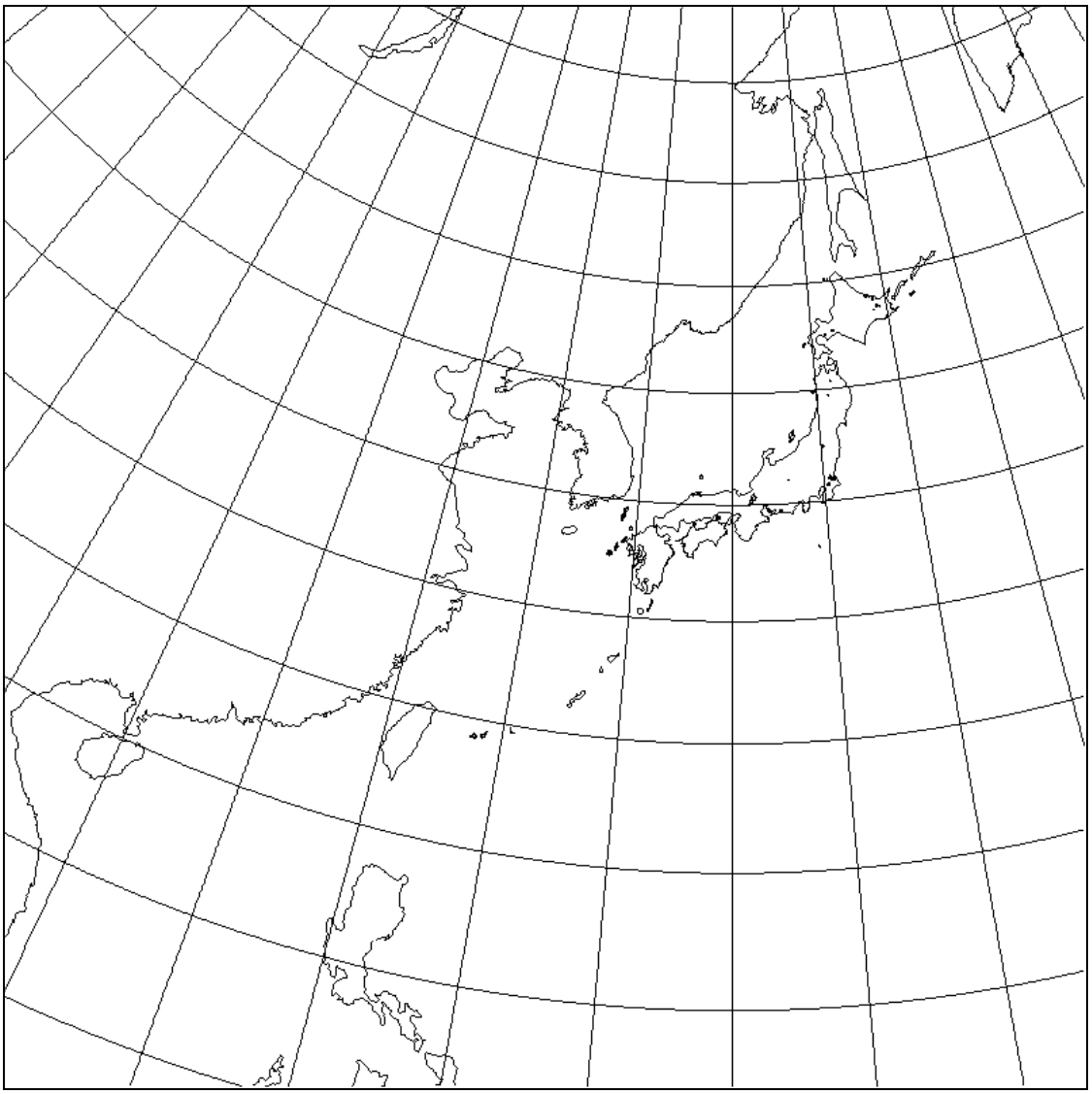
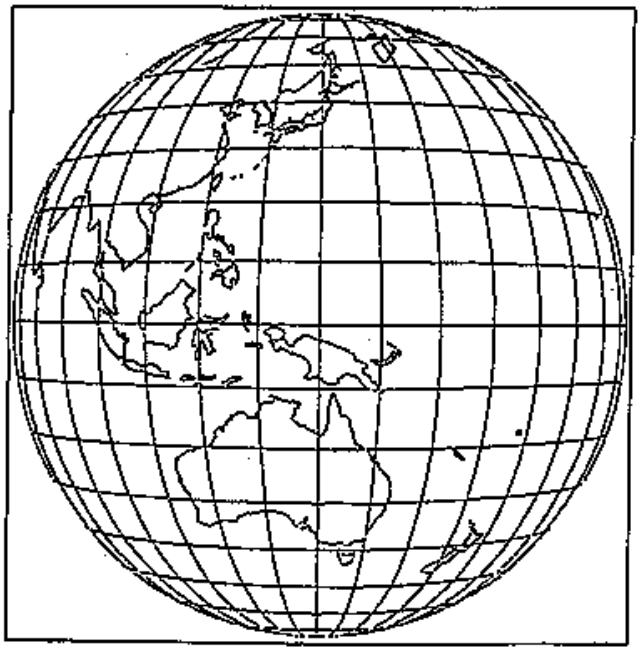
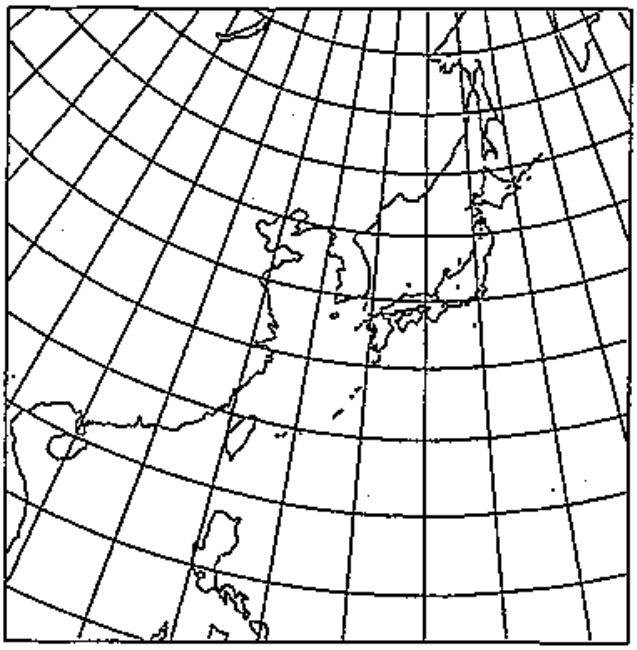


Fig. 2-E. 2 WEFAX “H” image of polar stereographic projection

NOTE: “I” and “J” images are of the same size and projection as “H”

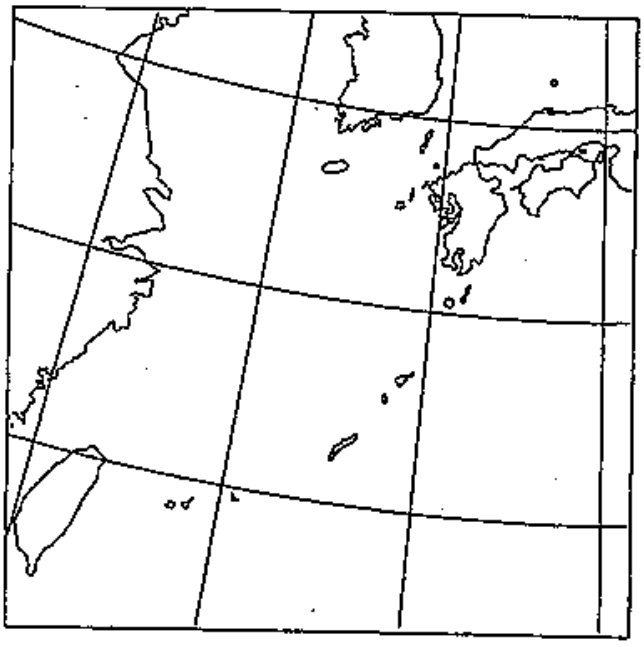


Full earth's Disk of normalized geostationary projection



Polar-stereographic projection covering East Asia

Polar-stereographic projection covering the north-east of Japan



Polar-stereographic projection covering the south-west of Japan

Fig. 2-E. 3 LRIT Images

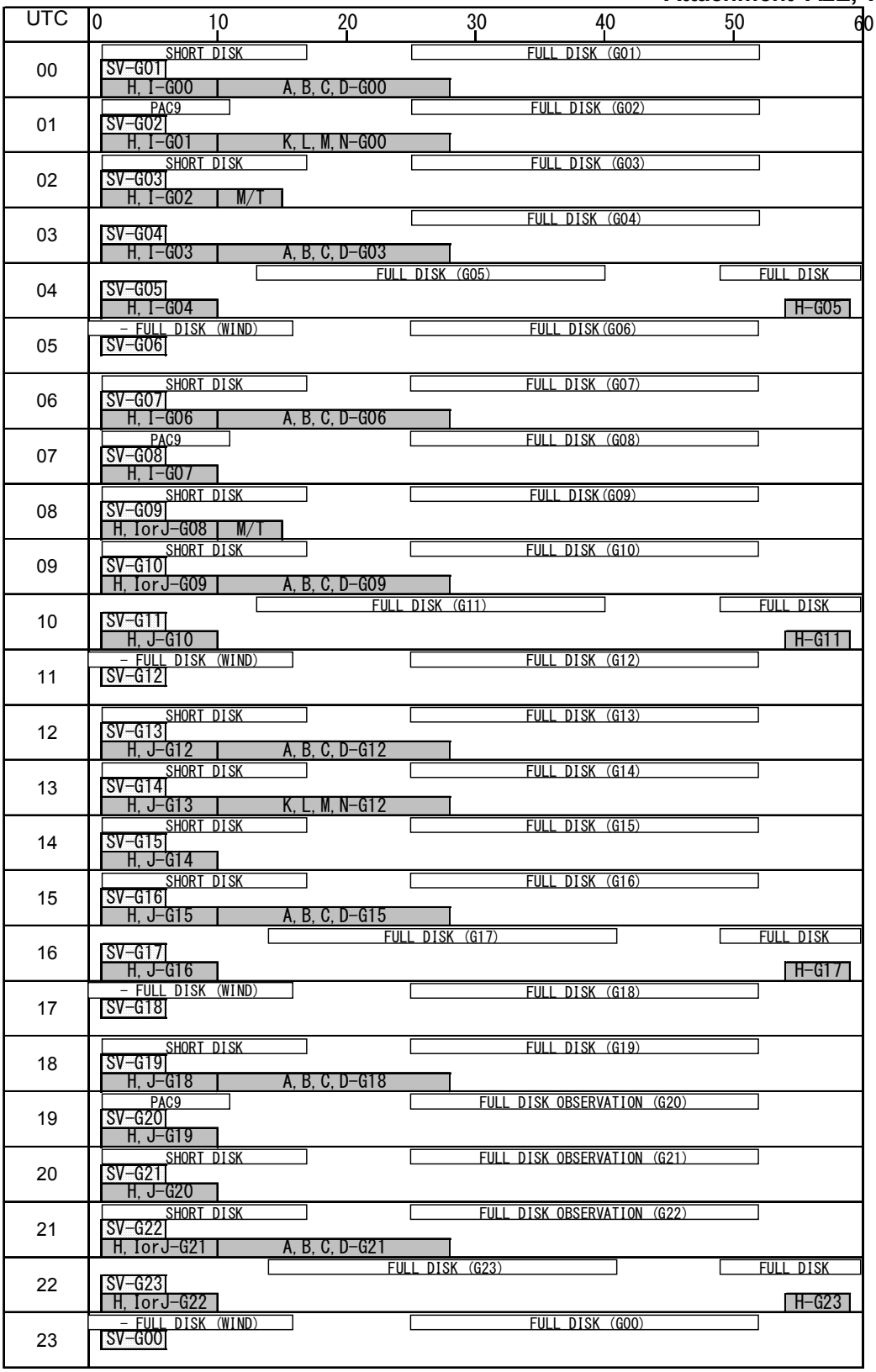
THE BACKUP OF GMS-5 WITH GOES-9

The Japan Meteorological Agency (JMA) started the backup of GMS-5 with GOES-9 on 22 May 2003 in cooperation with US NOAA/NESDIS. GOES-9 has been operated at 155E degrees of the geostationary orbit by US NOAA/NESDIS. The backup will be terminated when MTSAT-1R, the successor to GMS-5, starts its normal operation. The schedule of GOES-9 IMAGER observation is shown Fig 2-E.4.

The WEFAX converted from GVAR data are disseminated via GMS-5 stationed 140E degrees of the geostationary orbit. The schedule of GMS-5 WEFAX dissemination is shown Fig 2-E.4.

The S-VISSR type data (IR1 channel) converted from GVAR data are put on the RSMC Data Server of JMA for the National Meteorological and Hydrological Services, which have been registered to JMA to access the data through the Internet. S-VISSR type data are made about 10-15 minutes after observation end.

The observations of SHORT FULL DISK, PAC9 and WIND OBSERVATION are neither broadcasted via GMS-5 (WEFAX) nor distributed via the Data Server (S-VISSR typed data).



*OBSERVATION
FULL DISK, SHORT DISK, PAC9 : GOES-9 Observation.
*S-VISSR TYPE DATA
SV : S-VISSR type data (IR1) is posted on the RSMC Data Server.
*WEFAX DISSEMINATION
WEFAX is disseminated via GMS-5.
A-D : IR 4-sectorized picture of full-disk image,
H-J : IR, VIS and enhanced IR polar-stereographic picture covering the far east area including Japan,
K-N : WV 4-sectorzed picture of full-disk image, **M** : Manual amendment (MANAM), **T** : Test pattern.

Fig 2-E.4 THE BACK-UP OPERATION SCHEDULE OF GMS-5 WITH GOES-9

SATELLITE IMAGERY RECEIVING FACILITIES AT TYPHOON COMMITTEE MEMBERS

Member	Station		GOES 1. M-DUS 2. S-DUS 3. Movie	NOAA 1. HRPT 2. APT	Meteosat 1. P-DUS
Cambodia					
China	Beijing Shanghai Shenyan Guangzhou	(39.9°N, 116.4°E) (31.1°N, 121.4°E) (41.8°N, 123.6°E) (23.1°N, 113.3°E)	1, 2 1 1 1	1, 2 2	
Democratic People's Republic of Korea	Pyongyang	(39.0°N, 125.8°E)	1,2	1	
Hong Kong, China	Kowloon	(22.3°N, 114.2°E)	1, 2, 3	1	
Japan	Chichijima Chitose Fukue Fukuoka Fukuoka Hakodate Haneda Hirara Hiroshima Ishigaki Itami Kagoshima Kansai Kashiwa Kiyose Kobe Maizuru Minamidaito Minamitorishima Nagasaki Nagoya Naha Narita Naze Nemuro Niigata Okinawa Osaka Sapporo Sendai Takamatsu Tokyo Tsukuba	(27.1°N, 142.2°E) (42.8°N, 141.7°E) (32.7°N, 128.8°E) (33.6°N, 130.4°E) (33.6°N, 130.5°E) (41.8°N, 140.8°E) (35.6°N, 139.8°E) (24.8°N, 125.3°E) (34.4°N, 132.5°E) (24.3°N, 124.2°E) (34.8°N, 135.5°E) (31.6°N, 130.6°E) (34.4°N, 135.2°E) (35.9°N, 140.0°E) (35.8°N, 139.5°E) (34.7°N, 135.2°E) (35.5°N, 135.3°E) (25.8°N, 131.2°E) (24.3°N, 154.0°E) (32.7°N, 129.9°E) (35.2°N, 137.0°E) (26.2°N, 127.7°E) (35.8°N, 140.4°E) (28.4°N, 129.5°E) (43.3°N, 145.6°E) (37.9°N, 139.1°E) (26.2°N, 127.7°E) (34.7°N, 135.5°E) (43.1°N, 141.3°E) (38.3°N, 140.9°E) (34.3°N, 134.1°E) (35.7°N, 139.8°E) (36.1°N, 140.1°E)	2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 1, 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 1, 2 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 1, 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 2, 3 1, 2, 3 2, 3	1	

Member	Station		GOES 1. M-DUS 2. S-DUS 3. Movie	NOAA 1. HRPT 2. APT	Meteosat 1. P-DUS
Lao People's Democratic Republic					
Macao, China	Macao	(22.2°N, 113.5°E)	2, 3		
Malaysia	Petaling Jaya	(3.1°N, 101.7°E)	1	1	
Philippines	Quezon City	(14.7°N, 121.0°E)	1, 3	1	
Republic of Korea	Seoul	(37.6°N, 127.0°E)	1, 2, 3		1
	Seoul/Kimpo Int. Airport	(37.6°N, 126.8°E)	2, 3		
	Munsan	(37.9°N, 126.8°E)		1	
	Seosan	(36.8°N, 126.5°E)			1
	Pusan	(35.1°N, 129.0°E)	2, 3		
	Kwangju	(35.2°N, 126.9°E)	2, 3		
	Taejon	(36.4°N, 127.4°E)	2, 3		
	Kangnung	(37.5°N, 130.9°E)	2, 3		
	Cheju	(33.5°N, 126.5°E)	2, 3		
	Taegu	(35.9°N, 128.6°E)	2, 3		
	Taegu/Air Traffic	(35.9°N, 128.7°E)	2, 3		
	Chonju	(35.8°N, 127.2°E)	2, 3		
	Chongju	(36.6°N, 127.4°E)	2, 3		
	Ullung-Do	(37.5°N, 130.9°E)	2, 3		
	Mokpo	(34.8°N, 126.4°E)	2, 3		
	Chunchon	(37.9°N, 127.7°E)	2, 3		
	Masan	(35.2°N, 128.6°E)	2, 3		
	Tongyong	(34.9°N, 128.4°E)	2, 3		
	Inchon	(37.5°N, 126.6°E)	2, 3		
	Huksando	(34.7°N, 125.5°E)	2, 3		
	Suwon	(37.3°N, 127.0°E)	2, 3		
	Sokcho	(38.3°N, 128.6°E)	2, 3		
	Pohang	(36.0°N, 129.4°E)	2, 3		
	Kunsan	(36.0°N, 126.7°E)	2, 3		
Singapore*	Changi Airport	(1.4°N, 104.0°E)	GVAR	1	1
Thailand	Bangkok	(13.7°N, 100.6°E)	(.JPG Internet)	1	
USA	Guam	(13.4°N, 144.6°E)	1, 2	1	
Viet Nam	Hanoi	(21.0°N, 105.5°E)	2, 3	2	
	Ho Chi Ming City	(10.5°N, 106.4°E)	2, 3	2	
	Da Nang	(16.0°N, 108.2°E)	2, 3		

* Singapore receives MODIS(TERRA), MODIS(AQUA), FY2B(S-VISSR) and FY1(CHRPT).

Name of the Member **Republic of Korea**

Item	Method	Type of output
Name of the method Description of the method	**Global Data Assimilation and Prediction System (GDAPS)** Governing equations : Primitive equation Vertical resolution : 30 levels in hybrid coordinate Horizontal representation : Spectral, with triangular truncation at wave number 213, ~0.5625° x 0.5625° Gaussian Grid (640 x 320) Initial field : Global analysis by 3DVAR (3 Dimensional VARiational method) (See Appendix 3-D (1).)	6 hourly TC position up to 84 hours at 00/12UTC
Name of the method Description of the method	**Regional Data Assimilation and Prediction System (RDAPS)** Governing equations : Primitive equation Vertical resolution : 33 levels in sigma coordinate Horizontal resolution : 30 km on Lambert conformal projection Boundary condition: 12-hr interval prediction data by GDAPS (See Appendix 3-D (2).)	6 hourly TC position up to 48 hours at 00/12UTC
Name of the method Description of the method	**Double Fourier-series BARotropic typhoon model (DBAR)** Governing equation: Shallow water equations Domain: Global Resolution: ~0.3515° x 0.3515° Grid (1024x512) Initial field: global analysis from GDAPS 3DVAR (See Appendix 3-D (2).)	6 hourly TC position up to 72 hours at 00/06/12/18UTC

Name of the Member **Viet Nam**

Item	Method	Type of output
Name of the method Description of the method	Barotropic Model Governing equations : Three primitive equations formulated on a discrete grid in geographical coordinates. Dependent variables : geopotential height **H** (m), zonal **U** (m/s) and meridional **V** (m/s) components of wind. Domain : Two nested domains. The outermost forecasting domain is fixed and extends from 20 °S to 60°N, 60 °E to 180 °E with horizontal resolution 1.25° (121 x 81 grid points). The inner domain is vortex - centered, movable consisting of 20 x 20 grid points with resolution of 0.25 degrees. Approximation schemes: centered finite difference for spatial approximation, Adams-Bashforth for time integration. Boundary conditions are fixed. Initial global fields **H, U, V** are obtained from global analysis of Japan Meteorological Agency (JMA). Vortex initialisation scheme: bogus vortex is constructed based on the assumption that the storm motion is equal to the vector sum of the large scale environmental flow plus the vortex asymmetry (Smith and Ulrich, 1990; Smith, 1991; Smith and Weber, 1993; Weber and Smith, 1995; Davidson and Weber, 2000). A number of modifications had been done to this scheme for better representing characteristics of tropical cyclone motion near Viet Nam. Frequency of forecast : twice a day (for base times 00 UTC and 12 UTC) when a tropical storm is acting in the South China Sea.	Tropical cyclone positions (latitude, longitude) for +12h, +24h, +36h and +48h ahead

Name of the Member **Viet Nam**

Item	Method	Type of Output
Name of the method Description of the method	Barotropic model (referred to as WBAR model) with vortex initialization scheme **Governing Equations**: a set of shallow water equations that formulated in a geographical coordinate system **Data Domain**: Area of 161 x 101 grid points from 60^0E to 180^0E and from -5^0S to 55^0N with spatial resolution of 0.75^0 x 0.75^0 in lat-long **Initial Conditions**: predifined 850-200mb DLM wind and height operational objective analyses and forecasts of Global Spectral Model (GSM) of Japan. Geopotential height is provided in the form of deviation from a mean distribution. **Boundary Conditions**: time-dependent boundary **Integration Scheme**: An Euler forward step and a third-order Adams-Bashforth step are used for the first two time steps, while all other time steps are Adams-Bashforth steps of third-order. **Integration Step**: the model time steps are variable and determined automatically by evaluation of the Courant-Friedrich-Levy criterion using the current wind and height fields. **Integration Domain**: is storm-relative circular domain and movable . **Vortex initialization scheme**: consists of a postanalysis of the predifined 850-200mb DLM wind components of the operational objective analyses and forecasts of GSM model and the construction of synthetic vortex using the information provided that by the operational TC advisories. The analysis procedure is based on the methodology of Weber and Smith (1995) and is similar to the operational vortex enhancement scheme used in TC-LAPS model. **Frequency of forecast**: Twice times a day when existing any tropical cyclone over the East Sea	12h, 24h, 36h and 48h forecast position of tropical cyclone

OUTLINE OF KMA – Typhoon Dynamic MODELS

(1) < Global Data Assimilation and Prediction System (GDAPS) >

Initial field :

(analysis)

3DVAR (0.5625° horizontal resolution)

(bogusing)

symmetric vortex generated by empirical formulas + asymmetric structure derived from first guess field

(initialization) NNMI (Non-linear Normal Mode Initialization)

Operation :

(schedule)

two times (00UTC, 12UTC) a day

(integration time)

84 hr from 00UTC, 12UTC

Prediction model :

(dynamics)

primitive equations

(vertical resolution)

30 levels in hybrid coordinate

(horizontal resolution)

spectral, with triangular truncation at wave number 213

grids : 320 x 640 Gaussian latitudes and longitudes

Time integration :

semi-implicit with time filter

Physics :

(diffusion)

horizontal : linear Laplacian

vertical : Non-local PBL scheme

(surface flux)

similarity function proposed by Louis

Ocean : SST (unchanged from the initial field)

Land : Soil temperature predicted, Simple Biosphere scheme

(cumulus convection)

Kuo's scheme

(radiation)

long-wave cooling and solar heating with effects of diurnal cycle and cloud variation considered

Products :

location (lat./lon.), central pressure, maximum tangential winds, every 6 hr up to 72 hr in advance

(2) < Regional Data Assimilation and Prediction System (RDAPS) >

Data assimilation :

(objective analysis)

3DOI

(bogusing of tropical cyclones)

same as GDAPS bogusing method

(analysis nudging for four-dimensional data assimilation)

upper level : 12-hr interval, surface : 3-hr interval

Dynamics :

(basic equations)

primitive equations in terrain following coordinate
horizontal resolution : 30 km on Lambert conformal projection

(domain)

Far-East region with 191 x 171 grids

(vertical levels)

33 levels in sigma coordinate

Physics :

(diffusion)

fourth order horizontal diffusion
nonlocal PBL scheme

(Kain-Frish scheme for cumulus parameterization)

(cloud microphysical parameterization including ice effect)

(radiation scheme for long wave and short wave interactions
with explicit cloud and clear-air

Initial conditions : 12hr FDDA

Boundary conditions :

(12-hr interval prediction data by GDAPS from initial time at T-00 hr)

(daily SST analysis data produced by KMA with GOES data)

Frequency of forecast : twice a day (00UTC, 12UTC)

Products :

location (lat./lon.), central pressure, and maximum tangential winds every 6 hr
up to 48 hr in advance

(3) < Double Fourier-series BARotropic typhoon model (DBAR) >

Initial field:

Environmental field from a GDAPS global analysis (3DVAR)
vortex Specified based on GFDL-Type Initialization scheme
Height field obtained by solving the balance equation

Operation:

(schedule)

Four times (00, 06, 12, and 18 UTC) a day

(Integration time)

72 hours from 00, 06, 12, and 18 UTC

Prediction model :

(dynamics)

shallow water equations

(horizontal resolution)

grid (lat*lon): 512*1024, ~0.3515° x 0.3515° spacing

(vertical level)

1 level

(spectral transform method)

double Fourier series

Products :

6-hourly TC location (lat./lon.) in the western North Pacific up to 72 hours

Outline OF HKO – Operational Regional Spectral Model

Name of the method:
Operational Regional Spectral Model

Description of the method:

Meteorological data assimilated by the analysis scheme of the ORSM are as follows:

(A) From GTS

SYNOP, SHIP	surface data and ship data
TEMP, PILOT	radiosonde and pilot data
AIREP, AMDAR	aircraft data
SATEM	satellite thickness data
TOVS, ATOVS	virtual temperature profiles
SATOB	satellite wind data

(B) From RSMC Data Serving System (DSS) of JMA
GOES-9 IR1 brightness temperature data

(C) From NCEP data server
Daily sea surface temperature analysis at 1-degree resolution

(D) Through regional data exchange
Data from automatic weather stations over the south China coastal region

(E) Local data
Tropical cyclone bogus data during tropical cyclone situations
Automatic weather station data
Wind profiler data
Doppler weather radar data

Three–dimensional multivariate optional interpolation is performed four times a day based on 00, 06, 12 and 18UTC data for the 60-km outer domain. For the inner domain, the same objective analysis scheme is performed 8 times a day based on 00, 03, 06, 09, 12, 15, 18, and 21UTC. All analyses are applied to 36 vertical levels.

The horizontal domains of both inner and outer models compose of 151 x 145 model grids in Mercator projection. The first guess fields of the model analyses are provided by their respective latest forecasts.

Hourly rainfall information derived from real-time calibration of radar reflectivity with rain gauge data as well as from GOES-9 IR1 brightness temperature data, are incorporated into the model through a physical initialization process. In this process, the moisture of the initial field (between the lifting condensation level and the cloud top inferred from the cloud top temperature) at the point where rain is observed is adjusted to allow precipitation process to be switched on. The heating rate of the precipitation process is also adjusted to correspond to the rainfall amount observed. The rainfall information in the hour preceding analysis time is used in the outer model. For the inner model, pre-runs for 3 hours preceding analysis time are performed to incorporate the rainfall information.

Non-linear normal mode initialization is performed before the forecast model is run.

Basic equations	Primitive hydrostatic equations
Vertical	Sigma-P hybrid coordinate, model top at 10hPa
Forecast parameters	In (surface pressure), horizontal wind components, virtual temperature, specific humidity
Initialization	Non-linear normal mode initialization
Physical processes	
Radiation scheme	Sugi et al. (1990)
Short wave	Calculated ever hour
Long wave	Calculated ever hour
Moisture processes	
Cumulus convection	Arakawa-Schubert (1974)
Mid-level convection	Moist convection adjustment proposed by Benwell and Bushby (1970) and Gadd and Keers (1970)
Large-scale condensation	Included
Grid-scale evaporation and Condensation	Included
Planetary boundary layer	Scheme proposed by Troen and Mahrt (1986) in which non-local specification of turbulent diffusion and counter-gradient in unstable boundary layer are considered.
Surface	4-layer soil model
	Daily sea-surface temperature analysis (fixed in forecast)
	Climatological snow and sea ice distribution
	Climatological evaporation rate, roughness length and albedo
Numerical methods	
Horizontal	Double Fourier
Vertical	Finite difference
Time	Euler semi-implicit time integration
Topography	Envelope topography, derived from 30-second latitude/longitude resolution grid point topography data
Horizontal diffusion	Linear, second-order Laplacian
Boundary conditions	For the outer model, 6-hourly boundary data including mean sea level pressure, wind components, temperature and dew point depression at 16 pressure levels (1000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 10hPa) and the surface, are provided by JMA's GSM. For the inner model, hourly boundary data are provided by the outer 60km model.

APPENDIX VIII

SUMMARY OF THE REPORTS OF THE TYPHOON COMMITTEE MEMBERS ON THEIR ACTIVITIES RELATED TO THE HYDROLOGICAL COMPONENT

China

The delegate from **China** reported that China did not experience any basin-scale flooding during the flood season in 2004. But some small- and medium-scale rivers experienced serious local floods, flash floods and sediment disaster as well as severe drought in some other regions, especially in south China. In 2004, China has been taking part actively in the RCPIP activities of the hydrology component of TC, leading two projects, namely: (a) Extension of Flood Forecasting Systems (FFS) to Selected River Basin, and (b) Evaluation and Improvement of Hydrological Instrument and Telecommunication Equipment. China also actively participated in other RCPIP projects led by other TC Members. In 2004, China made big progress in aspects of development of operational flood forecasting system, standard development, warning information cell broadcasting and international technique cooperation, and data sharing and experts exchange.

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

In Hong Kong**,** since 1997, about HK$5 billion worth of major river-training works and flood-control projects has 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 Government has already completed 23 village flood pumping stations to protect 30 villages where ground topography is so low that river training work cannot improve the drainage condition.

In the rural areas, the construction of 21 km of drainage channels, 2 village flood pumping schemes and 7.5 km of stormwater drains were in progress. Major flood prevention works under planning and design include 40 km of drainage channels, 19 km of stormwater drains, two village flood pumping schemes and 5 km of drainage tunnel.

For the urban area in West Kowloon, 10 km of stormwater drains have been completed. The construction of another 35 km of stormwater drains, a stormwater diversion scheme comprising 1.5 km of stormwater drainage tunnel, and a 100,000 m^3 capacity underground floodwater storage tank were underway. Plan is also in hand to construct another drainage tunnel of 4 km long in Lai Chi Kok.

For other urban areas, major flood prevention works under planning and design include 24 km of stormwater drains, 10 km of drainage tunnels and a stormwater pumping station in Sheung Wan.

2b. Implications to Operational Progress

Rainfall data were relayed from Drainage Service Department's (DSD) server to HKO via the government wide network infrastructure, which provided a more cost effective means than using commercially leased line.

When the specified rainfall criteria are met, HKO will issue the respective rainstorm warnings, coded Amber, Red and Black, to warn of possible flooding or flooding of roads and low lying areas. In particular, the Special Announcement on Flooding in the Northern New Territories would be issued by HKO when heavy rain had fallen there and flooding had occurred or was expected to occur in the low lying areas.

The General Packet Radio Services (GPRS) mobile network and solar panels were used in some out-stations where electricity supply and land-based telemetry were unreliable.

Over 1,600 km of drains, engineered channels, culverts and watercourses were inspected and 200 km of them were cleansed with 85,000 m^3 silt removed. At locations where flooding may cause high risks to the local residents, local flood warning systems have been 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 liaises 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 has 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 was 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. 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.

2e. Research Progress

Computer hydrological and hydraulic models for the drainage systems in Hong Kong had been developed to provide quantitative information on the risk of flooding, impacts of development and the performance of various flood loss mitigation options. A computerized stormwater drainage asset inventory and maintenance system was also being developed. In the past year, DSD had completed several research studies including the design of stormwater inlets, rainstorm profiles for stormwater drainage design, and gully design and arrangement for improving the performance of flood prevention facilities. 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.

3. Opportunities for Further Enhancement of Regional Co-operation

Nil.

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

2a. Hardware and Software Progress

A new ground reception system for receiving MODerate resolution Imaging Spectroradiometer (MODIS) direct broadcast data from the Earth Observing System (EOS) series of satellites was implemented in mid-2004.

A web-based tool for dealiasing Doppler velocity and estimating the gale radii of tropical cyclones from single Doppler velocity fields was developed.

The infrared Doppler Light Detection and Ranging (LIDAR) system at the Hong Kong International Airport (HKIA) was declared operational in May 2004. It proved to be effective in monitoring winds shear under rain-free conditions including those occurring between the rainbands of tropical cyclones. Algorithms were being developed to automate the alerting of windshear based on LIDAR data to complement the warnings generated by the Terminal Doppler Weather radar which worked best in rainy conditions.

Enhancements of the Observatory's website included the display of animated radar images and numerical weather prediction products at 12-hour intervals up to 72-hours ahead based on the Observatory's Operational Regional Spectral Model (ORSM). Through ORSM's products the public could follow the evolution and movements of tropical cyclones.

At HKIA, the latest tropical cyclone forecasts became available to aviation users through the web-based, fully automatic Aviation Meteorological Information Dissemination System (AMIDS) which also disseminated the tropical cyclone warnings issued by the Tropical Cyclone Advisory Centre (TCAC) Tokyo and other centers.

2b. Implications for Operational Progress

Enhancements to the Observatory's tropical cyclone forecasting and warning services in 2004 included:

(a) Provision of tropical cyclone intensity forecasts up to 72 hours ahead in tropical cyclone warnings for shipping. This service was also made available to Typhoon Committee Members via the GTS.

(b) Introduction of the Chinese version of the Tropical Cyclone Warning for Shipping.

(c) Addition of tropical cyclone intensity information for the general public.

(d) Updating of the tropical cyclone forecast track on the HKO's website every hour instead of every three when the Tropical Cyclone Signal No. 3 or above was in force.

In respect of techniques development, a software tool for estimating tropical cyclone intensity was put into operational trial. Guidance on the probability of occurrence of strong winds or gales in the Hong Kong harbour area during tropical cyclone passage was also made available to forecasters.

TC-LAPS, a tropical cyclone specific application of the Local Analysis and Prediction System (LAPS) adapted from the Forecast Systems Laboratory of the National Oceanic and Atmospheric Administration (NOAA), was enhanced in 2004 to generate time series of wind speed, wind direction and mean-sea-level pressure at specific locations along a given track.

An algorithm based on the European Centre for Medium Range Forecasting's (ECMWF) ensemble prediction system (EPS), made available to the Observatory by ECMWF in April 2004, was developed to let forecasters assess the maximum winds likely to occur over Hong Kong during the passage of tropical cyclones.

Furthermore, a 5-km horizontal resolution Non-hydrostatic Model (NHM) adapted from the Japan Meteorological Agency (JMA) was put into semi-operational trial in late April 2004 to provide 12-hour forecasts twice daily. Case studies showed that the tropical cyclone wind and convection were better simulated by this model which would also be used forecast heavy rain associated with mesoscale convective systems.

Assessment of the performance of ECMWF global models in forecasting tropical cyclone intensity over the western North Pacific was carried out. The MPI-RSM 4DVAR data assimilation system adapted from JMA was being tested to study the impact of local observations and analysis schemes on tropical cyclone forecasts.

The possibility of using spectral width data from the two wind profilers near HKIA to indicate the occurrence of turbulence in the vicinity of HKIA under tropical cyclone situations was being explored. This was suggested by the good correlation between spectra width and turbulence reports from aircraft obtained during the approach of tropical cyclones.

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

The following joint research with local tertiary institutions were completed or in progress:

(a) A joint project with the Hong Kong University on "Tropical Cyclone Eye Fix" was completed. The resulting software was put into operational trial. A related paper was presented at the 17th International Conference on Pattern Recognition held in Cambridge, UK in August 2004.

(b) A joint project with the City University of Hong Kong on "Model Validation of Tropical Cyclone Wind Structure" was in progress. The objective was to evaluate the performance of JMA and the 20-km ORSM model forecasts of tropical cyclone wind strength and maximum wind and strong/gale/storm wind radii against QuikSCAT data.

2d. Training progress

Four HKO officers attended overseas training courses or seminars related to tropical cyclones between October 2003 and September 2004.

Tropical Cyclone and Disaster Prevention Related Training

1. Tropical Cyclone Related Training Overseas Attended by HKO Staff

(a) "First Roving Seminar of the Typhoon Committee Typhoon Research Coordination Group Visiting Lecturer Programme" in Seoul, Republic of Korea from 20 to 21 October 2003. One officer participated.

(b) "Fourth Typhoon Operational Forecasting Training" at the RSMC Tokyo-Typhoon Center, Japan from 28 July to 6 August 2004. One officer participated.

(c) Training course on "Living with Risk: Dealing with Typhoon-related Disasters as part of Integrated Water Resources Management" in Seoul, Republic of Korea from 20 to 24 September 2004. Two officers participated.

Professor C. P. Chang of the Naval Postgraduate School gave a lecture on Typhoon Vamei on 20 October 2003. Professor Johnny Chan of the City University of Hong Kong also delivered a lecture on tropical cyclones on 25 November 2003.

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

(a) Typhoon Committee Roving Seminar, 22- 24 October 2003.
(b) Lecture on "Typhoon Vamei" by Professor C P Chang of Department of Meteorology, Naval Postgraduate School, USA on 20 October 2003.
(c) Seminar on "Typhoon Studies Using NASA Space-based Data" by Dr. Timothy Liu of the NASA Jet Propulsion Laboratory on 17 November 2003.
(d) Symposium on Natural disaster Planning and Preparedness, 29-30 March 2004.
(e) Pre-Rain and Typhoon Season Seminar on 6 April 2004 and 25 May 2004. Workshop on Tropical Cyclone and Heavy Rain with Particular Focus on Airport Operation on 27 May 2004.

2e. Research Progress

In addition to the papers mentioned in sub-paragraph 1e of Section I, the following tropical cyclone studies were completed:

(a) The climatology of tropical cyclone intensity change in the western North Pacific.

(b) The impact of ENSO events on tropical cyclone activity in the western North Pacific.

2f. Other Co-operative/RCPIP progress

Further to the exchange of radar imageries, the exchange of raw radar data with Macao, China began in 2004. The objective was to enable the generation of dual-Doppler winds.

3. Opportunities for further Enhancement of Regional Co-operation

A lightning location network covering the Pearl River Estuary would be installed in collaboration with the meteorological services in neighbouring Guangdong and Macao.

Japan

The delegate from **Japan** reported on a project JMA is leading in promoting technical cooperation activities for the 'Preparation of a Hazard Map for Flood Prevention' and the 'Establishment of a Warning System for Flash Floods, Including Debris Flows and Landslides' under the RCPIP. At the international symposium "Dealing with Typhoon-related Disasters as

part of Integrated Water Resources Management," which was held in Seoul, Republic of Korea, in September 2004, experts in the field of hydrology and disaster prevention from member countries of the Typhoon Committee met for discussions and to receive training on hazard map preparation. Japan contributed in this symposium by sending several advisors and in other ways.

Based on the Flood Fighting Act, which was amended in 2001, efforts are being made to secure the smooth evacuation of people in the event of flooding in Japan. In municipalities ranging villages to cities, hazard maps for flood prevention marking forecasted inundation areas and designated shelters are being prepared to enable quick and smooth evacuation activities, and to raise disaster prevention awareness among local people. At present, a total of 334 municipalities (as of July, 2004) have already prepared and publicized such maps. Early completion of hazard maps, as well as the development of other pertinent measures are being encouraged.

In addition, to tackle frequent flood damage in urban areas, the Designated Urban River Inundation Prevention Act was established in Japan and put into force in May 2004. In areas where preventing inundation damage through river improvement works is difficult because of increasing urbanization, this law requires that three parties—river administrator, sewerage administrator, and prefectural governor—should make joint efforts to implement integrated flood damage prevention measures in river basins, such as formulation of various plans, establishment of storm water storage/infiltration facility, and other activities.

In response to frequent sediment-related disasters, non-structural preventive measures are being promoted on the basis of the Sediment-related Disaster Prevention Law, which was established in 2000. Measures include providing information on risks in sediment-related disaster-prone areas, developing a warning and evacuation system, restricting new land development for housing and other specific purposes, and promoting the relocation of existing houses.

As an organization contributing to regional cooperation in flood and sediment-related disaster prevention against typhoons, the "International Centre for Water Hazard and Risk Management under the auspices of UNESCO (tentative name)" will be established at the Public Works Research Institute in Japan. Through research, training, and information networking on mitigation of flood damages to be conducted at this center, and through activities being implemented at the International Flood Network (IFNet), which was established at the 3rd World Water Forum, International Sabo Network and incorporating other efforts by various organizations, Japan intends to strengthen cooperation with other countries and to further promote activities related to flood and sediment-related disaster prevention.

Macao, China

Interaction with users of hydrological components

A Meeting was held with the senior managers of the Macao Water Supply Company Limited during their visit to our bureau on the aspect of climate precipitation forecast, especially during winter to spring season when shortage of raw water affected by the problem of salinity. Statistical data analysis and trend prediction were thus provided for the management of raw water including drawing, pumping and storage of water.

Malaysia

1. Improvement of Facilities

The Department of Irrigation and Drainage (DID), in 2004 has installed about 343 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 228 automatic flood warning sirens and 68 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.

2. Technical Advancement

The website InfoBanjir (http://infobanjir.moa.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:

1 Rainfall and water level data
2 Flooded areas
3 Flooded roads
4 Landslide risk
5 Flood camera pictures
6 Drought monitoring
7 River forecast
8 Satellite imaginary
9 Current river and rainfall alarms
10 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.

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

River Basin	Catchment Area (km^2)	Number of Forecasting Point	Forecasting 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 2003 to February 2004 with some flooding occurring. Most river basins mentioned above received relatively less intense rainfall with the forecasting points recorded lower flood levels.

While monsoon flood was relatively less severe since 1993, flash floods and landslides (including debris and mud flow) have been increasing and causing greater damage. The 5th October 2003 flood in Sg.Muda recorded an average 4-day rainfall 390mm (from 19 Stations) and it was more than 200-years return period. It caused widespread flooding, especially in the coastal region of southern Kedah and Penang. More than 31,000 people were evacuated with 4 death tolls. Terengganu, Pahang and Kelantan were hit by annual flood from November to December 2004. It caused widespread flooding with total evacuation reached 5,400 and estimated DID structures damaged was RM7.7 million. Kluang, Johor experienced a first severe flood and recorded daily rainfall 358mm in Kluang has more than 100 year return period. Jalan Tapah to Tanah Rata (at Kg.Abu), Cameron Highlands was hit by landslide on 24th February 2004 and caused that stretch of road to be closed for more than a week. The Bukit Lanjan stretch of the New Klang Valley Expressway (NKVE) was closed for six months after a rockfall and re-opened to traffic on 2 June 2004. The Kuala Lumpur city and surrounding areas were hit by severe flash floods on 16 July 2004.

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

Besides providing flood forecasting and warning services, the 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.

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)

6. Training

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

1 A course on "Watershed Modelling Using Rainfall-Runoff Model" at Kuala Lumpur from 27 to 29 May 2004.

2 A course on "Basic Course on Hydrology Forecast" at Kuala Lumpur from 8 to 10 June 2004.

3 A course on "Frequency Analysis of Rainfall and Flood" at Kuala Lumpur from 13 to 15 July 2004.

Philippines

In the **Philippines**, the Flood Forecasting Branch (FFB) of PAGASA has continuously monitored the four major river basins in Luzon, including the sub-basins downstream of four dams, and to a limited extent, other principal river systems in the country. This year, it has already issued a total of 22 flood bulletins, 5 general flood advisories to non-telemetered river basins and 721 daily hydrologic forecasts.

Aside from its operational flood forecasting services, the Branch conducted hydro-meteorological and hydrological analyses, investigations, and forecasting and prediction methods improvement. Related to flood forecasting and warning, and its methods or techniques improvement, are the following activities:

1 Improved the Basin Flood Bulletin format in consonance to the needs or requirements of the populace for it to be user – friendly.

2 Prepared a general action plan for the "Proposed PAGASA Participation in the Management of the Pre-flood Disaster Period Through a Community - Based Flood Early Warning System."

1 Spearheaded the seminar - workshop on the "Inflow and Flood Simulation for the monitored river basins and reservoirs using the hydrologic model."

2 Continued the flood hazard mapping of San Juan River Basin, Metro Manila, as pilot basin for the combined geomorphological and historical data-based methods of flood hazard mapping.

3 Attended the regular and emergency meetings of the Regional and Provincial Disaster Coordinating Councils of Regions II, III and V.

4 Acted as member of the Project Steering Committee headed by the National Economic Development Authority (NEDA) of the project "River Basin and Watershed Management Program (RBMP) – Bicol River Basin.

b. Project on Strengthening of Flood Forecasting and Warning Administration

This is a technical cooperation between the Philippine Government through the Flood Forecasting Branch (FFB) of PAGASA and the Government of Japan to enhance the operation and maintenance capabilities for a more accurate and timely flood warnings issuance and dissemination. All activities pertaining to the project are regular activities and functions of FFB with emphasis on Pampanga and Agno river basins, as preparatory steps to a physical rehabilitation project being proposed under the GOJ Grant In Aid scheme. Under the cooperation, PAGASA gets the support of JICA experts regarding the transfer of technology on the use of flood forecasting models and on systematic maintenance program for telemetry and multiplex equipment., among others.

Republic of Korea

The delegate from the **Republic of Korea** reported the activities under the Hydrological Component

MOCT embarked on two RCPIP country leading projects in 2004. One is “the Project of Evaluation and Improvement of Flood Forecasting System focusing on model performance”, and the other is “Development of Guidelines for Dam Operation in relation to Flood Forecasting”. MOCT/ROK kindly accepted the request from the Committee to provide financial support for one expert each from TC Members who will participate in these two projects to attend hydrological workshops organized by the Committee.

As one of the activities of Hydrological Component in Korea, MOCT/ROK hosted TC hydrological component Workshop in Seoul, Korea 20-24 September. In conjunction with the Workshop, as an opening session, International Symposium on Living with Risk was held, with the participation of 40 experts from TC Members and about 400 Korean participants. The Symposium was presided by Mr. Kim Chang Se, Assistance Vice-Minister of MOCT. Eminent experts were invited as guests: Dr. William J. Cosgrove, president of World Water Council, Dr. Chow Kok Kee, incumbent Chairman of Typhoon Committee, Dr. Chung Rae Kwoon, Director, Environment and Sustainable Development Division of UNESCAP, Mr. Katsuhiro Abe from WMO, and Dr. Allan Retiere, Director of UNOSAT.

As for national projects of interest, in 2004, Ministry of Construction and Transportation(MOCT) of ROK installed 13 rain gauges and 9 stage gauges. ROK has now a total of 483 TM rainfall stations and 322 TM water lever stages for flood forecasting and hydrological investigation, excluding those being operated by KMA and other local governments. The density of the rainfall gauge is 140 square km and water stage is 210 square km.

MOCT already installed a weather radar system at Ganghwa island to improve the performance of Imjin River Flood forecasting System. The radar system is available to estimate and forecast the real time rainfall for the northern part of Imjin River. Because about 70 % of Imjin River basin is located in DPRK, real time rainfall information for that area has not been available until the establishment of the Ganghwa radar system. For the past year, MOCT developed many tools and upgrade system for more efficient operation of Ganghwa radar system.

In addition to the plan to set up 11 radars over the country until 2011, a small scale and movable X-band weather radar, mainly for the research purpose, was installed in September 2004. Also, MOCT/ROK launched a new project to develop a flash flood forecasting system for the small scale river basins using the rainfall radar system.

The 5 Flood Control Offices (FCC) of MOCT are in charge of operational flood forecasting system and hydrological investigation in Korea. At present, there are 13 flood forecasting and warning systems (at the 5 major rivers and the 8 small and medium rivers) in operation.

During the Typhoon Megi, 18 – 20 of August, with securing flood control capacity and optimal operation of multipurpose dams in the basin, MOCT provided the results of reducing the flood runoff from the basin.

Several research projects are conducted by MOCT which included "Improve the Flood Forecasting System for each River Basin", "Probable Maximum Precipitation Estimate", Establishment of Emergency Action plan for Dam", and "Development of Flood Hazard Map".

Singapore

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

1a. Hardware and Software Progress

In **Singapore**, hydrological matters are managed by the Public Utilities Board (PUB). Reducing the occurrences of flood in Singapore has always been a priority objective of the PUB. Several factors have made this a challenge.

First, Singapore lies in the monsoon tropics where rainfall is abundant (average annual rainfall amounts to 2340 mm) and often of high intensity. Secondly, the rapid pace of development and urbanization makes close co-ordination between PUB and other agencies, such as MSD and other agencies responsible for urban development, critically vital. The continued comprehensive flood reduction policy in the past decades has significantly reduced the extent of flood-prone areas in Singapore. Nevertheless, flash floods still occur in pockets of low-lying areas from time to time when heavy rain coincides with high tides because these areas are below or slightly above high tides.

Singapore is implementing a project of constructing a barrage across the 350m wide Marina Channel (Figure 1) will keep out seawater. The inflatable dams and steel gates with the barrage are non-obtrusive and will act as a tidal barrier to keep out high tides. Inbuilt floodgates and pumps will help to release excess rainwater during heavy rain.

When completed in 2007, the water catchment areas in Singapore will increase from half to two-thirds of Singapore. Over time, the reservoir water will turn into freshwater to supplement our local water supply.

1b. <u>Implications to Operational Progress</u>

Flash floods in low-laying areas will be significantly reduced.

Thailand

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

a. Hardware and Software Progress

In Thailand, the second phase of the Telemetering System Project (which was firstly established by the TMD in late September 1999) was completed on 23 March 2004 with all 43 automatic rainfall/hydro-meteorological stations constructed in 3 main river basins in the

Southern Region of Thailand. The contract for the 3rd phase was already signed on 23 August 2004. Under this phase, another 53 automatic rainfall/hydro-meteorological stations are planned to be constructed in 5 main river basins in the upper part of Thailand and are expected to be completed by the end of September 2006.

In case of the Royal Irrigation Department (RID), its two telemetering projects were completed in 2 provinces (Chumporn and Songkhla) in the Southern Region of Thailand this year. The real-time in-situ and remotely sensed data collection is on hourly basis. These two projects employ the "NAM-model" to simulate hydrological behavior in the upstream area and create the input for the "MIKE 11" Model to proceed further in order to produce the channel routing which gives flood forecasting and warning.

b. Implications to Operational Progress

Since the two projects of the RID have just started, no progress report can be made. However, remotely sensed data are constantly collected at the control rooms and disseminated to concerned agencies.

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

Presently, the forecasted results and warnings produced by the RID are disseminated to the concerned agencies via Internet, radio, and television.

d. Training Progress

Training programs are set only for the concerned local staffs of the RID and will be provided to the others in the future.

e. Research Progress.

Research is being run in the Pasak river basin by the RID. Instead of using "MIKE 11" as main engine, the unit hydrograph is employed. The results are impressive, but 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

Since the telemetering systems had been installed in the two river basins in the Southern Region of Thailand, detailed data have been collected by the RID. Some fruitful results are expected in the future.

b. Implications to Operational Progress

Exchange of in situ and remotely sensed data and uses can be easily done in the future via the Internet. The information gained during this period is expected to help improve forecasted results.

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

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

d. Training Progress

The training in flood risk map is carried out by the RID. However, none of the results have yet been produced this year since it takes time to collect data and analyze. However, some outcome are expected in the future.

e. Research Progress.

Nil

f. Other Cooperative/RCPIP Progress.

Nil

3. Opportunities for Further Enhancement of Regional Cooperation

Nil

United States of America,

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

None.

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

WFO Guam has identified critical rainfall parameters that appear to trigger mudslides in Chuuk State FSM, on Pohnpei Island FSM, in the Republic of Palau, and on Guam. Forecast parameters have also been identified to trigger the issuance of flood watches and warnings that identify the potential for mudslides.

WFO Guam has also expanded the number and frequency of flood products for Guam and the Commonwealth of the Northern Mariana Islands.

3. Opportunities for Further Enhancement of Regional Cooperation

Three Guam personnel have applied for a grant to further study mudslides on Weno Island (WMO 91334) in Chuuk State and flash floods on Pohnpei (WMO 91348). The ultimate goal is to provide better early warning of these events.

In Central Pacific, RSMC Honolulu Section

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

Areal Mean Basin Estimated Rainfall (AMBER). RSMC continues to use the AMBER system to improve operational flash flood forecasting. The system takes the estimated rainfall from Hawaii's 4 Doppler radars based on an appropriate Z/R relationship and then maps and then averages the rainfall to predetermined basis. Most of these basins are small (a few 10s of

kilometers^2. The system alerts the forecasters to the possibility of flash flooding in these small basins based upon certain rainfall thresholds.

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

WFO Honolulu Turn Around Don't Drown Campaign Success Story. The Honolulu Weather Forecast Office adopted the Turn Around Don't Drown (TADD) campaign in November 2003 as part its effort to boost flash flood safety awareness throughout the Hawaiian Islands. This simple message to avoid driving through flooded roadways is paying dividends during this rather active 2003-2004 rainy season. WFO Honolulu promoted TADD through its web page, on regular broadcasts on NOAA Weather Radio, and through the media. At an outreach event in Hilo, Hawaii, two separate families told WFO Honolulu personnel that the TADD message might have saved their lives. On January 23, 2004, the families encountered flooded roadways and because of the TADD message, they decided not to drive through the water. This decision may have saved them from unnecessary injury or death because of the depth and speed of the water on the roadway.

Drought Briefing for Big Island of Hawaii. In September 2004, certain parts of the Big Island are becoming very dry. With the large cattle ranches, agricultural areas, and catchments systems for drinking water, dry conditions for several months can produce devastating consequences. On September 13, 2004, Dick Mitsutani, Official in Charge (OIC) Data Collection Office (DCO) Hilo, briefed the mayor and federal, state, and local officials on the past precipitation for the different parts of the island and the forecast for the coming months. The purpose of the meeting was to ensure coordinated mitigation actions were taken for current and future drought conditions.

3. Opportunities for Further Enhancement of Regional Cooperation.

Drought. Currently the Hydrology section only discusses flood-related goals and objectives. However, although not directly related to typhoons but rather the non-occurrence of typhoons, droughts play a significant role in many Members' areas. The Typhoon Committee may wish to discuss drought aspects (goals and objectives) under the hydrology component and possible drought indexes or indicators.

Viet Nam

The delegate from **Viet Nam** reported that there were no changes in Hydrological network.

- ***Flood situation in Vietnam***

During the period from 01 October 2003 to 31 October 2004, Vietnam was affected by very early floods in April and May 2004; large floods in Cau, Thuong, Lucnam and Thaibinh rivers in July in the north, in the lower Mekong river in September in the south. From October 2004 up to present, severe drought occurred, such as in Taynguyen, in Southern part of Central Vietnam and in North Vietnam.

a) In the North:

1. From 14-19 April 2004, large flood occurred in Da river with the highest peak in the historical data record in April since 1902.
2. From 15-20 May 2004, in the North Region, large floods occurred in most rivers with the peaks higher than the I-alert values. Especially, the flood peak in Da river was the 2th highest peak in historical data record in May since 1956 (lower than May's flood of 1990).

3. From 19-24 July 2004, due to heavy rains in the North Region, the highest floods of 2004 occurred in most rivers. The flood peaks in Cau, Thuong, Lucnam and Thaibinh rivers were higher than the III-alert values about 0,23-0,58m.

b) In Central:

From 11-13 November 2003, large floods occurred in two rivers: Thubon river in Quang Nam province and in Darang river in Phu Yen province with the flood peaks higher than III-alert values.

c) In the South:

In the lower Mekong river, the flood lasted for 20 days from 18 September to 8 October 2004. Flood peaks occurred on 27-29 September 2004 and were higher than III-alert values about 0,21-0,52m.

- Comprehensive Flood Loss Prevention and Management
- To continue the project to increase the height of Hoa Binh hydro-power plant's dam aimed at augmentation of flood mitigation capability is undergone.
- To carry out project on modernization of monitoring and flood flow forecasting system and providing water resources management for Hoa Binh reservoir.
- To establish the flood inundation map for Hanoi City which includes 3 cases: a real heavy rainfall on 3 August 2001, an assumed exceptionally heavy rainfall, and an assumed dike break.
- To simulate the highest flash flood in the Nam La River on 27 July 1991 and build the map of the highest flood inundation in historical data record for Huong River in Central Vietnam on 6 November 1999 by applying MARINE model.
- To build a reservoir in Lo Gam river.
- To build a hydro-electric power Son La in Da river.

➢ **Hydrological Research**

- Application of New MARINE and Hydraulic models for short term flood forecasting and flood control for Da and Red Rivers.
- Continued researches for correcting "The guideline on the operation of Hoa Binh hydropower" for strengthening the reasonable water resources management.
- Assessment of flood diversion ability on Day system and propose the plan of using flood detention system during flood occurrence.

APPENDIX IX

REPORT OF THE PRE-SESSION MEETING ON HYDROLOGY

(6th Flr., Shanghai Sport Hotel, Shanghai, China, 15 November 2004)

1. The Pre-Session on Hydrology was attended by 29 participants from China; Japan; Macao, China; Republic of Korea; Thailand; USA; Viet Nam; ADRC, UN/ISDR, ESCAP; WMO and TCS, as listed in Annex 1. The Meeting was chaired by Mr. Kenzo Hiroki and Mr. Liu Jin-Ping, Chairman and Vice Chairman of the Working Group on Hydrology.

2. The Meeting considered the Report of the Workshop on Living With Risk: Dealing with Typhoon-related Disasters as part of the Integrated Water Resources Management, which was jointly organized by was jointly organized by the Ministry of Construction and Transportation of Republic of Korea, the Korea Water Resources Corporation and the Korean Institute of Construction Technology in cooperation with the Ministry of Land, Infrastructure and Transport (MLIT)-Japan, Infrastructure Development Institute (IDI)-Japan, Asian Disaster Reduction Centre (ADRC), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Typhoon Committee Secretariat (TCS) in cooperation with the World Meteorological Organization (WMO) in Seoul, from 20 to 24 September 2004.

3. The Seoul Workshop was attended by delegates representing the Typhoon Committee Member States and experts from Japan and Korea. Invited guests include Dr. William Cosgrove, President, World Water Council, Dr. Chow Kok Kee, incumbent Chairman, Typhoon Committee, Dr. Chung Rae Kwon, Director, Environment and Sustainable Development Division of UNESCAP, Mr. Katsuhiro Abe, WMO, and Dr. Allan Retiere, Director, UNOSAT.

4. The Meeting noted the continuing increase in the number of participants from the TC Members in the Workshop of this year as compared with those in the previous years and the participants included TC Hydrologists and DPP experts as well as invited meteorologists from TC members. It took note of the fact that the allocation from the TC Trust Fund of US$20,000 for the Workshop had generated over US$96,000 in kind contribution from various parties, especially from MLIT and MOCT and the total expenditures were estimated at about US$113,000.

5. With respect to the findings and recommendations of the Workshop, the Meeting endorsed the following recommendations and requested the Chairman of the Working Group to submit them to the Committee for approval:

   - The Meeting was to note the following important aspects of the 2004 Workshop: a new and inventive format of the Workshop, impressive progress of RCPIP projects on hydrology, and detailed jointly prepared roadmaps for further action. It took a special note that the format has enhanced cooperative efforts through better interaction between Members leading the respective projects of RCPIP and participating Members and enriched the knowledge of Workshop participants through advices of distinguished guests participating in the International Symposium on the first day of the Workshop. The Meeting expressed its appreciation to the organizers of the field training on flood hazard mapping and the active participation of Pyeongtaek City in this exercise. It recommended that this format be maintained in the future workshops of the Working Group.

   - With respect to important progress made in the implementation of the various RCPIP projects, the Meeting noted the results of work on the guidelines on flood hazard mapping, guidelines on sediment disaster forecasting and warning and the

production of handy rainfall warning equipment for use in the region, based on the results of consultation with the international organizations working in the Caribbean through this Working Group.

- It was noted that the number of participants had also increased significantly due to the increased interest and support to its activities; contribution of MOCT and MLIT; self-financing participation from Hong Kong, China and Thailand as well as first ever participation of invited TC meteorologists in the Workshop.

- On the basis of the advices of international experts participating in the International Symposium, Panel of Experts and interaction among the Working Group members as well as discussions during the pre-session, the Meeting recommended to the Typhoon Committee to adopt the following theme for the next Workshop of TC Hydrologists: "Risk Management towards Millennium Development Goals and Socio-economic Impact Assessment of Typhoon-related Disasters". This theme was proposed in order to ensure continuity and consistency of its activities by building on past achievements of activities of the Working Group and to synergize with other international efforts on disaster reduction and integrated water resources management (IWRM). In this connection, it noted the recommendations of the Panel of international experts on "Integration of Typhoon-related Disaster Management into Socio-economic Development Process for a Safer World" that socio-economic impacts of typhoon-related disasters must be fully understood and related risks appreciated by key stakeholders, particularly decision makers and financing institutions. It also noted the plan of the United Nations to review progress towards the Millennium Development Goals and ongoing efforts to prepare for the Fourth World Water Forum (WWF-4), which includes the theme "Risk Management". The Meeting thus recommended the Committee to allocate a total of US$20,000 for the organization of the Workshop for TC Hydrologists in 2005.

- In view of the importance of the World Conference on Disaster Reduction (WCDR), which will be held in Kobe in January 2005, as an opportunity to enhance visibility of TC for more support, the Meeting expressed its appreciation to the Secretariats (UNESCAP, WMO and TCS) for their efforts and assistance in mobilizing resources to enable active TC Members in hydrology and DPP components to participate in WCDR. In this context, it recognized the importance of the demonstration of willingness in participation in joint activities, the Meeting requested TC to provide funds for the TC Chair and WG Chair to participate in WCDR. It also requested that in case the Chair or TC Vice Chair cannot participate in WCDR, TCS Coordinator be authorized to participate on behalf of TC and in case WG Chair cannot participate, WG Vice Chair be authorized to participate on behalf of WG.

- In noting the importance of the international conference on IWRM in Tokyo in December 2004 for the implementation of the recommendations of the World Summit on Sustainable Development in 2002 on integrated management of water-related disasters, the Working Group recommended the Committee to authorize the Coordinator of the Workshop of 2004 to participate on behalf of the Working Group to present the findings to the conference. This participation does not require financial contribution of the Committee. The consolidated recommendations to be presented at the Conference is shown in Annex 2.

- The Meeting expressed its appreciation to Mr Kenzo Hiroki 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. It also expressed its best wishes to Mr Kenzo Hiroki, who would be soon transferred to take up other duties in his country. The Meeting has thus recommended Mr Katsuhito Miyake of Japan as the TC-WGH Chairman and Mr Liu Jin-ping of China as the Vice Chairman for 2005.

6. The Meeting also called on UN-ISDR and ADRC to continue their cooperation with the Committee and to take part in the work of TC-WGH.

Annex I

PARTICIPANTS' LIST
PRE-SESSION OF HYDROLOGICAL COMPONENT
37th Session of the Typhoon Committee
(Shanghai, China 15 November 2004)

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Annex 2

RECOMMENDATIONS OF THE TYPHOON COMMITTEE RELATED TO IWRM PRACTICES

1. Floods and droughts are inextricably connected, and that they should be addressed in an integrated manner. The water resource management strategies to cope with water shortages should be interconnected with the floods management strategies to ensure water management in an integrated and sustainable manner.

2. With the increasing socio-economic impacts of disasters, including floods and sediment disasters, management and mitigation of such risks are important components to be integrated into water resources management in order to ensure sustainable socio-economic growth of the country/region. Integrated Floods Management (IFM) including the adoption of strategic plan on disaster management is required as part of the integrated water resources management (IWRM) process, and floods should be coped wisely within IWRM. In this connection, the initiative taken by the Typhoon Committee with the strong support of MLIT has generated a great deal of progress in flood risk mapping in several TC Members and application of flood hazard maps to risk management in IWRM, including increase of investment for this purpose in several TC Members, especially China, Malaysia and Republic of Korea.

3. The socio-economic impact of floods and related risk is an important factor to be considered in sustainable development. The economic impact assessment of floods should be conducted in an integrated manner so that the socio-economic impacts are appropriately accounted for. The socio-economic impacts of floods and related risks perceived by key stakeholders, particularly decision makers and financing institutions must be fully understood in the formulation of strategies. The Working Group appreciated the guidance provided by the distinguished guests and international experts participating in the International Symposium on the need to formulate proper strategies to deal with floods based on existing approaches, such as resistant or resilient approaches, as part of the development of integrated water resources management plan.

4. Floods management should be a combination of structural and non-structural measures. The conventional structural measures should be coupled with appropriate non-structural measures such as promotion of appropriate land use, application of early warning and flood hazard maps in view of maximizing humanitarian, social and economic benefits.

5. Systematic collection and sharing of data and information are important to effectively deal with floods and water related disasters. The recently emerging trend of increasing impacts calls for better cooperation among countries to facilitate the development of tools and methodologies for better forecasting and warning systems. On the basis of experiences provided by Japan and recent development in China, the Working Group recognized important progress made on the methodologies on improving forecasting and warning systems. The initiatives of the Working Group, with support of MOCT and KOWACO, to develop guidelines for reservoir operation in relation to flood forecasting, and to develop methodologies and tools to evaluate and improve operational flood forecasting systems focusing on the model performance have provided excellent opportunities to bring experts from different sectors, especially on meteorology and disaster prevention and preparedness, as well as beneficiaries to work together for better impacts of water resources management. The Working Group recognized the opportunities to use these tools and methodologies to cope with global climate change and variability for better IWRM.

6. The Working Group noted important progress and achievement that had been made during the past four years by the TC Members under the framework of its Regional Cooperation Programme Implementation Plan (RCPIP) for hydrology and disaster prevention and preparedness (DPP). On the basis of these achievements, it recognized the importance of RCPIP as a strategic plan to promote regional cooperation on integrating activities of the hydrology and DPP components towards realization of the TC Vision for effective disaster mitigation and water resource actions towards sustainable development. Such efforts are an important part of the IWRM process.

APPENDIX X

SUMMARY OF THE REPORTS OF THE TYPHOON COMMITTEE MEMBERS ON THEIR ACTIVITIES RELATED TO THE DPP COMPONENT

The delegate from **China** reported that on May 25, 2004, the Ministry of Civil Affairs of China (MOCA) and the Secretariat for the UN International Strategy on Disaster Reduction (UN/ISDR) co-sponsored a three-day International Conference on Disaster Reduction. The participants represented 18 countries including Bangladesh, Japan, Russia, Republic of Korea, and Lao People's Democratic Republic; seven international organizations including UNICEF; over 20 national ministries and agencies; and more than 10 local departments of civil affaires in China. The conference identified the high-priority areas for the governments in Asia and adopted the Beijing Consensus that was to be submitted to the 2nd World Conference on Disaster Reduction in 2005 for discussion with an aim to guide the international disaster reduction practices.

Meteorological services at all levels have taken measures in improving their emergency management on meteorological disasters, setting up a direct reporting system and enhancing the assessment on high-impact meteorological-related disasters. Accordingly, the China Meteorological Administration (CMA) has made timely assessments on the impacts of typhoon Rananim and Aere. And CMA has worked out *Provisional Measures on the Issuance of Warning Messages for Contingent Meteorological Disasters* on 16 August 2004. The measures have defined 11 types of warning messages, and relevant criteria and approach to issuing. These measures will help increase public awareness on disaster reduction and prevention and effectively preventing and mitigating meteorological disasters.

CMA has devoted itself to the development of the Government Contingency Program on Meteorological Disasters, a program for disaster management at national level in China, which clearly defines the deployment system, prevention and alert mechanism, emergency response, assurance and management. This program is helpful to speed up the responding process and improve the emergency management through effective implementation of contingency program.

DPRK

1. Disaster Prevention and Preparedness

Heavy rainfall occurred in Kangwan Province by Typhoon, Mindulle(No.7). Maximum precipitation amount was 334mm from 4 to 5,July. Precipitation intensity 89mm/h was observed at Chonne County. And 0.6m storm surge occurred at the seashore.

The heavy rain occurred often in whole country in July. At least 1000,000ha of paddy and non-paddy field were inundated or washed away in over 70 cities and counties. It was hard to expect any harvest from the field washed away. Harvest in many fields is expected to drop 30percent. The dwelling houses and public buildings of about one thousand were destroyed and railway and road of some hundreds places were destroyed. Electric supply and communication facilities damaged.

Heavy rain occurred at many areas in the whole country under influence of tropical depression on 11,12 September. More than 200mm rainfall was observed at many places in this period. Particularly nearly 13.000ha of farmland were inundated in South Hwanghae Province, which is granary area.

In order to prevent damage from yellow sand, a research group has been organized by experts on meteorology, environment protection, health, biology and others, and cooperative study is being promoted actively as a measure of the government.

Public awareness on meteorological disasters, especially yellow sand and heavy rain, has been promoted actively through TV and other broadcast, and through publications and lecture.

Hong Kong

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

1a. Hardware and Software

Dr. K. K. Yeung of HKO provided expert service to WMO to help develop a website in connection with WMO's new Natural Disaster Prevention and Mitigation Programme. This website was implemented at **http://www.wmo.int/files/disasters/index.htm**.

1b. Implications to Operational Progress

Nil.

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

A symposium on natural disaster planning and preparedness was held in Hong Kong on 29 and 30 March 2004. Invited lecturers included the former President of WMO Dr John Zillman who gave the keynote speech, and the Director of the Hong Kong Observatory Mr. C. Y. Lam who talked about the weather aspects of disaster planning and preparedness in Hong Kong. More than 60 meteorologists and emergency response personnel from Hong Kong, Guangdong and Macao attended.

The Director of the Hong Kong Observatory Mr. C. Y. Lam represented WMO at the International Strategy for Disaster Reduction (ISDR) Asian Conference in Cambodia in February, and chaired a WMO meeting of experts on the newly established Natural Disaster Prevention and Mitigation Programme in Geneva in March 2004.

1d. Training Progress

HKO continued to provide training courses on the interpretation of radar and satellite images, weather charts as well as on weather forecasting, weather observation and numerical weather prediction to the public and other government departments. The objective was to promote awareness and preparedness of disasters. For the 12-month period ending September 2004, over 550 participants attended the courses.

Four meteorologists from Typhoon Committee Members were among the nine participants attending the Voluntary Cooperation Programme (VCP) Training Course on "Provision of Weather Service via the Internet" held from 8 to 12 March 2004 at HKO. Participants also learned the provision of tropical cyclone information and warnings on the Internet.

A list of the Observatory's tropical cyclone and disaster prevention related training activities is shown in Appendix 2.

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

Nil

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

The media and public are indispensable partners in disaster prevention. In view of this, during the year over 50 press releases were issued and some 8 media briefings held to strengthen the public's awareness of natural disasters and to foster their interest in weather and climate.

In particular, hourly media briefings for the public were made by HKO publicity officers during the close approach of Typhoon Kompasu. Joint media briefings were also made with the Airport Authority Hong Kong (AAHK).

The probability of tropical cyclone signal change was provided to public transport operators on a trial basis to facilitate the orderly suspension and resumption of transportation services during the passage of tropical cyclones.

HKO visited the relevant government departments and organizations to review disaster preparedness and prevention procedures for the tropical cyclones and the rainy season. In addition, briefings were held for government departments, transport operators and fishermen to promote the effective use of the forecasting and warning services provided by HKO. HKO also participated in AAHK's coordination meetings to brief the aviation community on tropical cyclone related hazards for their drawing up of contingency plans.

A number of lectures on HKO's warning services were given to private organizations and the public. HKO's Weather Service Officers gave talks on tropical cyclones and other aspects of the weather to pupils in HKO's outreach programme to primary schools.

2d. Training progress

A refresher pre-rain and typhoon season seminar was held for HKO colleagues in March. Another workshop on tropical cyclone and heavy rain with special focus on airport operations was conducted in May (see Appendix 2).

2e. Research Progress

Nil.

2f. Other Cooperative/RCPIP Progress

Nil.

3. Opportunities for Further Enhancement of Regional Co-operation

Nil.

Appendix 2

Tropical Cyclone and Disaster Prevention Related Training

1. Tropical Cyclone Related Training Overseas Attended by HKO Staff

   (a) "First Roving Seminar of the Typhoon Committee Typhoon Research Coordination Group Visiting Lecturer Programme" in Seoul, Republic of Korea from 20 to 21 October 2003. One officer participated.

(b) "Fourth Typhoon Operational Forecasting Training" at the RSMC Tokyo-Typhoon Center, Japan from 28 July to 6 August 2004. One officer participated.

(c) Training course on "Living with Risk: Dealing with Typhoon-related Disasters as part of Integrated Water Resources Management" in Seoul, Republic of Korea from 20 to 24 September 2004. Two officers participated.

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

(a) Typhoon Committee Roving Seminar, 22- 24 October 2003.

(b) Lecture on "Typhoon Vamei" by Professor C P Chang of Department of Meteorology, Naval Postgraduate School, USA on 20 October 2003.

(c) Seminar on "Typhoon Studies Using NASA Space-based Data" by Dr. Timothy Liu of the NASA Jet Propulsion Laboratory on 17 November 2003.

(d) Symposium on Natural disaster Planning and Preparedness, 29-30 March 2004.

(e) Pre-Rain and Typhoon Season Seminar on 6 April 2004 and 25 May 2004.

(f) Workshop on Tropical Cyclone and Heavy Rain with Particular Focus on Airport Operation on 27 May 2004.

JAPAN

The delegate from **Japan** reported that the Japanese Government set up a new study meeting on countermeasures for severe damage of floods by rain fronts in July and continuous typhoon floods, landslides and high tidal waves. The meeting focused on when and how the mayors of cities and leaders of towns and villages should order quick and safe evacuation of people in case of disasters especially for elder and handicapped residents. Some local governments in affected areas were criticized for their too late evacuation order during a disaster in which most of the fatalities were 65 years or over. The result of the study is expected by the end of coming March. Japan would like to exchange views on these problem with members of the Typhoon Committee.

Japan also reported on the UN World Conference on Disaster Reduction which was held coinciding with the 10th Anniversary of the Great Hanshin-Awaji Earthquake in 1995. Survivors from Kobe City and Hyogo Prefecture, who received warm support and encouragement from the international community, wanted to share the lessons learnt from the devastating earthquake with the foreign participants to help contribute to disaster reduction in the world.

MACAO, CHINA

The delegate from Macao, China reported that the Disaster Prevention Center (DPC) continued to strengthen prevention awareness and knowledge. In May each year, DPC promotes public awareness on typhoon mitigation, including bilingual advertisement on TV, radio and newspaper. New warning advise leaflets were distributed to residential apartments, with the cooperation of the Macao Security Force.

Revision of the Typhoon Contingency Plan is being made each year based on the needs. The Civil Defense Prevention Center conducts activities based on the general revision, especially in the area of communication. The continued cooperation with related institutions and the Residential Associations of Macao's islands, Taipa and Coloane, created favorable results.

A full scale communication exercise was held in Macao on to alert all concerned institutions on the start of tropical cyclone season and to remind residents to enhance coordinations every month of May.

In addition, education of the youth in school and childcare centers on the risk involved in following evacuation guides is also being done.

Moreover, prior access to telephone network in emergency situation under the Civil Protection has improved and a new system for transmission will be installed and implemented.

The MacaoSAR Civil Defense Prevention Operation Center will continue provide service and protection to their citizens and will continue cooperation on DPP of RCPIP 2002-2006.

MALAYSIA

The delegate from **Malaysia** reported that aside from floods, Malaysia is occasionally subjected to landslides. The disasters also occur in the cities due to excessive precipitation and human activities which contribute to slope instability that cause landslides.

Though most natural hazards are inevitable, their effects can be prevented or mitigated. The Malaysian 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.

Programmes for future direction

In order to enhance Malaysia's capability in disaster management, the country has adopted the following strategies:

- To integrate disaster mitigation planning into the overall national development plans and projects for sustainable development;

- To develop risk assessment capabilities, in order to reduce disaster vulnerability which can be translated into mitigation policies and measures;

- To develop contingency plans for hazardous and high risk sectors such as oil and gas, Petrochemical Industry and other hazardous industries;

    - the Standing Operational Procedures (SOP) for Oil, Gas and Petrochemical Disasters was prepared and signed by the Honourable Deputy Prime Minister of Malaysia on 15 September 2004

- To form Working Committees involving Lead Agencies in risk analysis and assessment for specific sectors of disaster prevention;

    - The Working Committees on risk management which have already been formed are:

        i. Petroleum and Gas;
        ii. Landslides;
        iii. Flood;
        iv. Forest Fire; and
        v. Radiological accident.

- To develop an integrated database management system for disaster planning and prevention;

    - National Security Division (NSD) and Malaysian Centre for Remote Sensing (MACRES) had jointly cooperated in developing the National Disaster Data and Information Management System (NADDI). NADDI functions as a central system for collecting, storing, processing, analyzing and distributing value-

added data and information on disaster to NSD and other related agencies involving with disaster management.

- To strengthen the existing laws and regulations on the aspect of safety, licensing and enforcement for the protection of public safety, properties and the environment in disaster preparedness and prevention;

  - To Review the existing laws and Regulations related to the safety of water transportation in lakes and rivers to avoid accidents which happen during the moonsonal season and for tourism purposes.

- To conduct regular educational and community awareness programmes in disaster prevention measures, particularly for risk mitigation strategies;

- To involve the District and State Disaster Management Committees and authorities in the development, testing and implementation of the overall emergency response plans, especially on the Industrial Disaster Management System of the respective industries;

- To introduce standard safety control at the installations in order to have zero-threat during the occurrence of any industrial incident, which could affect the nearby population;

- To develop specific knowledge, skills and expertise for personnel of relevant agencies especially the Special Malaysia Disaster Assistance and Rescue Team (SMART) team for the enhancement of disaster response and management capabilities. Among courses which were already been conducted in 2004 are:

  i. Rescue Net Course;
  ii. RTA (Road Traffic Accident) Exercise;
  iii. Wilderness SAR Course;
  iv. Pinnacle – Mulu SAR Exercise;
  v. Mount Kinabalu Exercise;
  vi. Open water Diver and Advanced Open Water Course;
  vii. Cave Rescue Exercise; and
  viii. Land Slide Exercise etc.

- To promote and develop regional cooperation and networking for exchanging, sharing and training on disaster management, as well as cooperation in rendering and receiving of disaster assistance, be it in the form of humanitarian assistance or the dispatch of search and rescue teams; and

- To develop the Stormwater Management and Road Tunnel or “SMART” system which aim at alleviating floods in the city centre. It will address the city’s problems with a 9.7 kilometre tunnel with a height almost as tall as a four-storey building.

Conclusion

Due to rapid development in the country, the cost of damage due to disasters is also escalating. Malaysia has realized the importance that the element of safety must be built into each development project to avoid high casualty and damage to life and property in the event of a disaster. An integrated approach in the various aspects of disaster management involving the various agencies is adopted to achieve higher efficiency and greater effectiveness. Efforts are being made by the Government to create higher awareness among the people so as to enhance disaster preparedness as well as to build a culture of prevention and Civil Protection/Public Safety in the community. The Government also hopes to enhance its national capabilities in disaster management by setting up training facilities and through related activities in cooperation with other countries. Malaysia hopes to create a safer environment for the

people through effective management, risk reduction efforts and sustainable development in the 21st century.

PHILIPPINES

In the **Philippines**, as part of the public services rendered, PAGASA has intensified its information, education and communications on hydro-meteorological hazards to enchance public awareness on these issues through lectures, exhibits and press releases. Since 1994, lectures on these topics have been continually provided to students and teachers on their visits to PAGASA on school days.

One of the urgent concerns of the Flood Forecasting Branch (FFB) of PAGASA, is to provide assistance in the development of a community-based flood forecasting system. This program is committed to assist flood-prone communities, which are outside the telemetered river basins monitored by FFB. It calls for the active participation of the community in all phases of flood prevention and mitigation, i.e. before, during and after flood situations. This undertaking will be properly coordinated with the disaster coordinating councils at the barangay level. At the initial stage of the program, a hydrologist from FFB will be assigned temporarily to provide in-house training workshop on operational hydrology to capable local government units to properly equip them with the necessary tools needed for flood mitigation. In 2004, as a result of massive flooding in Central Luzon, most of the provincial governments had requested for PAGASA briefings on the possibility of putting up selected rainfall and water level monitoring stations as part of a community-based flood management system.

Also, in coordination with the local government units and various government and non-governmental organizations, the PAGASA has been preparing flood hazard and vulnerability maps of different places in the Metro-Manila area. Other places in the Philippines such as Davao and Butuan in the south are now included in the mapping activities.

Singapore

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

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

In **Singapore,** The media and Ministry of Information, Communications and the Arts (MICA) are indispensable partners in dissemination of critical information to public. In view of this, a Crisis Message Announcement forum has been set up among lead media companies and government agencies to study and implement procedures so as to ensure prompt round-the-clock broadcast of emergency messages.

For meteorological service, criteria and procedure for Crisis Message Announcement have been established.

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

e. Research Progress.

Nil

f. Other Cooperative/RCPIP Progress.

Nil

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

a. Hardware and/or Software Progress

+ The Department of Disaster Prevention and Mitigation (DDPM) has installed more simple rain gauges and hand-spin warning sirens in flood-prone villages all over the country. This has brought about 3,000 pieces of necessary equipment for observing, notifying, forecasting, and warning on local flood conditions.

+ Temporary shelters for evacuees have been designed and manufactured by the technicians of the DDPM. Each of them approximately cost US$ 250 for the building materials and can accommodate 4 persons. Last fiscal year, the Department has mobilized the central fund to manufacture 21 temporary shelters and the private sector has funded for 4 more. It is expected that apart from the government budget, more funds from private sectors and NGO will be mobilized in this project as well.

+ The National Civil Defence Committee assigned the DDPM to set up "Flood Vigilance Clusters" to monitor potential floods in flood-prone areas throughout the country. According to their locations, the "Flood Vigilance Clusters" can be grouped into 5 areas namely;

  - Lower Northern Region area
  - The Chao Phraya basin
  - Bangkok Metropolis and peripheral provinces area
  - Eastern Region area
  - Lower Central Region area.

  The provinces under each area have to collaboratively prepare flood prevention action plan and implement the exercise or drilling accordingly.

+ Besides launching community-based disaster management to enhance the participation from the people in the community, the DDPM has also organized and trained the Civil Defence Volunteers to become the disaster tackling network. These Civil Defence Volunteers are community-based who will work closely with government officials in managing disasters. At present, there are 407,382 Civil Defence Volunteers throughout the country and the Department has a plan to annually increase their number at the rate of 1% of total number of the country population.

b. Implications to Operational Progress

+ Since the adoption of the community-based disaster management approach with the aims to generate the awareness, strengthen disaster preparedness, and enhance disaster prevention capacity of the community, the DDPM has launched the

community-based training course in 51 communities countrywide. The findings achieved from having monitored and evaluated this programme revealed its success. Thus, the Department will continue launching this training course in order to cover more communities, particularly those located in vulnerable areas, in this fiscal year. Moreover, the workshops on Disaster Prevention and Mitigation Network at Village Level will be carried out to equip villagers with new disaster prevention and mitigation methodology and to enhance their efficiency in collaboration.

+ Since the DDPM launched its website: www.disaster.go.th for disseminating DPP information via Internet a couple of years ago, the number of its visitors has increased very rapidly. This website has also been recognized as one of the best sources of the official information dissemination service.

+ Having introduced the Information and Communication Technology for disaster management since last year, the DDPM has succeeded in designing data-base structure of water-related disasters. For the time being, all relevant data, including those on flood-prone areas; repeated flooded areas; and flood potentiality of the said areas, have been compiled and analyzed. All data will be applied for disaster impact assessment and for the decision-makers to use both applied data and the results from such assessment as the tools in managing water-related disasters.

+ The Natural Disaster Warning Center has been established at the Southern Meteorological Center (East Coast) by TMD in the town of Songkhla District with the responsibility to distribute the warning for natural disasters in Songkhla Province and its vicinity.

+ The Southern Meteorological Center (East Coast) of TMD and the Asian Disaster Preparedness Center hosted twice the Public Disaster Preparedness and Mitigation Training Workshop in Hat Yai District.

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

+ To maintain effective working relationship and communications with the mass media, the DDPM has continuously disseminated disaster-related information for public notification. Enhancement of the level of awareness and preparedness of the people in risk areas is another aim of the information.

+ Initiation of the orientation for the journalists has been put in practice so as to better their understanding and knowledge on disaster prevention and mitigation. It also aims to establish the disaster prevention and mitigation network.

+ The DDPM has joined ADPC and UNESCAP as the judging committee in the ADPC-UNCESCAP Journalism Award. This award aims at building up partnerships and emphasizing the vital role of mass media in promoting the awareness of disaster management issues in the mainstream press.

d. Training Progress

+ Several computer-based and internet-based training had been conducted by the DDPM last fiscal year (2004). The participants of these courses were from administrative level, computer technician and other related staffs. For this fiscal year, more internet-based and computer-based training are on the way, such as “GIS Application” training course and “Adoption of GIS System for Disaster Management” workshop.

+ Many other disaster management related training courses and workshops will be carried out such as, “Disaster Victim Relief Operation” Workshop, “Early Warning

System and Emergency Management" training, "Telecommunication System and Emergency Management" training.

+ The DDPM has sent their staffs to attend various international workshops and conferences. This provided the staffs' good opportunities to exchange experience and information and to enhance their capability and know-how.

e. Research Progress.

The DDPM has been carrying out a research on "Community-Based Disaster Management". The conclusion of this research is expected to be applied in the set up guideline for future development of the community-based disaster prevention, mitigation, and rehabilitation plan.

f. Other Cooperative/RCPIP Progress.

Nil

3. Opportunities for Further Enhancement of Regional Cooperation

Nil

United States of America

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

Maintain effective communications and a closer working relationship between the National Weather Service and Emergency Management.

Aviation User's Workshop – November 2003 –Aviation Workshop was held in Guam for aviation users in Guam and the CNMI. This workshop was held to familiarize users with NWS products, including tropical cyclone products, to inform them of programmed changes in aviation support, and to address aviation support deficiencies identified by users. Several commercial airlines, both US and international, were represented.

Typhoon Preparedness Exercise – April 2004 - WFO Guam, in conjunction with the Guam Emergency Management Office (EMO), military interests on the island, and the Joint Typhoon Warning Center (JTWC) in Hawaii, conducted a canned exercise on 14-16 April 2004. The scenario was one of a tropical cyclone developing well southeast of Guam and Saipan, then eventually intensifying into a typhoon with a maximum intensity of 80 knots as it passed northeast of the Island. The exercise consisted of local agencies executing their operations in dealing with an approaching typhoon expected to cause light to moderate damage and disruption of services on Guam, Rota, Tinian, and Saipan. JTWC issued the bulletins, and WFO Guam produced the suites of tropical cyclone products based on those warnings. WFO Guam also provided the coordination with the EMOs, which set the local response categories (Conditions of Readiness) for the Islands.

Safe Boating Week – May 2004 – WFO Guam set up a large, manned weather display at a popular shopping mall during Safe Boating Week. This was coincident with displays from the Guam Emergency Management Agency, the U.S. Coast Guard, and a multitude of other safety-oriented agencies. Weather personnel interacted with hundreds of people, providing invaluable information to the marine community.

Annual Tropical Cyclone Preparedness Workshop for Guam - June 2004 - The 8th Annual Tropical Cyclone Workshop was held on 8-9 June 2004. Members of the Guam EMO, other Government of Guam agencies, military interests on the island, and the private sector were invited to the event, which highlighted: tropical cyclone climatology, hazards and behavior;

the tropical cyclone program and products of the National Weather Service; typhoon vulnerability of the island; and the basics of climate and El Niño influences, including an update on the on-going El Niño event.

Media Workshop – September 2004 - WFO Guam held a Media Workshop on Guam and Saipan. Representatives from all media outlets were invited to attend this informative session on: tropical cyclone characteristics and behavior and the WFO Guam tropical cyclone programs and products; routine forecast and warning products; non-routine forecast and warning products; and ideas for improving the interaction between WFO Guam and the media.

Micronesian Tropical Cyclone Preparedness Workshops – August through October 2004 - The Guam Warning Coordination Meteorologist (WCM), Mr. Chip Guard, conducted 2-day Tropical Cyclone-Disaster Preparedness and Climate Workshops for EMO officials, Weather Service Office (WSO) personnel, government agencies, and other interested parties in: the Republic of Palau; the Republic of the Marshall Islands; the Federated States of Micronesia, including the states of Yap, Chuuk, Pohnpei, and Kosrae; and, Saipan, Tinian and Rota in the CNMI. The Workshops included a review of JTWC warnings, WFO Guam tropical cyclone products and procedures, hazards associated with tropical cyclones, response procedures, ENSO status and impacts, causes of regional weather events, the Saffir-Simpson Tropical Cyclone Scale (relates maximum wind speed to potential damage and storm surge), typhoon risk and vulnerability, plotting and speed-time-distance exercises, and hydrological aspects of meteorology. The presentations were specifically tailored for each island state/nation. The WCM also provided additional 1-day training sessions at the WSOs and provided several presentations at other island venues. The WCM and the WSOs will jointly develop typhoon vulnerability studies for the respective states/nations.

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

WFO Guam implemented use of the Saffir-Simpson Tropical Cyclone Scale (STiCkS) around Micronesia. STiCkS is a scale that relates maximum tropical cyclone wind speed to potential damage and storm surge and it was specifically developed for tropical regions. The Scale was introduced to all of the regional weather offices and disaster offices. It has been incorporated into the WFO Guam tropical cyclone products.

At the request of the WMO, Mr. Chip Guard (WFO Guam WCM) introduced STiCkS to the South Pacific region at the Regional Association V (RA V) meeting held in Brisbane, Australia in July. In addition to a comprehensive presentation on the Scale at the RA V meeting and at the International Conference on Storms, copies of the Scale were given to each attendee. WMO also agreed to translate the Scale and User's Manual into French.

3. Opportunities for Further Enhancement of Regional Cooperation

Opportunities exist to introduce the Scale to other hurricane/typhoon-prone tropical areas, and to conduct workshops on application of the Scale for both cyclone preparedness and post analysis.

Central Pacific, RSMC Honolulu Section

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

Maintain effective communications and a closer working relationship between National Weather Service and Emergency Management.

StormReady/TsunamiReady. Jim Weyman, Director RSMC Honolulu – Hurricane Center and Nezette Rydell, Warning Coordination Meteorologist (WCM), visited Kauai County September 17 as part of the StormReady/TsunamiReady certification process. In cooperation with state and county civil defense, the Hawaii StormReady Advisory Board certified Kauai

County as both StormReady and TsunamiReady on September 23. Kauai County becomes the first TsunamiReady community in Hawaii and the second StormReady community. Maui County is currently in the process of renewing its StormReady designation and is seeking TsunamiReady status as well. In partnership emergency management and weather services help communities or counties to meet a set of criteria on communications, plans, training, and outreach to be designated as StormReady/TsunamiReady. People in StormReady communities receive a discount on their insurance.

Hawaii State Hurricane Advisory Committee (HSHAC). The HSHAC is an advisory group to State and County Civil Defense on hurricane-related matters. It is composed of two meteorologists, one oceanographer, one social scientist, Red Cross Representative, and five engineers with different specialties. The Director, RSMC Honolulu is the Chairperson of HSHAC. At a March 23, 2004, the HSHAC approved the development of a Hurricane Atlas for the Central Pacific, emergency shelter criteria, protocol for disaster response teams formed by State CD, terms of service for members, and the development of a strategic plan for the Committee.

Hurricane Preparedness Briefings. On June 23 and 25, 2004, Jim Weyman, Director RSMC Honolulu, and Nezette Rydell, WCM WFO Honolulu, provided hurricane preparedness briefings on Maui and Kauai, respectively. The briefings were sponsored by the two counties Civil Defense Administrators and were held at their counties' Emergency Operations Center (EOC). They discussed the seasonal tropical cyclone (TC) forecast for the central Pacific, average and past TC seasons, relationship of TCs to El Nino cycle, triple threat from hurricanes, TC products, fire weather issues, and upcoming product changes. Attendees included representatives from all county offices and many other national and state agencies.

Radio Program on Hurricanes. In partnership, the Director of RSMC Honolulu and the Vice-Director of State Civil Defense participated in an hour long radio program on hurricanes on the most listened to radio station in Hawaii. The Director discussed the recent hurricanes in Florida, the potential for late season tropical cyclones in Hawaii during an El Nino event, the formation of hurricanes, and the frequency of them. The Vice-Director discussed preparedness and recovery issues associated with hurricanes.

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

Hawaii State and County Civil Defense and Warning Point Flash Flood Reference. RSMC Honolulu's Senior Service Hydrologist, Kevin Kodama, has completed flash flood reference binders tailored to meet the requirements of the office's emergency management partners. The reference includes descriptions and samples of WFO Honolulu's flash flood products, types of flooding problems expected in Hawaii, the office's flash flood threat areas, and descriptions of Hydronet rain gage locations and their nearby streams and communities. These binders were sent to the warning points and greatly improved the Civil Defense and Warning Points personnel's ability to fully understand and act upon rain gage and warning information.

3. Opportunities for Further Enhancement of Regional Cooperation.

Viet Nam

- **Overview of the disaster situation in Vietnam (01 September 2003 to 31 August 2004)**

During the period from 1 September 2003 to 31 August 2004, water related disasters were mainly due to tropical cyclones, floods, landslides, whirlwinds and flash floods.

Summary report on damage caused by disaster in Vietnam in 2004
(Until November 2004)

CATEGORY	ITEM DAMAGED	UNIT	Whirlwind	Flood	Tropical cyclones	TOTAL
PEOPLE	Killed	No	45	107	26	178
	Injured	No	72	41	33	146
	Missing	No	0	4	30	34
HOUSING	Houses collapsed, drifted	No	390	413	389	1192
	Houses submerged and damaged	No	6404	3,618	1,655	11,677
SCHOOL	Schools collapsed	Room	26	2		28
	Schools submerged and damaged	Room	0	0	0	0
HOSPITAL, CLINICS	Clinics collapsed	No	0	0	0	0
	Clinics submerged and damaged	No	246	58	28	332
AGRICULTURE	Rice fields submerged	Ha	2,629	263,313	159,130	425,072
	Farms submerged, damaged	Ha	4,014	33,293	27,870	65,177
	Food damaged by water	Ton	0.7	0	258	258.7
WATER RESOURCES	Land washed away	m^3	0	0	140916	140916
	Stone drifted	m^3			1387	1387
	Dykes slumped	m				
	Small hydraulic structures collapsed	unit				
	Small hydraulic structures damaged	unit	1	9	242	252
TRASPORTATION	Land drifted	m^3	0	0	0	0
	Rock drifted	m^3				
	Bridge, sewer collapsed	unit				
	Bridge, sewer damaged	unit				
	Roads damaged	Km	0	1231	4	1235
AQUATIC PRODUCT	Shrim, fish poll broken	m^3	6600	1205	2566	10371
	Ships sunk, lost	unit				
	Ships sunk, damaged	unit	0	0	0	0
COMMUNICATION	Telephone poles collapsed	unit	0	0	0	0
	Telephone wire broken	m	450	0	0	450
ENERGY	High voltage electric towers broken	unit	0	0	0	157
	Electric distribution poles broken	unit	0	0	0	0
	Electric wire broken	m				
	Total damage	USD	2,000,000	4,500,000	20,500,000	27,000,000

Disaster Prevention and Preparedness Activities

- Regular maintaining and upgrading the dikes systems and hydraulic structures for dyke system in Bacbo and northern part of Central Viet Nam.
- Many reservoirs were built for flood retention and diversion areas such as Tuyen Quang reservoir in Gam river, Viet An in Quang Nam…
- Implementing a programe to relocate residents living in disaster prone areas.
- Implementing a program for building residential clusters for people living in Me Kong rivers Delta.

APPENDIX X.a

REPORT OF THE PRE-SESSION MEETING ON DPP

Conclusions:

The 45 minute-long pre-session meeting was held at 2:30 p.m. on 15 November 2004. The meeting was chaired by a representative of UN/ISDR with sixteen participants from eight countries, namely Japan, Thailand, Republic of Korea, Macao/China, China, the Philippines, Viet Nam and U.S.A.

It was agreed by Members that the Disaster Prevention and Preparedness (DPP) component, which is currently closely associated to the Hydrological Working Group, will be implemented in a more independent manner. The targeted time frame is the next TC workshop to be held in Malaysia in August/September in 2005.

Members reviewed the DPP component of the ICPIP projects. The members agreed to propose to the Typhoon Committee of their participation to two existing projects of ADPC/ESCAP as a start. The two projects were on 1) Community based disaster management and 2) Maintaining effective communication systems, including media aspect.

Members requested continuous supports from both Meteorological and Hydrological components of the Typhoon Committee because of the close linkage.

Members expressed their appreciation to the IDI, Japan for their generous contribution to assist DPP participation from several member countries during the Workshop held in Seoul, Republic of Korea in September 2004.

Recommendations:

The necessity of a guiding mechanism to facilitate the process is identified. Establishment of the DPP Working Group as well as nominations of Chair and Vice-Chair is expected. Continuous supports from UN-ISDR, UNEP/IETC, ADRC, and IDI are welcomed for the further development of DPP.

Budget allocation to support forming the DPP Working Group is important to implement the process.

APPENDIX XI

REPORT OF TYPHOON RESEARCH COORDINATION GROUP (TRCG)

30 September 2004

Introduction

According to its terms of reference, the TRCG is required among other things to identify problems in the operational analysis and forecasting of tropical cyclones and relevant components in hydrology and disaster prevention and preparedness, to report on recent developments in related research activities, to promote research addressing common problems, and to suggest key research projects for the consideration of the Typhoon Committee.

Action Proposed

The Committee is invited to :

(a) Note the major activities summarized in APPENDIX I;
(b) Consider the plan for the regional workshop on effective tropical cyclone warning in 2005 (Annex V)
(c) Call for support and for active participation on the roving seminars being held in Beijing and Kuara Lumpur in November 2004 immediately after the 37th session (Annex IV)
(d) Consider the remaining offers and a request for the TC research fellowship scheme in Annex II
(e) Consider the update of the list of resource person for the exchange of information among experts in various fields on tropical cyclone in Annex III.

APPENDIX I:	Report of Typhoon Research Coordination Group (2004)
ANNEX I.A-E	Research activities of Members
ANNEX II.A-B	Status of Typhoon Committee Research Fellowship Scheme
ANNEX III.	List of Resource Persons or Contact Points
ANNEX IV.	Program for the roving seminars under the visiting lecturer program in November 2004
ANNEX V.	Plan for regional workshop in 2005

APPENDIX I

TYPHOON RESEARCH COORDINATION GROUP
Activity Report in 2004

Recent Research Activities of Members

1. Wide ranges of research activities has been carried out by Members during the intersession period, including topics associated with data assimilation and bogusing, application of ensemble technique, both atmospheric and ocean modeling, interactive tools, and field observation studies. Some details of research activities are presented in Annex I.A to I.E for RSMC Tokyo, China, Hong Kong China, Rep. of Korea and JTWC, with the understanding that the rest of Members report their activities directly at 37th session.

TC Research Fellowship Scheme

2. Four research fellowships had been offered by the Members as of 15 September 2004. Among them two fellowships had been awarded, but the remaining two wait for applicants. Meanwhile two research fellowships are requested from Members, which yet wait for host organizations. The status of the TC research fellowship scheme in 2004 is summarized in Annex II.A.

3. The summary of the activity of the TC fellow Dr. Vicente B. Malano from PAGASA, who conducted research under the scheme for three months during 2004 on the extratropical transition of tropical cyclone at Korea Meteorological Administration, is given in Annex II.B. The paper for his research will be submitted for publication in the Typhoon Committee Annual Review.

Visiting Lecturer Program

4. Following the decision of the 36th session of Typhoon Committee, two roving seminars on the typhoon forecasting will be held immediately after the 37th session at Beijing and Kuala Lumpur respectively with the financial support of 10,000 USD from the Typhoon Committee Trust Fund (TCTF) and voluntary support from Members. The implementation plan to be carried out in this November is presented in the Annex IV.

Proposed Activities in 2005

5. The Committee is invited to review the proposal in Annex V for the regional workshop on effective tropical cyclone warning in 2005. The proposed workshop could cover how to reduce false alarm ratio for flooding and wind damage from landfalling typhoons, how warning systems should be designed and operated, how to involve the recipient population in the process, how to incorporate tropical cyclone warnings into public policies, disaster reduction and emergency relief, etc.

6. The Typhoon Committee fellowship scheme has been maintained since 2002. It is desired to review the achievements and problems on the scheme during the 2005 before proceeding further. The Members are invited to comment on the possible direction for the improvement of the scheme. A survey will be conducted in 2005 for getting suggestions on the scheme. In the meantime, the scheme may continue in 2005. The Members are encouraged to offer or to participate on short or long term fellowships under the scheme.

7. The TRCG is investigating an option to hold next roving seminar in 2006 instead of 2005, considering that the proposed workshop in 2005 would provide informative materials for the training.

Other Considerations: Asian THORPEX

8. A THORPEX program is under progress with the international collaboration to improve forecasting on timescales of 1 to 14 days and to assess the impact which forecasting can have on the world. THORPEX is now being led by WWRP/ WMO. Some key themes of THORPEX are: (a) Targeting of observations to allow resources to be better spent in making observations which have a positive impact on forecasts, and (b) creation of global multi-model ensembles through collaboration between different centres for the benefit of all (which could be very beneficial to WMO member states which do not run their own ensembles or models).

9. The Asian THORPEX is acting for this region. It would be beneficial if ensemble forecasting of tropical cyclone be improved in this region through the collaboration with Asian THORPEX. More details on Asian THORPEX can be found at WMO homepage, or direct contact with Chairperson of Asian THORPEX, Dr. Tetsuo Nakazawa (nakazawa@mri-jma.go.jp).

List of Resource Persons

10. The list of resource person is useful to stimulate researchers to exchange knowledge and expertise with experts in the field through Internet or other communication channels. The list of resource person or contact point has been updated, and summarized in Annex III.

11. The Members are invited to confirm and to update the list for the exchange of information among experts in various fields on tropical cyclone.

Membership

12. The TRCG was set up in 1996 following the decision of the 28th session of Typhoon Committee. A number of membership changes have been notified to the TRCG chairman since 2003. The current composition

Chairman: Mr Woo-Jin Lee, Rep. of Korea

Members: Ms Seth Vannareth, Cambodia
Ms Tian Cuiying, China
Mr Kang Bong Jin, DPR Korea
Mr Edwin S.T. Lai, Hong Kong China
Mr Nobutaka Mannoji, Japan
Mr Nitharath Somsanith, Lao PDR
Mr Ku Chi Ming, Macao, China
Mr Subramaniam Moten, Malaysia
Ms Rosa Perez, Philippines
Ms Yihong Hu, Singapore
Mr Dusadee Sarigabutr, Thailand
Mr Frank Wells, USA
Ms Duong Lien Chau, Vietnam

ANNEX I.A

Recent Research Activities in RSMC, Tokyo
Japan Meteorological Agency (JMA)

1. Operation

1.1 Change to Numerical Storm Surge Model

The JMA storm surge model was upgraded on 27 January 2004 to forecast storm surges caused by extratropical cyclones and by typhoons. It employs the surface wind and pressure fields from Meso Scale Model (MSM) as external forcing. The frequency of its operation increased from occasional runs only when typhoons exist around Japan Islands to every 6 hours.

1.2 Development of Guidance for the Maximum 10-minute Average Wind Speed and Wind Direction Using the RSM and MSM Outputs

Guidance for the 3-hourly wind speed and its direction for a short-range weather forecast, based on the Kalman filter adaptive system using the Regional Spectral Model (RSM) output, have been operated since March 1996. Using the same principle, a wind guidance based on the MSM output has been operated since June 2002 to estimate the maximum wind speed and the corresponding direction in 1-hour interval for the aerodrome forecast for short-range flight (TAF-S).

In addition, a new guidance based on the same technique was developed to forecast the maximum wind speed and its direction as in 3-hour interval for providing wind information in view of disaster prevention. Both the RSM-based guidance and the MSM-based guidance were developed. The former has an advantage that it covers through the day after tomorrow and the latter has an advantage that it is updated more frequently (four times a day) and available earlier than the former.

Verification of the forecasts at the same initials showed the MSM-based guidance had almost the same accuracy as the RSM-based guidance does. The threat score of around 0.4 for the 10 m s-1 threshold means usefulness of the maximum wind guidance for strong wind forecast.

The new guidance has been in operation since 18 December 2003.

2. Development

2.1. Development of a High-Resolution Typhoon Model

Based on the Meteorological Research Institute/Numerical Prediction Division unified non-hydrostatic model (MRI/NPD-NHM), a high resolution non-hydrostatic typhoon model is under development at MRI. The model has a multiply-nested movable mesh configuration with a two-way interactive nesting strategy and explicit microphysics to correctly represent typhoon inner-core structure and its evolution in a cost-effective manner. Preliminary forecast experiments using the model have been conducted with initial and boundary conditions supplied from the RSM.

2.2 Development of a Typhoon-Ocean Coupled Model

In order to introduce the effect of typhoon-ocean interaction into the numerical model for typhoon intensity prediction, a mixed-layer ocean model has been developed at MRI. The model has been extensively tested so far in coupled mode after a series of stand-alone

sensitivity studies. A version of Typhoon Model (TYM) was used for the coupled experiments. On the whole, the TYM-ocean coupled model has a tendency to underestimate wind stress at the sea-surface, resulting in the undervaluation of the upper ocean cooling caused by TCs. The underestimation of the wind stress is to be expected since the coarse 20-km resolution of the model is unable to represent very strong winds near the storm center. Now, the mixed-layer ocean model is being coupled to the MRI/NPD-NHM with a much higher resolution. The newly coupled model is expected to provide more realistic strength of winds associated with TCs.

2.3 Development of a Storm Surge Model Including Effect of Wave Set-Up

Currently a 2-dimensional linear storm surge model has been operationally run at JMA with a horizontal grid resolution of 1 minute in each direction. The forecast performance of the model is reasonably good over inland bay areas where coastal topography and water depth mainly determine the magnitude of storm surge. On the contrary, it frequently fails to provide accurate estimation over the sea along coasts and islands shores where tends to be hit by high waves. To cope with this problem, a new storm surge model, which includes effects of ocean waves, was developed based on the Princeton Ocean Model (POM) and the third generation wave model MRI-III. The model significantly improves the storm surge prediction in such cases that wave set-up play a significant role in storm surge. The model will be put into operation at JMA in near future.

2.4 Towards Use of Wave Model in the Typhoon-Ocean Coupled Model

The third generation wave model MRI-III has been put into operation at JMA since 1998. While its performance is quite good in windseas, swell is rather overestimated in open waters. To remedy this problem, a damping term for swell was introduced in the model equations and new model has good accuracy both in windseas and swell. Surface winds induce ocean waves which in turn affect surface winds through the sea state. For this reason a wave model should be coupled to the typhoon-ocean coupled model under development at MRI to improve air-sea exchange processes included in the models.

2.5 Development of the Typhoon Ensemble Forecast

JMA plans to implement a typhoon Ensemble Prediction System (EPS) in 2007 to provide new probabilistic products for typhoon forecasts. Preliminary experiments have been made on the reliability of the typhoon EPS, using operational one-week EPS. The results show encouraging performance such as high reliability and positive brier skill score. However, it is found that ensemble mean tracks from EPS is much apart from the corresponding observed data compared with those from the current deterministic typhoon forecast.

JMA has a plan to implement a singular vector (SV) technique to generate initial conditions for new EPS in 2007 in place of the breeding method currently used. Initial perturbations will be based on the diabatic SV in the targeted area around a typhoon.

2.6 Analysis of Differences in Model Forecast Track with a Diagnostic Tool

A number of numerical studies demonstrate that the evolution of TC vortices is highly sensitive to the formulation of convective heating. Numerical experiments with a 20km version of MRI/NPD-NHM also suggest that the motion of simulated typhoons is sensitive to and systematically changed with the tuning parameters included in the convection scheme. An evaluation study on the relative contribution to the track differences of steering flow and storm structure, both of which are significantly affected by the formulation of convective heating, is underway using a recently developed diagnostic tool.

ANNEX I.B

Research activities at China Meteorological Administration
August 2004

1. The research work carried out in Chinese Academy of Meteorological Sciences has focused on the following aspects. This is the partial research results from the project number "2001DIA2006" of the Ministry of Science and Technology (MOST)

1.1 Field experiment of tropical cyclone

An atmospheric field experiment of tropical cyclone landfall with the acronym of CLATEX (China Landfalling Typhoon Experiment) was launched in July-August 2002. Some advanced instruments such as wind profiler, Doppler radar, ultrasonic anemometer, optical rain-gauge, radiosonde, satellite observation, tower observation, automatic weather stations and conventional upper level and surface observation etc. were employed. Real-time intensive data from various sources of boundary layer and upper level of landfalling typhoons were acquired and the target typhoon database including more than twenty categories of data was established.
The SNR (signal-to-noise ratio) data of the wind profiler associated with a target landfalling severe tropical storm Vongfong demonstrate that the turbulence developed up to more than 5km several hours before landfall whereas receded back to 1-1.5 km several hours after landfall. The variation of the boundary layer thickness was coincided with the turbulent layer variation. Other properties of the boundary layer in the landfalling storm were also found which are valuable to the dynamical research for tropical cyclone landfall.

1.2 Tropical cyclone structure

With high-resolution satellite TRMM data and multiple assimilated data, the severe tropical storm Vongfong making landfall on Guangdong province was analysed. The results show that the storm's wind speed and precipitation distribution and convection are asymmetric. Before the landfall, severe convective cloud bands evolved into spiral cloud bands and precipitation increased while it was rapidly decreased during the landfall

1.3 Tropical cyclone intensity change

Under two types of initial tropical cyclone structures that are characterized by high and low vorticity zones, four sets of numerical experiments have been performed with barotropic model equation to investigate the interaction of a typhoon and an adjacent mesoscale vortex (MSV) and its impact on the tropical cyclone intensity change. The results suggest that the interaction of the tropical cyclone vortex of different structure with the MSV leads to different results. Under the condition of low vorticity zonal structure, the interaction leads to a pressure decrease of 3.8 hPa at the tropical cyclone center while under the condition of high vorticity zonal structure, the interaction results in a pressure decrease of 14.1 hPa. The latter is 3.7 times the former. Therefore, the tropical cyclone structure also plays an important role in the intensity change of tropical cyclone itself.

1.4 Sustaining and decaying mechanism of a tropical cyclone over land

The sustention and intensification of typhoon Nina(1975) over land were simulated with MM5V3 and its bogus scheme. The results suggest that the fluxes of latent and sensible heat are favorable to Nina sustention and intensification whereas the flux of kinetic energy would dissipate and fill up the Nina's depression over land.

Dynamical and diagnostic analyses were employed with composite data of two sets of landfalling typhoons (quick dissipation and longer sustention). The results exhibit that the lower

layer moisture channel connect with a landfalling tropical cyclone moving toward north and gain the baroclinic energy from the mid-latitude trough as well as the upper level envelope of the cyclone links with a mid-latitude jet to enhance the upper level out flow towards northeast which will be favorable to sustaining of the tropical cyclone over land.

1.6 *Tropical cyclone track prediction*

The experiences and observations indicated that transition of synoptic patterns surrounding a tropical cyclone is one of the key factors to determine where a tropical cyclone will go in future. The study presents a technique that may be able to identify transition of synoptic patterns so that a tropical cyclone environment can be characterized into two areas, "Tropical Cyclone Resistant" and "Tropical Cyclone Favoured". The study finds that the area will depend on the distribution of the atmospheric stratification. The unstable channel will be favorable to tropical cyclone passing through. On the contrary, the stable stratification area would be resistant to the tropical cyclone move towards the area.

1.7 A data bank for centennial landfall typhoons in China

The data (1901-2000) of centennial landfall tropical cyclones over China were processed and established a data bank. The details of the data are including the best tracks, intensity, precipitation and wind distributions etc. Correspondingly, a centennial landfall typhoon service system via a network was set up to serve the public.

2 The research work carried out by the members of Shanghai Typhoon Institute has been focused on the following aspects:

2.1 Sea-Land-Atmosphere Coupled Model for tropical cyclone study and forecasting

An air-sea coupled model for tropical cyclone study is proposed with MM5V3 the atmospheric part and multi-level POM the oceanic part. Idealized experiments demonstrate the model's capability in simulating tropical cyclone and reflecting the interaction between ocean and tropical cyclone. Using the air-sea coupled model, a series of experiments are carried out to study the effect of changes in the ocean on tropical cyclone intensity and track.
The effect of land surface processes is studied using the Noah Land Surface Model of MM5 by simulating the landfall process of an ideal typhoon. Results indicate that the location of precipitation belt is changed markedly in the experiments with and without the land surface processes.

2.2 Satellite data assimilation in tropical cyclone simulating and forecasting

The three-dimensional varational data assimilation scheme (3DVAR) in the mesoscale model version 5 (MM5) is used to study the effect of assimilating the sea-wind data from QuikScat on the prediction of typhoon track and intensity. The case of Dujuan is first tested and the results showed appreciable improvements. Twelve other cases in 2003 are then further evaluated. With the assimilation, the 24-h (48-h) track prediction of 11 (10) out of the 12 typhoons is improved. The 24-h (48-h) prediction of typhoon intensity is also improved in 10 (9) of the 12 cases. These experiments demonstrate that assimilation of the QuikScat sea-wind data should increase the prediction accuracy of the track and intensity for typhoon through modification of the initial fields associated with the typhoon.

2.3 Tropical cyclone bogus technique

Two bogus schemes, NCAR-AFWA and bogus data assimilation (BDA), are compared by carrying out 41 experiments for 9 tropical cyclones in 2002. Results show that both schemes work to improve the track forecasting with BDA even better.

2.4 Concensus tropical cyclone track prediction techniques

A consensus forecast technique based on canonical correlation analyses is proposed for tropical cyclone track forecasting. The three sub-methods selected are official forecasts from China Meteorological Administration (CMA), Japan Meteorological Agency (JMA) and the Joint Typhoon Warning Center (JTWC). Both the developmental and dependent results show that the concensus output is generally better than any of the three sub-methods. Especially, the 24-h forecast error of moving speed is decreased.

2.5 Tropical cyclone intensity

Temperature retrievals from NOAA-15 AMSU-A from July to September in 2001 and 2002 are used to develop an estimative algorithm for the intensity of TC in the western North Pacific. The variance (R^2) explained by the final estimative algorithm is comparable to the published results for the Atlantic and Eastern Pacific TCs.
Favorable large-scale conditions are searched for abrupt intensification of TC in East China Sea before landfall through both case and composite studies. Evidence indicates that, different from the situation in the South China Sea, few common features of the large scale atmospheric environment could be obtained. However, the underlying SST was generally (~ 2° C) higher than those for filling cases, which was assumed to be a good predictor along East China coast. Such a result indicates that large scale factors might have played a quite different role in the pre-landfall intensification of TCs in different regions.

2.6 Tropical cyclone climatology

Differentiating rules have been set up to re-build typhoon data from historical disaster records. According to these rules, typhoon data are retrieved for Shanghai City and East China, which could serve as valuable sources for climate study.

ANNEX I.C

Recent Research Activities in Hong Kong, China for Report of TRCG, 2004 (Interim reply)

1. In **Hong Kong, China**, a study on the climatological statistics of tropical cyclone intensity change in western North Pacific was conducted.

2. A review on the performance of numerical models in forecasting tropical cyclone intensity in western North Pacific was completed.

3. A study on the probability of occurrence of gales in the harbour area of Hong Kong when wind speed of a remote station exceeds a specific threshold during tropical cyclone scenarios was completed.

4. A tropical cyclone monitoring and analysis system called TC-LAPS, based on the Local Analysis and Prediction System (LAPS) of the Forecast Systems Laboratory of NOAA, was developed and put into trial operation. Apart from conventional synoptic data, TC-LAPS also ingests various types of remote sensing data, including radar Doppler winds, multi-level radar-derived TREC (Tracking Radar Echoes by Correlation) winds and QuikSCAT sea surface winds for a 3-D analysis of the wind structure of tropical cyclones in the vicinity of Hong Kong. Near real-time analyses at 10, 5 and 1 km resolutions are generated every hour for forecasters' reference.

5. The development of a tool for providing TC intensity forecast guidance and local high winds probability based on global as well as regional NWP models was undertaken by HKO. A web-based display together with detailed verification statistics and documentation was developed and made available to forecasters for reference.

6. Development of a tool for providing probability forecast of tropical cyclone warning signals using statistical and NWP tracks was completed.

7. The feasibility of using the 10-metre wind speed forecasts extracted from the ECMWF Ensemble Prediction System (EPS) meteograms to forecast the maximum strength of local winds during the approach of tropical cyclones was assessed based on recent cases of landfalling cyclones near Hong Kong. A summary report was submitted to ECMWF for reference and publication.

8. The prototype of the next generation Tropical Cyclone Information Processing System providing enhanced guidance and tools for TC forecasts has been developed and was put into pre-operational trial in June.

9. Case study on the impact of radar-derived TREC winds on model forecast of heavy rain associated with landfalling tropical cyclone has been completed and reported in CAS/JSC Working Group on Numerical Experimentation Report No. 33.

10. The infrared Doppler Light Detection and Ranging (LIDAR) system installed at Hong Kong International Airport (HKIA) proved useful in depicting windshear and turbulence associated with small-scale wind disturbances at HKIA during the passage of TCs in the vicinity of Hong Kong.

11. After the conclusion of a two-year pilot study, HKO began to issue short range climate forecasts on an annual basis to the public starting from 2003. The forecast included the number of tropical cyclones affecting Hong Kong as well as the annual rainfall for the year.

12. The following tropical cyclone research projects were undertaken at the City University of

Hong Kong: tropical cyclone intensity change modeling; tropical cyclone landfall modelling; ensemble forecasting of tropical cyclone motion.

13. The development work of a JAVA software by a research group from the University of Hong Kong for the automatic identification of TC centre on radar images based on genetic algorithm and Kalman filter techniques was completed.

ANNEX I.D

Research activities relevant to typhoon at Korea Meteorological Administration: meteorological perspective
July 2004

1. Direct assimilation of ATOVS through global 3dVar

The satellite radiance ATOVS has been assimilated into global model through 3dVar since September 2004. The enhanced analysis of north Pacific high further improve the steering of the tropical cyclones particularly when they move under the ridge. It is anticipated that the track errors would be significantly reduced with the assimilation of the ATOVS radiance.

2. New tyhpoon bogusing scheme

As the 3DOI (3-Dimensional Optimal Interpolation) was replaced with 3DVAR (3-Dimensional Variational method) in December 2003 for the global model data assimilation system, the typhoon bogusing scheme was modified accordingly. In the new scheme, the typhoon in the background field of the 3DVAR cycle is moved to the observed position, where the surface pressure and wind fields are compared with the observed fields to decide the observation increment. The observation error is empirically determined as a linear increase with the distance from the typhoon center. The application of the 3DVAR typhoon bogussing technique for the past typhoon events showed promising results. Verification of typhoon tracks and intensities indicated that the new scheme has a better prediction capability. The most noticeable improvement was the realistic representation of pressure at the typhoon center. The new typhoon bogussing scheme has been on operation at KMA since June 2004.

3. Assimilation of Doppler wind and reflectivity with 3dVar

The assimilation of reflectivity from the radar network nationwide has been developed at KMA through the cooperation with NCAR for the improvement of moisture analysis. The simplified precipitation physics are applied to derive the relationship between hydrometeors in cloud and radar reflectivity. The new scheme is under test operation for 10km mexh mesoscale model, and will be on operation at Autumn 2004. The assimilation of Doppler wind is under progress. The thining of the high density wind information and quality control is the major difficulties, but an algorithm is developed to cope with the problems. The new assimilation scheme for Doppler wind be under test, and hopefully be operational by 2nd half of 2004. Both schemes are expected to be beneficial for the prediction of rainfall and wind for the landfalling tropical cyclone.

4. Migration of NWP system to new supercomputer environment

The Cray X1E, a vector parallel machine with a maximum performance of 18 Tflops, will be installed at KMA in two phases. In first phase, the 2TFlops system will be set up in October 2004. In second phase, the 16TFlops system will be installed in 2005. These systems will be used for numerical weather prediction including tropical cyclone forecasting.

5. Collaborative research under TC research fellowship scheme

Dr. Vincente Malano from PAGASA has been doing research on the case study of three extratropical cyclones since May 2004 for about three months, hopefully to give insight how to interpret model guidance to identify mechanisms of ET process and characteristic of model behavior.

6. Improvement of TAPS (Typhoon Analysis and Prediction System)

The interactive tool for the typhoon forecasting, TAPS, has been improved to incorporate function for the support of Intensity forecasting for +48 hours, which is based on the statistical forecasting system STIPS (Statistical Tropical Cyclone Intensity Prediction Scheme)

ANNEX I.E

Research activities at Joint Typhoon Warning Center, USA

In the continuing efforts to improve tropical cyclone track and intensity forecasts, JTWC has been evaluating or using new software or tools. These efforts are part of research and development either directly supported by JTWC or part of a national tropical cyclone forecast improvement effort.

Two independent "guidance on guidance" efforts are under evaluation. One is a U. S. Weather Research Program Joint Hurricane Testbed (USWRP JHT) development effort (see Goerss, 26th Conference on Hurricanes and Tropical Meteorology) and the other an Office of Naval Research (ONR) effort (Weber, submitted to Monthly Weather Review). Both were installed for evaluation on the Automated Tropical Cyclone Forecast System (ATCF) workstations.

In an effort to standardize U. S. tropical cyclone warning formats and to better assist the U. S. National Weather Service with Micronesia forecast support, JTWC dropped the 100 knot wind radii from the warning message and implemented 64kt wind radii.

As part of another USWRP JHT funded research project, JTWC was provided with experimental wind speed probability software (see Gross, et al, 26th Conference on Hurricanes and Tropical Meteorology).

The USAF MM5 numerical TC forecast has been reinserted into the baseline track consensus (CONW). MM5 was dropped from the consensus forecast in late 2003 due to poor performance caused by a relative humidity bug. The bug was reported to USAF and corrected in October 2003.

CONW was also expanded to include the Australian TCLAPS in early 2004. In experiments with limited data, TCLAPS was found to improve the consensus in the Australian Region and not degrade it in the western North Pacific. Refining the baseline track consensus is a continuing effort of JTWC and NRL Monterey.

JTWC, NRL Monterey and CIRA are experimenting with an intensity consensus using the Statistical TC Intensity Prediction Scheme (STIPS; see Knaff et al., 26th Conference on Hurricanes and Tropical Meteorology. JTWC is also beginning an effort to evaluate a STIPS version which incorporates AMSU data (Cecil, AGU Meeting in Honolulu in 2004).

JTWC is evaluating a new wind radius CLIPER (see Gross, et al, 26th Conference on Hurricanes and Tropical Meteorology) and Southern Hemisphere intensity CLIPER (see Knaff,et al, 2003 in Wea. And Forecasting).

Near real-time overlay of meteorological satellite imagery onto TC best tracks/fixes for quality control of position, intensity and wind radii are also being evaluated. The image overlay includes many products on the NRL Monterey TC Website/Page and is intended improve TC visualization and post-storm best tracking efforts.

JTWC is also working with CIRA and CIMSS in the evaluation of AMSU intensity and wind radii fixes. An effort to evaluate intensity fixes from NASA has also been initiated.

JTWC also continues to work with Dr. Michael Fiorino, Lawrence Livermore Laboratories to improve visualization of numerical model output. Dr. Fiorino in an Ad hoc advisory status while activated as a U. S. Navy Reserve officer has worked at the JTWC for the past 3 years to improve the depiction of the tropical cyclone horizontal wind field and vertical structure as forecast by the NOGAPS and GFS models.

ANNEX IIA. Typhoon Committee Research Fellowship Scheme (as of 15 February 2004)

– Offers from Members

Member	*Host Organization*	*Research Topics*	*Resources & Facilities*	*Visiting Fellow*	*Financial Support*	*Remark*
China	Central Meteorological Observatory, NMC/CMA	To estimate typhoon intensity with several micro-wave data	Provide the latest Quikscat data, TRMM & TBB data	1-2 months	Accommodation and per diem expenses	Dr. Bing Zhou Bingz@cma.gov.cn
Hong Kong, China	Hong Kong Observatory	Effect of tropical cyclone bogusing on model analysis and forecasts	Hardware and software facilities in the Open Laboratory	11 Oct. – 10 Dec. 2004	Lump sum per diem for 2 months	Ms. Wang Dongliang, Shanghai Typhoon Institute has been awarded for the said fellowship.
Japan	Meteorological Research Institute	(a) TC vortex initialization (b) Improved cumulus parameterization in TC numerical models (c) TC ensemble forecasting (d) TC analysis using satellite data of sea surface wind and precipitation (e) TC analysis using Doppler radar data (f) Data analysis related to extratropical transition	PCs, UNIX Workstations and Supercomputer	Up to 2 years for max. 2 persons	Not provided	Mr. Nobutaka MANNOJI RSMC Tokyo Typhoon Center, Japan Meteorological Agency, 1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100-8122, Japan. E-mail: mannoji@met.kishou.go.jp
Korea (Rep. of)	Forecast Bureau/ KMA	Validation of intensity forecasting including wind structure change	PC or W/S, Supercomputer	May 31-August 28, 2004		Dr. Vicente Malano (PAGASA) has been awarded for the fellowship, and finished his research by end of August 2004.

– Request from Members

Member	*Host Organization*	*Research Topics*	*Resources & Facilities*	*Visiting Fellow*	*Financial Support*	*Contact Person*
China		Consensus forecasting for track and intensity of typhoon	1. Computer condition, 2. Data of numerical model guidance	3-6 months	Accommodation and per diem expenses	Mr. Gao Shuanzhu Email: gaosz1129@sina.com
Thailand		Dynamic aspect of tropical cyclones evolution and movement in the South China Sea and the Gulf of Thailand a. moisture adjustment impact on typhoon behavior both in track and intensity b. Beta effect on TC movement	24 hr internet service PC GTS data access Supercomputer with w/s Radar/ satellite data	3-4 months		Mr. Sampan Thaikruawan (E-mail: thhsamp@yahoo.com) Mr. Tanya Tongnunui (E-mail: krootan@yahoo.com)

ANNEX IIB. Research Activity under the Typhoon Committee Research Fellowship Scheme in 2004

Extratropical Transition of Tropical Cyclone: Case study with moving nested typhoon model

Vicente B. Malano
Philippine Atmospheric, Geophysical and Astronomical Services Aministration (PAGASA)
BIR Road, Diliman, Quezon City, Phillipines-1401

Model results generated by the Moving Nest Typhoon Model (MTM) of Kongju National University (KNU) were analyzed during the period (May 31-August 28, 2004). The objective was to evaluate the onset and the completion of extratropical transition of tropical cyclone (TC). Three TC events in the past were simulated by the MTM. These are listed as follows:

1. TC 0302 (Kujira) – simulated during April 24, 12UTC–April 26, 12UTC
2. TC 0303 (Chan-Hom) –simulated during May 26 to May 28-12UTC and
3. TC 0315 (Choi-Wan) – simulated during September 22, 00UTC – September 23, 21UTC.

Simulation predicted the extratropical transition of Chan-Hom and Choi-Wan after T=42 hrs and T=24 hrs, respectively. Choi-Wan completed ET between T=33 hrs and T=36 hrs. A research paper entitled "**Analyses on the Responses of Tropical Cyclone to its Environment as it Moves Towards the Midlatitudes**" was presented and submitted to the Numerical Weather Prediction Division (NWPD) of the Korea Meteorological Agency (KMA).

ANNEX III. List of Resource Persons or Contact Points (as of 2 March 2004)

Field	Specialties	Name	E-mail	Affiliation	Members
Data Assimilation	TC vortex initialization	Xuedong Liang	Liangxd@mail.typhoon.gov.cn	Shanghai Typhoon Institute/CMA	China
	TC intensity estimation by rarad,satellite,SSMI and Quikscat	Gao Shuanzhu Zhou Bing	gaosz1129@sina.com bingz@cma.gov.cn	National Meteorological Center/CMA National Meteorological Center/CMA	China China
	Radar data quality control and assimilation scheme	Gong Jiandong	gongjd@cma.gov.cn	National Meteorological Center/CMA	China
	Tropical cyclone data assimilation	P.W. Li	pwli@hko.gov.hk	Hong Kong Observatory	Hong Kong China
	TC vortex initialization	Mitsuru Ueno Masaru Kunii	mueno@mri-jma.go.jp mkunii@mri-jma.go.jp	MRI/TRD	Japan
	satellite data analysis	Tetsuo Nakazawa	nakazawa@mri-jma.go.jp	MRI/TRD	
	TC intensity estimation	Tetsuo Nakazawa	nakazawa@mri-jma.go.jp	MRI/TRD	
	Data analysis related to extratropical transition	Naoko Kitabatake	nkitabat@mri-jma.go.jp	MRI/TRD	
	typhoon bogusing	Rha, Deuk-Kyun	dkrha@kma.go.kr	Numerical Weather Prediction Div. /KMA	Korea (Rep.)

Field	Specialties	Name	E-mail	Affiliation	Members
		Lim, Jang-Ho	limjh@kma.go.kr		
	Typhoon bogusing	Kwon, H. Joe	hjkwon@kongju.ac.kr	Prof. Kongju National University	
	satellite data analysis	Kim, Kum-Lan	kkl@kma.go.kr	Remote sensing Div./KMA	
	radar data analysis	Lee, Jong-Ho	jhlee@kma.go.kr	Observation Div./KMA	
Modelling	Numerical schemes of TC model	Yihong Duan	duanyh@mail.typhoon.gov.cn	Shanghai Typhoon Institute/CMA	China
	TC model physics and bogussing schemes	Ma Suhong	mash@cma.gov.cn	National Meteorological Center/CMA	China
	Ensemble track forecasting	Xiaqiong Zhou	zhouxq@mail.typhoon.gov.cn	Shanghai Typhoon Institute/CMA	China
	Typhoon modelling	Xudong Liang	Liangxd@mail.typhoon.gov.cn	Shanghai Typhoon Institute/CMA	China
Modelling	Tropical cyclone modelling and bogussing schemes	W.K. Wong	waikwong@hko.gov.hk	Hong Kong Observatory	Hong Kong China
	numerical schemes of TC model	Wataru Mashiko	wmashiko@mri-jma.go.jp	MRI/TRD	Japan
	physical processes of TC model	Mitsuru Ueno Akihiko Murata	mueno@mri-jma.go.jp amurata@mri-jma.go.jp	ditto	Japan

Field	Specialties	Name	E-mail	Affiliation	Members
	TC-ocean interaction (incl. mixed-layer ocean modeling and ocean surface wave modeling)	Nadao Kohno Akiyoshi Wada	nkohno@mri-jma.go.jp awada@mri-jma.go.jp	ditto	Japan
	storm surge modeling	Nadao Kohno	nkohno@mri-jma.go.jp	MRI/TRD	Japan
	typhoon modelling	Rha, Deuk-Kyun Lim, Jang-Ho	dkrha@kma.go.kr limjh@kma.go.kr	Numerical Weather Prediction Div.	Korea (Rep.)
	ensemble track forecasting	Rha, Deuk-Kyun	dkrha@kma.go.kr	ditto	
	global NWP model tracks	Park, Hoon	hoon@kma.go.kr	ditto	
	Typhoon modelling	Kwon, H. Joe Baik, Jong-Jin	hjkwon@kongju.ac.kr jjbaik@snu.ac.kr	Prof. Kongju National University Dept. Atmos., Seoul National University	
Forecasting	Track and intensity forecasting	Xiaotu Lei	Leixt@mail.typhoon.gov.cn	Shanghai Typhoon Institute/CMA	China
	Long-range prediction of typhoon	Ming Xu	Xum@mail.typhoon.gov.cn	Shanghai Typhoon Institute/CMA	China
Forecasting	Tropical cyclone climatology and best track analysis	T.C. Lee	tszclee@hko.gov.hk	Hong Kong Observatory	Hong Kong China
	Tropical cyclone intensity, structure and landfall impact	Edwin S.T. Lai	stlai@hko.gov.hk	Hong Kong Observatory	

Field	Specialties	Name	E-mail	Affiliation	Members
	Long-range forecasting of tropical cyclones	W.M. Leung	wmleung@hko.gov.hk	Hong Kong Observatory	
	Tropical cyclone motion, intensity, size, modelling and seasonal prediction	Johnny C.L. Chan	Johnny.Chan@cityu.edu.hk	Department of Physics & Material Sciences, City University of Hong Kong.	
	track and intensity forecasting	Chung, Kwan-Young	kychung@kma.go.kr	Forecast Management Div./ KMA	Korea(Rep.)
	long-range prediction of typhoon	Yook, Myung-Ryul	mryook@kma.go.kr	Forecaster/ KMA	
	track and intensity forecasting	Kwon, H. Joe Baik, Jong-Jin Sohn, Keon-Tae	hjkwon@kongju.ac.kr jjbaik@snu.ac.kr ktsohn@pusan.ac.kr	Dept. Atmos., Kongju National University Dept. Atmos., Seoul National University Dept. of Statistitcs, Pusan National University	
	long-range prediction of typhoon	Sohn, Keon-Tae	ktsohn@pusan.ac.kr	Dept. of Statistitcs, Pusan National University	
	seasonal prediction of typhoon	Lim Tian Kuay	LIM_Tian_Kuay@nea.gov.sg	Meteorological Services Division, National Environment Agency	Singapore
Application	Tropical cyclone warning system	Hilda Lam	hildalam@hko.gov.hk	Hong Kong Observatory	Hong Kong China
	Tropical cyclone warning operations	M.C. Wong	mcwong@hko.gov.hk	Hong Kong Observatory	

Field	Specialties	Name	E-mail	Affiliation	Members
	Tropical cyclone information visualization and display systems	K.K. Yeung	kkyeung@hko.gov.hk	Hong Kong Observatory	
	web manager	Chang, Ki-Dong	gdjang@kma.go.kr	Forecast Research Lab./ METRI/KMA	Korea (Rep.)
	typhoon data on GTS	Wu, Chong-Gyu	woojk@kma.go.kr	Information and Telecommunication Div./KMA	
	To be extended to cover hydrology & disaster prevention and preparedness				

KMA : Korea Meteorological Administration

METRI : Meteorological Research Institute

MRI : Meteorological Research Institute

TRD : Typhoon Research Division

ANNEX IV

VISITING LECTURER PROGRAM
2004

Background

A visiting lecturer program was suggested in the 34th session of Typhoon Committee (28 Nov –4 Dec 2001, Honolulu) to promote research and development of tropical cyclone forecasting technique and associated scientific issues on hydrology and disaster prevention measures. The proposal for the program was reported in the 35th session of Typhoon Committee (18 –25 Nov 2002, Chiang Mai), and the Committee decided to support for the visiting lecturer program. The first series of the roving seminars under the program was held in Seoul, Hong Kong, and Shanghai in 2003 with financial support of USD 10,000 from TCTF. The details for the roving seminars in 2003 was reported in the 36th session of Typhoon Committee (15-20 December 2003, Kuara Lumpur Malaysia). The 36th session also decided to support the visiting lecturer program in 2004 with financial support of USD 10,000 from TCTF.

Definition

The visiting lecturer program may consist of several roving seminars taking place at different countries, and each roving seminar may consist of number of lectures given by number of lecturers from overseas and/or local services.

Objective

The aim of the visiting lecturer program is to stimulate research and development activities in the region by providing lectures focused on the regional perspective in operational environment from knowledgeable experts visiting the region, considering the parallel activities such as regional workshops every 3 or 4 years, TC research fellowship scheme, and update of the list of resource person in various areas of typhoon forecasting

Guideline for Implementation

1. Approach:

A few knowledgeable experts could visit Members in the region and provide lectures on topics with common regional interest. The program can be extended such that those interested gathered together to a common place to receive the lectures.

2. Lecture Service, Duration, and Topics

Depending on the circumstances and resources available, number of lecturers would be invited to visit operational centers in the region for a few days, preferably about 2-3 days, and to give lectures on the urgently needed topics including:

(1) Interpretation of satellite data including microwave imagery for intensity forecasting including rainfall amount
(2) Use of radar data in operational tropical cyclone forecasting particularly for landfall case
(3) Interpretation of NWP model output for typhoon analysis and forecasting
(4) Operational application of multi-model ensemble technique
(5) Quantitative precipitation forecasting

3. Resource

In principle, the Typhoon Committee Trust Fund (TCTF) is devoted to the expert services and possibly extended to the support for the limited number of participants. The hosting organization provide venues and other facilities and possibly for the invitation of some experts or trainees in the neighboring countries. The participating Members may also contribute part of the travelling cost or per diem.

4. Hosting organization

Members are invited to host a roving seminar turn by turn, considering the efficiency and effectiveness with moderate investment for the benefit of all Members.

5. CDroms

It is desired that the CDrom of the lecture note be distributed to the members as an information particularly for those who could not attend the roving seminars.

Implementation Plan for Roving Seminars in 2004

The hosting countries, topics, and invited lecturers were discussed in the TRCG meeting held during the 36th session. After the meeting, more comments and ideas have been collected from the TRCG members. The major outcome from the latest discussion among TRCG members are summarized in Table 1.

It is noted that only 10,000 USD is available for the roving seminars in 2004, and only very limited number of participants, with high proiority for those who did not have a chance in 2003, may get support from TCTF in 2004. In any case, the Members are welcome to attend the planed roving seminars at their own expenses. The major break down of the expenses is summarized in Table 2.

Table 1. *Summary of major elements for the roving seminars during 2004, based on the input from the TRCG members (as of 5 April, 2004)*

Venue/ Period	Topic	Invited Lecturer		Participants with financial support	
		Candidates	Fund source		Fund source
Beijing 22-24 Nov. 2004	Operational application of multi-model ensemble typhoon forecasts 1. RSMC Tokyo's perspective 2. US perspective with particular focus on intensity forecasting	 Dr. Nobutaka Mannoji Dr. Russell L. Elsberry	 TCTF TCTF	two participants from Hong Kong China, and North Korea	TCTF
Kuala Lumpur 25-27 Nov. 2004	Same as above	Same as above	Same as above	three participants from Cambodia, Singapore, and Thailand	TCTF

- TCTF : Typhoon Committee Trust Fund

Table 2. Break down of financial support from TCTF (USD 10,000) for the roving seminars in 2004, based on rough estimate, which may be variable to change.

Place of venue	Activities	Remark	Rough estimate
Roving seminar at Beijing	Invitation of two participants from Hong Kong China, and North Korea	Two round trip air tickets, and lump sum per diem	Travel cost + per diem ≅ 2*($500+$500) ≅ $2,000
Roving seminar at Kuara Lumpur	Invitation of three participants from Cambodia, Singapore, and Thailand	Three round trip air ticket and lump sum per diem	Travel cost + per diem ≅ 3*($500+$500) ≅ $3,000
Lecturer services for the two roving seminars	Invitation of two lecturers (Drs. Mannoji, and Elsberry)	Two round trip air tickets and lump sum per diem	California-Shanghai-Beijing-KR-California; Tokyo-Shanghai-Beijing-KR-Tokyo (A lump sum support for the lecturer service considering the local travel between Shanghai, Beijing, and KR, and the per diem, which may exceed $5,000, depending on the voluntary support for the usual cost attending the Typhoon Committee)

Remark

1. Arrangements of financial support and protocol for the invitation of lecturers and participants, if necessary, for the visiting lecturer program (2004) from TCTF are under progress.
2. The hosting countries, China and Malaysia, are taking procedures to host the roving seminars including preparation of the program, to announce the program to Member countries, to invite both supported or voluntary participants, and to arrange necessary preparations for the roving seminars including lecture material.

ANNEX V

A Proposal for the Regional Workshop on "Effective Tropical Cyclone Warning"
May 2005

1. Background

The 36th session of typhoon committee supported to hold a regional workshop on effective tropical cyclone warning in 2005. The proposed workshop is designed to stimulate the research and developments on three components, i.e., meteorology, hydrology and disaster prevention and preparedness (DPP), to mitigate the natural disaster associated with tropical cyclone. The importance of the effective warning on tropical cyclone has been stressed by international community including the fifth International Workshop on Tropical Cyclone (IWTC-V, Cairns, 2003), the Second Regional Technical Conference on Tropical Cyclones, Storm Surges and Floods (Brisbane, Australia, 1 to 3 July 2004), and International Conference on Storms (Brisbane, Australia, 5 to 9 July 2004).

2. Participants

The proposed participants include:

(a) TRCG members or other working group members under Typhoon Committee, who is willing to present in depth the experience and demonstration for the particular subject,
(b) Five to ten keynote speakers

Financial support for (a) and (b) may be offered by Typhoon Committee. The whole success of the workshop depends on the invitation of the qualified speakers, and the financial support from TCTF for the invitation of reasonable number of speakers is essential depending on the voluntary support by local hosts and other Members. The workshop should be open to others who could finance their participation themselves.

3. Contents

The workshop program might include:

Section 1 Forecast accuracy and reliability
* by knowledgeable expert to review the status and prospects based on state of art science and technology

(a) Positioning and track forecast
(b) Intensity assessment and forecast including rainfall and wind; formation to extratropical transition
(c) Nowcasting for severe weather near landfall
(d) Storm surge prediction and meteorological hazard model
(e) Advanced observation technique
(f) Verification technique

Section 2 Impact and vulnerability analyses
* Demonstration of activities at leading DPP or research centers

(a) Societal vulnerabilities and meteorological variability
(b) Understanding public response to cyclone threat: behavioral approach?
(c) Quantitative assessments of the impacts on society
(d) Strategies and plans to reduce vulnerabilities; risk management
(e) Cooperation at international and national levels

Section 3 Warning dissemination
* presentation by participants to share experience

(a) Conventional channels for communication
(b) New opportunities; Internet, mobile phone and pager
(c) Emergency management network
(d) Conflict and confusion by non-official source
(e) Serving and communicating to specific users

Section 4 Warning presentation
* presentation by participants to share experience
(a) Text messages
(b) Interactive graphics
(c) Probability and uncertainty
(d) Access on real-time weather situation
(e) Language

Section 5 Public education and promotion
* presentation by participants to share experience
(a) Real-time education through warning messages
(b) Media packages at TV, radio and newspaper
(c) Internet
(d) School based package
(e) Interaction with local government units and local community
(f) International cooperation and information exchange

4. Venue

The China Member expressed interests in hosting the said workshop (TRCG meeting during the 36th session of Typhoon Committee).

5. Procedures

5.1 Subject to guidance from Typhoon Committee, TRCG could provide assistance to Typhoon Committee Secretariat regarding the scientific programme of the proposed workshop in consultation with working groups of hydrology and DPP.

5.2 The local organization committee, being established at host country, is requested to assist TCS to develop a complete program in consultation with the TRCG, and to provide necessary arrangements for the workshop.

6. Remark

It is desired that the proposed workshop be held in conjunction with the WMO training seminar for ensemble prediction system for RAII and RAV around May 2005.

APPENDIX XII

REVIEW OF TROPICAL CYCLONES IN 2004 AFFECTING TYPHOON COMMITTEE MEMBERS

In Hong Kong, China, the following typhoons occurred:

In 2004, three tropical cyclones necessitated the issuance of local warning signals in Hong Kong. A summary of these tropical cyclones is given below.

(a) Typhoon Conson (0404) : 5 - 11 June 2004

In Hong Kong, the Standby Signal No. 1 was issued for the first time in the year at 2.15 p.m., on 8 June, soon after Conson attained typhoon strength over the northern part of the South China Sea. Conson was closest to Hong Kong about 4 hours later when it was about 660 km to Hong Kong's east-southeast. It brought no significant damage to Hong Kong.

(b) Tropical Storm Kompasu (0409) : 14 - 16 July 2004

Kompasu was the first tropical cyclone to necessitate the issuance of No. 8 Gale or Storm Signal in 2004. It made landfall in the northeastern part of Hong Kong on the afternoon of 16 July 2004. During its passage, 12 people were injured. A total of 19 cases of fallen trees were reported at various places under high wind conditions. At the Hong Kong International Airport, 13 flights were delayed and two were cancelled. Ferry services were suspended. The rainbands of Kompasu and its remnant brought heavy squally showers to Hong Kong on 16 and 17 July. More than 120 millimetres of rainfall were recorded at the Hong Kong Observatory (HKO) Headquarters during the passage of Kompasu.

(c) Typhoon Aere (0417) : 20 - 27 August 2004

The Standby Signal No. 1 was issued on 26 August when Aere was about 330 km to the east-northeast of Hong Kong. Aere came closest to Hong Kong on 27 August 2004 when it was about 120 km to the north-northwest. Rainy weather associated with the remnant of Aere persisted for a couple of days. Rain was particularly heavy on 29 August. The Amber Rainstorm Warning Signal was issued and about 200 millimetres of rainfall were recorded in parts of the territory that day. Aere did not bring significant damage to Hong Kong.

In the **Philippines,** the following typhoons entered the Philippine Area of Responsibility (PAR) from 1 September 2003 to 31 August 2004.

TY ONYOK (0313, DUJUAN)
Aug. 29 – Sep. 02
Maximum winds: 150 to 185 kph

ONYOK formed in the vicinity of the Caroline Islands and had already attained storm intensity when it entered the Philippine Area of Responsibility (PAR) on 29 August. It intensified rapidly while over the Philippine Sea; becoming a typhoon on the 31st. ONYOK moved west northwest by morning of 1 September as it passed between Batanes and Taiwan. It was closest to Batanes at 60 kilometers by evening of the same day. On the next morning, it moved away from the country into the Formosa Strait.

TY POGI (0314, MAEMI)
Sep. 07 - 10
Maximum winds: 185 to 220 kph

This disturbance originated north of Caroline Islands. It traversed the N. Philippine Sea in a northwest direction far from the Philippine landmass. It was already a storm with a

maximum winds of 85 kph when it entered the PAR on September 7. Due to favorable environmental conditions, POGI continued to gain strength. It reached maximum sustained winds of 185 kph as it moved away from the Philippines by 10 September towards the direction of southern Japan.

TD QUIEL
Sep. 15 - 19
Maximum winds: 55 kph

Tropical depression QUIEL was the fifth cyclone that crossed the archipelago. It formed into a tropical depression on 15 September about 750 km east of Visayas. It moved west - northwest to northwest for two days then turned west and crossed Northern Luzon. QUIEL weakened slightly over land due to the effect of topography and by the more dominant and stronger circulation of another tropical cyclone in the northern Philippine Sea (ROSKAS). It was out of the PAR by the morning of September 19.

TS ROSKAS (0315, CHOI-WAN)
Sep. 18 - 19
Maximum winds: 85 to 100 kph

TS ROSKAS started as a tropical depression 760 kilometers east of Calayan Island on the morning of September 18. It followed a west-northwest to northwest track over the Philippine Sea as it interacted with QUIEL in the southwest ROSKAS did not directly affected any part of the country.

TD SIKAT
Sep. 25 - 26
Maximum winds: 55 kph

SIKAT was another weak and short-lived tropical cyclone. It originated in the eastern border of the PAR on the afternoon of 25 September. It remained almost stationary until it weakened into a low pressure area in the morning of the following day.

T TISOY (0317, KETSANA)
Oct. 17 - 21
Maximum winds: 160 to 195 kph

TISOY developed into a tropical depression on the morning of October 17 while over the central Philippine Sea. It remained almost stationary for two days before interacting with another system (URSULA) to the southwest. TISOY looped over the area for another two days as it continued to intensify into typhoon intensity. By the evening of October 20, its maximum wind near the center was at 120 kph. TISOY then moved north to northeastward and exited the PAR on 21 October.

TS VIRING (0319, MELOR)
Oct. 30 – Nov. 04
Maximum winds: 115 – 145 kph

The initial warning was issued when VIRING formed as a weak tropical depression at about 500 kilometers east of Bicol Region on the afternoon of 30 October. It intensified into a tropical storm as it moved in the general direction of Northern Luzon. It made landfall in Isabela then crossed Cagayan, Kalinga, Apayao and Ilocos Norte while it followed a northnorthwest path. It entered Luzon Strait where it changed course to the north. VIRING recurved to the northeast and then turned eastward skirting Taiwan. It left the PAR on November 3.

TS WENG (0320, NEPARTAK)
Nov. 12 - 15
Maximum winds: 110 – 140 kph

WENG is the 2nd tropical cyclone that crossed the Visayas. It originated from a low-pressure area in the vicinity of the Caroline Islands. On the 12th of November, TD WENG entered the PAR and moved westward. It made landfall in Northern Samar and traversed N. Visayas passing through Masbate, the Visayan Sea, S. Mindoro and the Calmian group of islands. It intensified further as it moved into the South China Sea with maximum sustained winds of 110 kph. It left the western border of the PAR on the 30th and headed towards N. Vietnam.

T YOYOY (0321, LUPIT)
Nov. 27 - 30
Maximum winds: 205 – 250 kph

YOYOY was the strongest tropical cyclone for the year 2003 but it did not affect any part of the country. It entered the PAR with maximum sustained winds of 205 kph, on the early morning of 27 November. It moved northwestward until it began to recurve by 29 November. At the same time, its maximum sustained winds decreased into 165 kph. YOYOY accelerated and exited the PAR on November 30.

TD ZIGZAG
Dec. 25 - 28
Maximum winds: 55 kph

ZIGZAG developed from an active low pressure area east of Bicol with maximum sustained winds of 55 kph on Christmas morning. The depression then moved westward until it slowed down in the evening of the 26th. It then moved to the southwest towards Visayas. ZIGZAG passed south of Samar and Leyte and eventually weakened into a low pressure area while over Bohol Sea on the morning of December 28.

In 2004:

Between January to August 2004, there were 17 tropical cyclones that entered the PAR but only 5 had directly affected the country. Damages caused by these tropical cyclones are presented as Annex 1. Typhoon MARCE (0417, AERE) was especially cited. Although its track did not cross any landmass in the Philippines, it interacted with the southwest monsoon flow, causing widespread heavy rainfall and subsequently flooding. Many water reservoirs (dams) in the Northern Philippines released water to avoid breaking.

Tropical Cyclone	Date of Occurrence	Max. Sustained Winds	Central Pressure:
1. TS AMBO (01W)	February 13 - 14	55 kph (45 kts.)	1004 hPa
2. TS BUTCHOY	March 17 - 23	85 kph (45 kts.)	991 hPa
3. Super TY COSME (Sudal/03W)	April 10 - 14	240 kph (130 kts.)	910 hPa.
4. Super TY DINDO (Nida/04W)	May 13 - 19	260 kph (140 kts.)	898 hPa
5. TY ENTENG (Omais/06W)	May 19 - 21	120 kph (65 kts.)	976 hPa.
6. TY FRANK (Conson/07W)	June 5 – 9	175 kph (95 kts.)	949 hPa.
7. TS GENER(Chanthu/08W)	June 07 - 11	65 kph (35 kts.)	996 hPa.
8. Super TY HELEN (Dianmu/09W)	June 16 - 19	285 kph (155 kts.)	879 hPa.
9. TY IGME (Mindulle/10W)	June 25 - July 02	230 kph (125 kts.)	916 hPa.
10. TS JULIAN (Kompasu/12W)	July 13 - 15	85 kph (45 kts.)	991 hPa.

Tropical Cyclone	Date of Occurrence	Max. Sustained Winds	Central Pressure:
11. TY KAREN (Rananim/16W)	Aug 06 - 12	165 kph (90 kts.)	954 hPa.
12. TS LAWIN (Megi/18W)	Aug15 - 17	75 kph (40 kts.)	994 hPa.
13. TY MARCE (Aere/20W)	Aug 20 - 23	140 kph (75 kts.)	967 hPa.

TY MARCE (0417, AERE)
August 20 – 24, 2004
Maximum winds: 120 – 150 kph

Marce was first detected as a broad and active tropical disturbance in the vicinity northwest of Guam on 13th August. Its formation and development was continuous and progressive while embedded in the monsoon trough. During the period when Marce occurred within the PAR together with Typhoon east of it, the monsoon depression was likewise deepening.

Marce was already a tropical storm of 65 kph winds when it reached the 135 ^{0}E longitude and located at 13.6 ^{0}N about 1,130 kilometers east of Luzon on the morning of August 20. Marce took an unusual pole ward movement by about 360 kilometers to the north for 18 hours. It changed course to the north-northwest in the next 6 hours taking an average speed of 19 kilometer per hour. It became a severe tropical storm of 95 kilometers per hour on the morning of August 21. From this time until the period it had exited the PAR in the northwestern border, Marce had taken a generally northwestward track. It gained typhoon strength of 120 kilometers per hour while it was about 610 kilometers almost east of Batanes. It underwent structural changes while on a deepening process when it approached land (nearing Taiwan). Another typhoon, Chaba was also intensifying, being part of the monsoon depression that set the trough in a northwest to southwest orientation across the Northwest Pacific Ocean. As Marce moved through the southern islands of Japan (Okinawa), just about 220 kilometers east of Taiwan, the southern and eastern periphery of Marce had established a monsoon surge, which encompassed most of Northern and Central Luzon including Metro Manila and surrounding areas. These areas experienced heavy rains resulting to flooding. Flooding due to Marce continued even when rains had stopped. There was suspension of work and classes in some parts of Luzon particularly in Metro Manila that were affected by heavy rainfall and floods on August 24 to 26, 2004.

In the **Republic of Korea**, a total of five typhoons affected the Korean peninsula both directly and indirectly this typhoon season, mainly from May to September in 2004; Mindulle(0407), Namtheun(0410), Megi(0415), Chaba(0416), Songda(0418). No typhoon landed on the Korean peninsula. Typhoon Megi(0415) passed nearby Busan, located on the southern part of the Korean peninsula, and the other four typhoons(Mindulle, Namtheun, Chaba, and Songda) passed relatively farther from the Korean peninsula, through the Korean Channel. The above typhoons affected the country, caused 8 deaths (7 by Megi, 1 by Mindulle) and lose of property worth 370 billion Korean Won (US$ 321 million).

Mindulle (0407)

A tropical depression over the sea 150 km northwestward of Guam, strengthened to a tropical storm(TS) status on 06UTC 23 June, and gradually strengthened to a typhoon on 12UTC 27 June. The typhoon reached a peak intensity of 90 kt during 18UTC 28 June and 12UTC 29 June, when the center of typhoon moved within 700 ~ 800 km of Taipei, Taiwan. The center slowly moved to a northwestward direction and reached the sea 200 km southwest of Jeju Island, Korea.

Namtheun (0410)

A tropical depression over the sea 1220 km northeastward of Guam, strengthened to a tropical storm(TS) status on 12UTC 25 July and developed to a typhoon on 02UTC 26 July. The typhoon reached a peak intensity of 85 kt during 12UTC 26 July and 15UTC 27 July, when the center of typhoon came within 1550 km of Kagoshima, Japan. The center slowly moved to a northwestward direction and passed through the Korean Channel during 10UTC 31 July and 14UTC 1 August. The cyclone quickly weakened to an extratropical low by 12UTC 1 August.

Megi (0415)

A tropical depression formed on 18UTC 15 August, about 1400 km northwest of Guam. The cyclone reached a tropical storm status by 06UTC 16 August. The cloud pattern continued to organize and the cyclone developed an eye, becoming a typhoon at 00UTC 18 August. Typhoon Megi moved northeastward and intensified continuously after 06UTC 18 August. It's maximum intensity was 65 kt, and the minimum pressure was 970 hPa during 00UTC ~ 15UTC 18 August and 03UTC ~ 12 UTC 19 August. Typhoon Megi passed near Busan, located in the southern part of the Korean peninsula at 7:30 19 August. The hourly rainfall was the range of 50 ~ 80 mm, and sustained winds were 20 ~ 30 m/s at the southern part of the Korean peninsula as the typhoon came to close. The cyclone was weakened to an extratropical low around 09UTC 20 August at the East sea near Sapporo, Japan.

Chaba (0416)

A tropical depression over the sea 2230 km eastward of Guam, strengthened to a tropical storm(TS) status on 12UTC 19 August and developed to a typhoon on 18UTC 21 August. The typhoon reached a peak intensity of 105 kt during 21UTC 22 August and 03UTC 24 August, when the center of typhoon came within 230 ~ 600 km of Guam. The center continuously moved northwestward until 15UTC 30 August, and then it moved northeastward and passed through the Straits of the southern part of Japan during 00UTC ~ 12UTC 30 August.

Songda (0418)

A tropical depression over the sea 2230 km eastward of Guam, strengthened to a tropical storm(TS) status on 00UTC 28 August and developed to a typhoon on 12UTC 30 August. The typhoon reached a peak intensity estimated at 90 kt during 06UTC 31 August and 09UTC 2 September, then weakened on 3 ~ 4 September. Typhoon Songda again developed about 90 kt from 06UTC 4 September to 03UTC 4 September. The typhoon moved northeastward from 06UTC 6 September and passed through the east coastal area of Japan.

In **Singapore,** no direct impact of tropical cyclones were experienced during the year.

In **Thailand,** from October 1, 2003 to September 15, 2004, a tropical depression and a typhoon named "CHANTHU" (0405) had entered Thailand. A brief description of the two tropical cyclones is shown in three types of assessment hereunder :

(a) Tropical Depression : October 2003

An active low pressure cell in the Gulf of Thailand intensified into a tropical depression on the evening of 22nd October while its center was found to be in the latitude 10.2 degree North and the longitude 101.0 degree East. It had initially been almost stationary before taking on a more northerly course on the following day. On the evening of 24th October, it made landfall between Kui Buri District (Amphoe Kui Buri) and Sam Roi Yod Sub-district (King Amphoe Sam Roi Yod), Prachuap Khiri Khan province in the Southern Region of

Thailand. Afterward, it moved further to Myanmar and the Andaman Sea before moving to the Bay of Bengal on the 25th.

As this tropical depression hit Thailand, upper Thailand was also dominated by the extending ridge of a high pressure area in China. This high pressure area was the cause of rainfall and temperature reduction in the Northern and Northeastern Regions of Thailand while the tropical depression induced almost widespread rainfall in the Central, the Eastern, and the Southern Regions. In addition, serious flash floods, the consequence of heavy and very heavy rainfalls brought about by the tropical depression, occurred in several areas of the Central Region as well as the upper part of the Southern Region. The economic loss was estimated to be more than 1 billion baht.

(b) Typhoon "CHANTHU" (0405) : June 2004

CHANTHU originated from a tropical depression over the Western part of the North Pacific Ocean (east of the Philippines). It moved through the Philippines on 9th June and made tracks westward to the South China Sea before intensifying into a tropical storm on 11th June. Later on, it developed into a typhoon while its center was located at the latitude 14.0 degree North and the longitude 110.5 degree East on 12th June. On the same day, it made landfall over the middle area of Vietnam and weakened into a tropical storm. Then, it moved further inland to the Lao PDR before entering Thailand at Ubon Ratchathani Province on 13 June. At this stage, CHANTHU weakened into a tropical depression before moving further through other provinces, including Yasothon, Roi Et, Kalasin, Udon Thani, and Nong Khai. Afterward, it moved to the upper part of Lao PDR and weakened into a low pressure cell before finally dissipated on the morning of 16th June.

As CHANTHU moved closer to upper Thailand, an active low pressure trough was setting across the Central and the Northeastern Regions of the country. In addition, the strong southwest monsoon also prevailed over Thailand. These features induced abundant rainfalls together with heavy and very heavy ones in several areas, particularly in the Northeastern Region. Flash floods had been reported as the consequence of CHANTU in several areas along its path.

In **United States of America, Micronesia,** Western North Pacific section –WFO Guam

Name	Date	Island(s) affected
0321 Lupit (26W)	22-26 November 2003	Yap State: Ulithi, Fais, Faraulep
0401 Sudal (03W)	6-9 April 2004	Chuuk State: Polowot, Ulul, Fananu
0404 Omais (06W)	16-18 May 2004	Yap State: Yap Palau: Koror
0406 Dianmu (09W)	12-14 June 2004	Palau: Koror, Kayangel Yap State: Yap, Ngulu
0408 Tingting (11W)	26-29 June 2004	CNMI: Rota, Tinian, Saipan Guam, Pagan, Agrihan
0416 Chaba (19W)	20-22 August 2004	CNMI: Rota, Tinian, Saipan Guam
0417 Aere (20W)	18-19 August 2004	Yap State: Ulithi, Fais
21W	27 August 2004	CNMI: Rota, Tinian, Saipan Guam
0418 Songda (22W)	30 August-01 September 2004	CNMI: Tinian, Saipan, Agrihan, Pagan
0419 Sarika (23W)	5-6 September 2004	CNMI: Pagan, Agrihan

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.

0321 LUPIT (26W)

Lupit began as a circulation 205 nautical miles (nm) east of Enewetak (WMO 91251) on 17 November 2003. Three days later, the circulation became Tropical Depression 26W and was upgraded to Tropical Storm Lupit the following night. Lupit reached typhoon intensity on 22 November and moved westward over the next few days passing 35 nm north-northeast of Woleai Atoll (WMO 91317) on 24 November and later on 25 November passing 52 nm northeast of Ulithi (WMO 91203) and 122 nm northeast of Yap (WMO 91413). The typhoon continued to move toward the northwest away from any other islands, exiting the Guam AOR on the morning of 30 November. Sea water destroyed the crops and damaged the soil and water distribution system on Ulithi. Inundation and salt spray also damaged much of the agriculture on Woleai Atoll and the surrounding islands. Damages to the islands in Yap State amounted to $1.4 million (US). No deaths or major injuries were reported on any islands.

0401 SUDAL (03W)

A circulation in the monsoon trough was noted near Kosrae (WMO 91356) on the night of 28 March 2004. The circulation drifted west, forming into Tropical Depression 03W on 4 April, while it was about 115 nm west-southwest of Chuuk (WMO 91334). The depression was named Tropical Storm Sudal by RSMC Tokyo on 5 April. On 6 April, Sudal was upgraded to a typhoon and was located 280 nm south-southeast of Guam (WMO 91212). Sudal acquired a westward to southwestward track passing 200 nm south of Guam and heading toward Yap state. On the afternoon of 8 April, the typhoon passed 61 nm south-southeast of Ulithi (WMO 91203), where sustained winds were measured at 50 kt and gusts were measured to 71 kt. On the morning of 9 April, Typhoon Sudal passed 22 nm south of Colonia, Yap (WMO 91413). The highest wind measured on Yap was 60 kt with gusts up to 97 kt, but a more thorough wind assessment revealed that sustained winds near 100 kt actually hit parts of the island. Yap also received more than 153 millimeters of rain in 24 hours from the typhoon. On Yap there was considerable inundation from a storm surge that exceeded 3.4 meters (m) in many locations. There was also considerable damage to most wooden structures and to roofs made of wood and tin. Many power and phone lines were knocked down, and the hospital and airport terminal lost their roofs. After this passage, Sudal continued to track northwest, away from Yap, and recurved toward the northeast until it exited the Guam AOR on the 14 April.

Despite the strong intensity of Typhoon Sudal, there were no direct storm deaths or serious injuries. However, damage to Yap Island was heavy, amounting $14 million.

0404 OMAIS (06W)

The circulation that was to become Tropical Storm Omais developed 435 nm east-southeast of Yap (WMO 91413) on 15 May 2004. On 16 May, the system intensified to tropical storm intensity. Tropical Storm Omais passed 40 nm southwest of Yap on the afternoon of 18 May. The highest wind reported on Yap was 20 kt with a gust to 36 kt. Twenty-four hour rainfall on Yap was only 45.2 mm. During its passage near Yap, Tropical Storm Omais was a small storm with strong winds just above the surface, but with minimal peripheral convection to bring these winds to the surface.

On 19 May, Omais briefly attained typhoon intensity for just over 24 hours. Omais continued to move out of the Guam AOR, eventually passing west of Iwo Jima as a tropical depression. No injuries or significant damages were attributed to Omais during its trek through Micronesia.

0406 DIANMU (09W)

A circulation in the monsoon trough was located 330 nm south-southeast of Yap (WMO 91413) at 12 June 2004. By the morning of the 13th, the circulation had moved to within 80

nm south-southwest of Yap. On the night of the 13th, Tropical Depression 09W, located 115 nm west of Yap, was upgraded to Tropical Storm Dianmu. It passed 61 nm west-northwest of Yap on the 15 June and became a typhoon shortly thereafter. The typhoon continued to intensify and move northward, passing well to the west of the Guam and the CNMI on the 15th and 16th. Dianmu moved out of the Guam AOR on the morning of the 19th as a strong typhoon. Dianmu eventually passed to the east of Okinawa and eventually crossed the Japanese main island of Honshu. No reports of injuries or significant damages were received in Micronesia.

0408 TINGTING (11W)

Tropical Depression 11W developed in an active monsoon trough on 26 June 2004, and quickly intensified to Tropical Storm Tingting later in the day. As the storm passed to the east of Guam (WMO 91212) and toward Saipan (WMO 91232), enhanced monsoon flow moved across Guam and Rota (WMO 91221). Guam experienced winds of 44 kt with gust to 57 kt on the 28 June. Tingting, having attained typhoon intensity, passed just northeast of Saipan on 28 August. Eye passage was observed on the northern third of the island, and many trees were blown down during the passage. At the airport on southern Saipan, measured sustained winds were 54 kt with gusts to 67 kt. Typhoon Tingting continued to strengthen and passed 50 nm west of Pagan Island (WMO 91222) on 29 August. On Pagan, a remote observing system measured sustained winds of 57 kt with a peak gust to 115 kt.

Strong monsoon flow over Guam into Tingting brought heavy rains to the island. Twenty-four hour rainfall on Guam on 27 June totaled 406 millimeters (mm). There was extensive flooding, and several mudslides occurred on the island. Swollen rivers caused one bridge collapse and this resulted in an auto accident and one casualty. Strong surf generated by the monsoon and storm created high surf and strong rip currents on the reefs of Guam. Five kayakers were caught in the surf and rip currents and eventually succumbed to their strength. Another individual was swept over the reef and presumed dead. There was an additional drowning on Saipan.

The typhoon moved northwest and out of Guam's AOR on the night of the 29th.

0416 CHABA (19W)

The circulation, which was to become Tropical Depression 19W, developed southeast of Enewetak (WMO 91251) along the monsoon trough on 19 August 2004. This depression became Tropical Storm Chaba and continued to intensify quite rapidly, reaching typhoon intensity later that night. Chaba took a west to west-northwestward track towards the Mariana Islands. While nearly all forecast models predicted a northward turn east of Saipan (WMO 91232), indirect interaction with Tropical Storm Aere, which was located well to the west of the Marianas and south of the Ryukyu Islands, delayed that turn. Instead, the center of the typhoon moved west through the Mariana Islands passing about 25 nm north-northeast of Rota (WMO 91221) on the morning of the 23rd. As the 45 nm-diameter eye approached the islands, its eye wall encompassed Rota to the south and Saipan and Tinian (WMO 91231) to the north. However, as Chaba started to rapidly intensify, the eye shrunk and moved south of Tinian and Saipan. The west-southwest track kept the eye wall cloud of the shrinking eye over Rota. The storm moved very slowly resulting in the eye wall cloud residing over the island for 12 hours. A wind gust of 118 kt was reported on Rota during the eye wall passage. There were about 54 homes destroyed and many more damaged. There was also significant damage to vegetation, trees and crops.

Tinian, the island north of Rota, did not report any fatalities but only a few minor injuries. Several wooden houses were heavily damaged or destroyed. There was an island wide power outage and the port was damaged and remained unusable for two days. On Saipan, one person was missing and presumed drowned. Many tin and wood roofs were damaged or destroyed. The island also experienced an island wide power outage. On Guam one person

was swept over the reef and drowned. Chaba caused a temporary loss of power and water for certain parts of the island. After its destructive rampage through the Mariana Islands, Typhoon Chaba moved northwestward and eventually passed out of Guam's AOR on 25 August.

(21W)

A circulation east of the Mariana Islands, about 385 miles north of Chuuk (WMO 91334) became Tropical Depression 21W on 26 August 2004. Some additional strengthening resulted in the depression being upgraded to a tropical storm on 27 August. However, this level of intensity was short lived, as an upper tropospheric low pressure system moved very close to the cyclone, and sheared its convective clouds to the west, away from the center of the storm. The system weakened to a depression on the night of the 27th. Tropical Depression 21W, void of most of its convective clouds, moved north of Saipan on the 28th and finally dissipated west of the Mariana Islands. No reports of injuries or damage were received.

0418 SONGDA (22W)

A circulation 120 nm north of Kwajalein (WMO 91366) became Tropical Depression 22W on 27August 2004. Further deepening allowed the depression to be upgraded to a tropical storm early on the morning of 28 August. At this time, Tropical Storm Songda was close to Enewetak (WMO 91251) in the Marshall Islands. Songda became a typhoon on 29 August while about 260 nm to the east of Saipan (WMO 91232) in the Mariana Islands and tracked northwestward. Initially, the typhoon was not expected to impact Saipan, however, on 31 August, the size of its wind field grew dramatically, bringing some tropical storm conditions to the island. The typhoon passed about 35 nm northeast of Pagan Island (WMO 91222) on 01 September. The highest sustained wind recorded on Pagan was 46 kt with a wind gust to 94 kt. No deaths or injuries were reported. All homes and crops were lost. The system passed out of Guam's AOR by 1 September.

0419 SARIKA (23W)

On the morning of the 5 September 2004, a small circulation rapidly intensified into Tropical Depression 23W. The depression continued its deepening, and quickly became Tropical Storm Sarika in the afternoon and Typhoon Sarika later that night. Typhoon Sarika was a midget typhoon, with its entire circulation barely 100 nm across. Late on the night of the 5th, Typhoon Sarika passed midway between the islands of Pagan (WMO 91222) and Agrihan (18.8N 145.7E). The highest sustained wind measured on Pagan was 30 kt with a wind gust to 50 kt. On Agrihan, 40 nm north of Pagan, the highest winds were estimated to be between 60 and 70 kt on the same day. The eye wall cloud passed between the two islands. No deaths or injuries were reported on either island.

The tropical storm continued its northwest trek and moved out of Guam's AOR on 6 September.

In Viet Nam

Narrative accounts of tropical cyclones

During this period, 1 severe tropical storm landed on Viet Nam and 2 TD indirectly had its impact in our country. Their characteristics are shown in table 1.

- The first tropical depression with average speed of 12 km/h landed on Nghe An province on the early morning of 9 September 2003. Due to the interaction with cold air from the north, heavy rains of 200 - 300 mm occurred in coastal provinces from Quang Ninh to Ha Tinh. Due to this tropical depression, 22 person were reported dead and the total damage amounted to 44 millions US$.

- The second tropical depression with speed of 14 km/h landed on Quang Ngai province on early morning of 19 September 2004. Due to the interaction with SE winds from subtropical high, heavy rains of 100 - 150 mm occurred in central provinces from Nghe An to Binh Dinh. But no significant damage was reported on this tropical depression.
- Severe tropical storm CHANTHU (0405) with speed of about 25 km/h landed on Binh Dinh province (Central Viet Nam) in 12 June 2004. At Quang Ngai (48863), maximum sustained winds of 16 m/s, gust of 20 m/s and minimum pressure of 988.9mb. After landfall, Chanthu weakened rapidly and dissipated as a low area pressure in the Viet Nam - Laos border. Heavy rains of 200 - 300mm occurred in most provinces of central Vietnam bringing moderate floods to some river system in this region. Due to Chanthu, 26 person were dead, 33 injured and another 30 were missing.

Table 1. List of Tropical cyclones landed or directly affected Vietnam (From 1 Sept. 2003 to 31 Aug. 2004)

No	Number / Name	Landfall			
		Location (province)	Date	Intensity	
				Pmin (hPa)	Vmax (m/s)
1	0405/ Chanthu	Binh Dinh	12 June, 2004	988.9	16, gust 20

APPENDIX XIII

SUMMARY OF THE 2004 TYPHOON SEASON

As of 30 September, 21 tropical cyclones of tropical storm (TS) intensity or higher generated in the western North Pacific and the South China Sea in 2004. The total number exceeds the 30-year average* frequency of 19.2 by the end of September. Fourteen cyclones out of them (67% of the total) reached typhoon (TY) intensity. Three out of the remainder attained severe tropical storm (STS) intensity and the others reached only TS intensity (see Table 1). Eight cyclones landed on Japan, which made a new record of the number of tropical cyclones landing on Japan within a year (from January to December) since 1951.

Table 1 *List of tropical cyclones which attained TS intensity or higher in 2004*

Tropical Cyclone			Duration						Minimum Central Pressure				Max Wind
			(UTC)			(UTC)			(UTC)	(N)	(E)	(hPa)	(kt)
TY	SUDAL	(0401)	050000	Apr	-	161200	Apr		100000	10.8	#####	940	90
TY	NIDA	(0402)	140000	May	-	210600	May		161200	12.7	#####	935	95
STS	OMAIS	(0403)	180000	May	-	210600	May		191200	11.4	#####	985	50
TY	CONSON	(0404)	061800	Jun	-	110900	Jun		090600	22.4	#####	960	80
STS	CHANTHU	(0405)	101800	Jun	-	130600	Jun		120600	13.8	#####	975	60
TY	DIANMU	(0406)	131200	Jun	-	211800	Jun		160000	14.3	#####	915	100
TY	MINDULLE	(0407)	230600	Jun	-	040000	Jul		290000	18.8	#####	940	95
TY	TINGTING	(0408)	260000	Jun	-	040600	Jul		300900	25.8	#####	955	80
TS	KOMPASU	(0409)	140000	Jul	-	161200	Jul		141200	20.4	#####	992	45
TY	NAMTHEUN	(0410)	250000	Jul	-	020000	Aug		270000	27.7	#####	935	85
TS	MALOU	(0411)	040000	Aug	-	042100	Aug		040300	30.9	#####	996	40
TY	MERANTI	(0412)	041200	Aug	-	090600	Aug		051800	28.0	#####	960	75
TY	RANANIM	(0413)	081200	Aug	-	130000	Aug		111200	24.4	#####	950	80
TS	MALAKAS	(0414)	110000	Aug	-	131800	Aug		111800	30.7	#####	990	45
TY	MEGI	(0415)	160600	Aug	-	200900	Aug		180000	28.4	#####	970	65
TY	CHABA	(0416)	191200	Aug	-	310600	Aug		231800	17.1	#####	910	110
TY	AERE	(0417)	200000	Aug	-	260600	Aug		240000	24.7	#####	955	80
TY	SONGDA	(0418)	280000	Aug	-	080000	Sep		310600	16.7	#####	925	95
STS	SARIKA	(0419)	041800	Sep	-	070600	Sep		051200	18.4	#####	980	55
TS	HAIMA	(0420)	110000	Sep	-	130600	Sep		111800	24.4	#####	996	40
TY	MEARI	(0421)	201800	Sep	-	300000	Sep		240600	20.1	#####	940	90

The tropical cyclone season of this year began in early April with the development of Sudal (0401). From May to June, seven tropical cyclones of TS intensity or higher formed due to active convections in the South China Sea and over the sea east of the Philippines. Particularly, five tropical cyclones of TS intensity or higher (1.7 for the 30-year average*) formed in June, and the number was largest in June since 1951. Two cyclones out of them (0.2 for the 30-year average*) hit Japan. The position of subtropical high in the western North Pacific shifted northeastward from normal in June.

In July, convective activities were suppressed over the sea east of the Philippines, and only two cyclones of TS intensity or higher (4.1 for the 30-year average*) formed over the western North Pacific.

In August, convective activities were enhanced again from the Philippines to the International Date Line and eight cyclones of TS intensity or higher (5.5 for the 30-year average*) formed there. From August to September, two and four out of them hit China and Japan, respectively. The extension of subtropical high in the Pacific to the west was weaker than normal in August.

In September, three cyclones (5.1 for the 30-year average*) formed near Taiwan Island and around the Mariana Islands. Convective activities around the Philippines were inactive.

In 2004, the mean formation latitude** of 16.3ºN was almost the same as the 30-year average* of 16.2ºN, while the mean formation longtitude** of 140.8ºE was to the east of the 30-year average* of 136.9ºE. In August, four tropical cyclones of TS intensity or higher formed over the area to the east of 158°E. Monthly mean sea surface temperatures (SSTs) in August were more than 0.5°C above normal from 165°E to 125 °W in the equatorial Pacific.

*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.

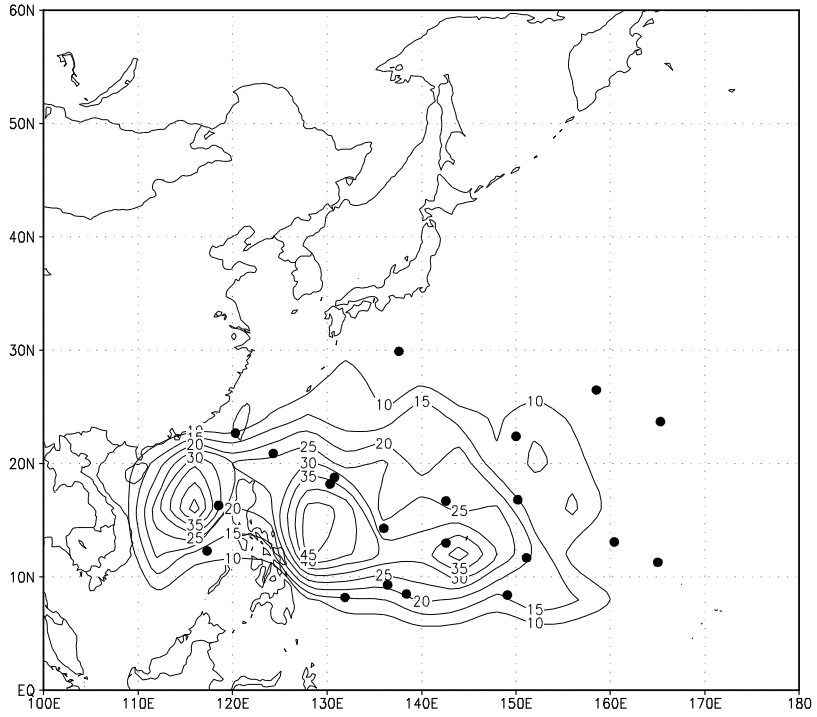


Figure 1 *Genesis points of 21 TCs generated from January to September 2004 (dots) and frequency distribution of genesis points for 1951-2003 (lines).*

Narrative Accounts of Tropical Cyclones in 2004

TY SUDAL (0401)
Sudal formed as a tropical depression (TD) southeast of Truck Island at 18UTC on 2 April 2004. It moved westward, then north-northwestward and developed into a tropical storm (TS) around the Caroline Islands at 00UTC, 5 April. Moving westward with slight meanders, it was upgraded to the typhoon (TY) intensity at 18UTC, 7 April. With a gradual change of its direction to the north, it reached its peak intensity with maximum sustained wind of 90kt over the waters east of the Philippines at 00UTC on 10 April. After recurving on 12 April, Sudal accelerated east-northeastward weakening its intensity south of Chichijima Island on 15 April. It was downgraded into the TS intensity and further transformed into an extratropical cyclone north of Minamitorishima Island at 06 and 12UTC the next day, respectively. It crossed the International Date Line south of the Aleutian Islands on 17 April.

TY NIDA (0402)
Nida formed as a tropical depression (TD) over the sea east of Mindanao Island at 00UTC 13 May 2004. Moving northwestward, it developed into a tropical storm (TS) over the same water at 00UTC 14 May, and further a typhoon (TY) over the sea east of Philippines at 12UTC 15 May. Moving in the same direction, it reached its peak intensity with a maximum sustained wind of 95kt over the same water at 12UTC 16 May. NIDA accelerated northeastward after recurved on 18 May over the sea east of Luzon Island. It passed over the sea south of Japan, nearly keeping its own intensity. After it passed south of Hachijojima Island, it weakened rapidly and transformed an extratropical cyclone at 06UTC 21 May over the sea east of Japan and dissipated over the same water at 00UTC 23 May.

STS OMAIS (0403)
Omais formed as a tropical depression (TD) around Caroline Islands at 12UTC 16 May 2004. Moving northwestward, it developed into a tropical storm (TS) over the same water at 00UTC 18 May. Moving in the same direction, it developed into a severe tropical storm (STS) and reached its peak intensity with a maximum sustained wind of 50kt over the sea east of Philippines at 12UTC 19 May. At the same time, OMAIS changed the direction north-northeast and gradually weakened over the same water. Over the sea south of Okinotorishima Island, it weakened into a tropical depression (TD) at 06UTC 21 May and dissipated over the same water at 06UTC 22 May.

TY CONSON (0404)
Conson formed as a tropical depression (TD) in the South China Sea at 18UTC on 4 June 2004. It moved eastward, then north-northeastward and developed into a tropical storm (TS) west off Luzon Island at 18UTC, 6 June. After it changed the direction to northeastward, it was upgraded to the typhoon (TY) intensity at 06UTC, 8 June. Keeping the track to the northeast, it reached the peak intensity with maximum sustained wind of 80kt at 12UTC on 9 June. Conson moved northeastward along the Nansei Islands holding its intensity. After tracking over the water east of Tanegashima Island, it weakened gradually into the TS strength at 06 UTC, 11 June. It made landfall over Shikoku after 07UTC on that day. It transformed into an extratropical cyclone at 09 UTC, 11 June, and crossed the International Date Line south of the Aleutian Islands on 14 June.

STS CHANTHU (0405)
Chanthu developed as a tropical depression (TD) east of the Philippines at 18UTC on 7 June 2004. It moved west-northwestward and passed through the Philippines. Chanthu kept moving west-northwestward and developed to the typhoon (TY) force at 18UTC, 10 June in the South China Sea. Soon after attained the peak strength with maximum sustained wind of 60kt at 06UTC on 12 June, it started to weaken its intensity gradually. After making landfall over Vietnam on 12 June, it changed the direction to northwestward. It weakened into a TD at 06UTC, 13 June, and dissipated on 15 June around the northern part of Thailand.

TY DIANMU (0406)
Dianmu formed as a tropical depression (TD) at 18UTC over the sea near the Caroline Islands on 12 June 2004. Moving northwestward, it developed to a tropical storm (TS) over the same waters at 12UTC, 13 June. Changing the direction from the north to the northwest, Dianmu intensified rapidly into a typhoon (TY) at 18UTC 14 June, and then reached the peak strength with central pressure of 915hPa and maximum sustained wind of 100kt at 00UTC on 16 June. After its recurvature south of Okinawa Island on 19 June, it moved to the northeast with gradually weakening. Soon after making landfall on Shikoku on 21 June, it was downgraded into the severe tropical storm (STS) strength. After entering the Japan Sea on that day, Dianmu weakened to a tropical storm (TS) at 12UTC, 21 June and then transformed into an extratropical cyclone off the western coast of Hokkaido six hours later. It crossed the International Date Line south of the Aleutian Islands on 28 June.

TY MINDULLE (0407)
Mindulle formed as a tropical depression (TD) off south of Saipan Island at 18UTC, 21 June 2004. Moving northwestward, it developed to the tropical storm (TS) intensity northwest of Saipan Island at 06UTC, 23 June. Moving westward and then northwestward, it developed into a typhoon (TY) east of Philippines at 12UTC, 27 June, and further reached the peak strength with central pressure of maximum sustained wind of 95kt on 29 June. Turning sharply from the west to the north off the north coast of Luzon Island, Mindulle moved with weakening, and made a landfall on Taiwan Island on 1 July 2004. After recurving in the East China Sea on 2 July, it was downgraded to a tropical storm (TS) at 00UTC, 3 July. Mindulle was transformed into an extratropical cyclone at 00UTC, 4 June. It moved through the Korea Peninsula and the Japan Sea, and dissipated north of Vladibostok at 00UTC, 6 July.

TY TINGTING (0408)
Tingting formed as a tropical depression (TD) north of the Truk Islands at 00UTC, 25 June 2004. Moving westward, it developed to a tropical storm (TS) at 00UTC, 26 June. It changed the track on the northwest to develop into a severe tropical storm (STS) and a typhoon (TY) over the sea around the Mariana Islands at 00UTC, 27 June, and 06UTC, 28 June, respectively. At 06UTC, 30 June, Tingting reached the peak intensity with maximum sustained wind of 80kt over the waters south of Chichijima Island. It approached Chichijima Island on the northerly course, and then moved toward the northeast with gradually weakening. It was downgraded to a severe tropical storm (STS) and a tropical storm (TS) east of Japan at 12UTC, 2 July, and 18, 3 July, respectively. Tingting was transformed into an extratropical cyclone far east of Japan at 06UTC, 4 July, and dissipated south of the Aleutian Islands at 06UTC, 13 July.

TS KOMPASU (0409)
Kompasu formed as a tropical depression (TD) over the sea far east of Philippine at 06UTC 11 July 2004. Moving westward, it developed into a tropical storm (TS) over the waters northeast of Luzon Island at 00UTC 14 July. Moving in the same direction, it reached its peak intensity with a maximum sustained wind of 45kt around the Straits of Luzon at 12UTC 14 July. Until it reached off the coast of Hong Kong, it maintained almost same intensity. Then it turned to the northwest over the waters southeast of Hong Kong and made landfall at Hong Kong on 16 July. After landing, it weakened into a tropical depression (TD) at 12UTC 16 July and dissipated around the north of Hong Kong on the same day.

TY NAMTHEUN (0410)
Namtheun formed as a tropical depression (TD) on the sea southwest of Minamitorishima Island at 12UTC, 24 July. It moved to the northwest and developed rapidly into a tropical storm (TS) at 00UTC on the following day, a severe tropical storm (STS) twelve hours later and a typhoon (TY) another twelve hours later. Namtheun attained the peak intensity with maximum sustained wind of 85kt east of Chichijima Island at 12UTC, 26 July. Then it turned to the west-northwest and made landfall on Shikoku after 07UTC, 31 July with slowly weakening its strength. After landfall, Namtheun moved through the western Japan and weakened into a STS at 09UTC on that day and a TS another three hours later. Namatheun entered the Japan Sea changing the track abruptly to the north on 1 August. Turning gradually

toward the northeast, it weakened into a TD in the Japan Sea at 00UTC, 2 August, transformed into an extratropical cyclone at 06UTC, 3 August, and dissipated over the waters west of Hokkaido at 00UTC, 4 August.

TS MALOU (0411)
Malou formed as a tropical depression (TD) over the waters southeast of Chichijima Island at 00UTC, 2 August 2004. Advancing to the northwest, it developed into a tropical storm (TS) over the sea south of Honshu at 00UTC, 4 August, and reached the peak intensity with maximum sustained wind of 40kt three hours later. Then it turned to the north and made landfall over the western Japan after 13UTC. Malou weakened into a tropical depression (TD) on the Japan Sea at 18UTC on that day, shortly after crossing the Honshu. It changed the track from the north to the east-northeast, and moved through the northern part of Japan, and dissipated over the waters south of Hokkaido at 18UTC, 6 August.

TY MERANTI (0412)
Meranti formed as a tropical depression (TD) over the sea around the Marshall Islands at 00UTC, 3 August 2004. It moved northward and developed into a tropical storm (TS) over the waters north of Wake Island at 12UTC, 4 August. Changing the track to the northeastward, Meranti deepened quickly to the typhoon (TY) strength at 12UTC, 5 August. After it attained the peak intensity with maximum sustained wind of 75kt at 18UTC, 5 August, it gradually weakened into a severe tropical storm (STS) and a tropical storm (TS) at 00UTC, 7 August and 00UTC, the following day, respectively. Meranti became an extratropical cyclone south of the Aluetian Islands at 06UTC, 9 August, and passed the International Date Line on 13 August.

TY RANANIM (0413)
Rananim formed as a tropical depression (TD) over the sea far east of the Philippines at 00UTC, 6 August 2004. Changing the track from the westward to the northward, it developed into a tropical storm (TS) over the same waters at 12UTC, 8 August. After upgrading to a severe tropical storm (STS) at 00UTC, 9 August, Rananim kept moving to the northwest. It became a typhoon (TY) at 06UTC, 10 August, and further attained the peak intensity with maximum sustained wind of 80kt at 12UTC, 11 August when it approached Miyakojima Island. It made landfall on China on 12 August keeping almost the same intensity. Turning toward the west, it weakened into a TD at 00UTC, 13 August and dissipated over the central part of China at 12UTC, 15 August.

TS MARAKAS (0414)
Marakas formed as a tropical depression (TD) over the waters west of Minamitorishima Island at 00UTC, 9 August 2004. Moving the eastward and later northeastward, it became a tropical storm (TS) over the sea northeast of Minamitorishima Island at 00UTC, 11 August. After attained the peak intensity of 45kt at 18UTC, 11 August, Marakas kept almost the same intensity. Continuing on a northeast track, it weakened into a TD and crossed the International Date Line on 18UTC, 13 August and 00UTC, 14 August, respectively.

TY MEGI (0415)
Megi formed as a tropical depression (TD) over the sea west of the Mariana Islands at 00UTC, 14 August. Moving to the west and then gradually to the northwest, it became a tropical storm (TS) over the waters east of the Philippines at 06UTC, 16 August. It was upgraded to a severe tropical storm (STS) on 17 August when it approached Okinawa Island. Megi developed into a typhoon (TY) and attained the peak strength with maximum sustained wind of 65kt during its recurvature on 18 August. Keeping the same intensity, it went through the Korea Strait and moved in the Japan Sea on northeasterly course. Megi made landfall on the northern part of Japan on 19 August and then transformed into an extratropical cyclone over the sea southeast of Hokkaido at 09UTC, 20 August. It finally dissipated over the waters south of the Aleutians at 12 UTC, 22 August.

TY CHABA (0416)
Chaba formed as a tropical depression (TD) over the sea around the Marshall Islands at

06UTC, 18 August. It developed into a tropical storm (TS), moving in the westerly direction, over the same sea at 12UTC, 19 August. Holding the track to the west, it was upgraded into a severe tropical storm (STS) over waters south of Minamitorishima Island at 00UTC, 20 August and then a typhoon (TY) east of the Mariana Islands at 18UTC on the following day. Turning gradually to the northwest, Chaba reached the peak strength with central pressure of 910hPa and maximum sustained wind of 110kt over the sea west of the Mariana Islands at 18UTC, 23 August. After the recurvature over the sea west of the Nansei Islands, it made landfall on Kyushu, went northeastwards through the western part of Japan, and entered the Japan Sea on 30 August. Keeping the northeasterly track, it made landfall on Hokkaido after 03UTC on the following day. After transforming into an extratropical cyclone in the northeastern part of Hokkaido at 06UTC on that day, it entered the Sea of Okhotsk on the following day, and then dissipated in the Sea at 18UTC, 5 September, respectively.

TY AERE (0417)

Aere formed as a tropical depression (TD) over the sea around the Caroline Islands at 00UTC, 18 August. It moved northwestwards and became a tropical storm (TS) over the waters east of the Philippines at 00UTC, 20 August. Keeping the track to the northwest, it was upgraded to a severe tropical storm (STS) over the same area at 00UTC, 21 August and then a typhoon (TY) over the sea south of Okinawa Island at 12UTC, 22 August. Aere reached the peak intensity with maximum sustained wind of 80kt near Ishigakijima Island at 00UTC, 24 August. After passing off the north coast of Taiwan Island, it turned to the west-southwest. Aere made landfall on the southern part of China on 25 August and weakened rapidly into a TD at 06UTC, 26 August. Keeping the track to the west-southwest, it moved along the coast of the southern China, and dissipated in the Gulf of Tongking at 00UTC, 31 August.

TY SONGDA (0418)

Songda formed as a tropical depression (TD) over the sea around the Marshall Islands at 06UTC, 26 August. It moved in the westerly direction, and developed a tropical storm (TS) at 00UTC, 28 August over the same waters. Changing the track to the west-northwest, it developed into a severe tropical storm (STS) at 12UTC, 28 August and then a typhoon (TY) on the sea east of Saipan Island at 12UTC, 30 August. Songda kept the track toward west-northwest and attained the strength with the sustained wind of 90kt over the waters northeast of Saipan Island at 06UTC, the following day. Though it weakened slightly over the sea north of Okinotorishima Island, it developed again to reach the peak intensity with maximum sustained wind of 95kt southwest of Okinawa Island at 06UTC, 4 September. After going through Okinawa Island, it recurved to the northeast in the East China Sea with weakening its intensity on 6 September. Songda made landfall on Kyushu after 00UTC, the following day and then enter the Japan Sea keeping the track to the northeast. Moving close to the western coast of Hokkaido, it transformed into an extratropical cyclone over La Pérouse Strait at 00UTC, 8 September. Changing the track gradually to the east, it passed Kamchatka Peninsula and then crossed the International Date Line on 10 September.

STS SARIKA (0419)

Sarika formed as a tropical depression (TD) over the sea northwest of the Marshall Islands at 18UTC, 3 September. Moving to the west-northwest, it developed into a tropical storm (TS) east of Saipan Island at 18UTC, 4 September and then into a severe tropical storm (STS) with the peak intensity of maximum sustained wind of 55kt over the sea northwest of Saipan Island at 12UTC, the following day. After changing the track to the north over the sea east of Okinotorishima Island on 6 September, it weakened into a TS and a TD over the waters southwest of Iwojima Island at 00UTC and 06UTC, 7 September, respectively. It dissipated over the waters south of Honshu at 06UTC, 9 September.

TS HAIMA (0420)

Haima formed as a tropical depression (TD) over Taiwan Strait at 18UTC, 10 September. It moved to the east and developed into a tropical storm (TS) around the southwest coast of Taiwan Island at 00UTC, 11 September. After it turned to the north off the southeast coast of Taiwan Island, it reached the peak intensity with maximum sustained wind of 40kt off the

northeast coast of Taiwan Island at 18UTC on that day. Changing the track to the northwest, Haima weakened into a TD around the coast south of Shanghai at 06UTC, 13 September. Moving to the north, it transformed into an extratropical cyclone west of Shanghai at 18UTC on that day. After it turned to the east around upper waters of the Amur on 16 September, it dissipated north of Khabarovsk at 12UTC, 19 September.

TY MEARI (0421)

Meari formed as a tropical depression (TD) over the sea west of Guam at 00UTC, 20 September. Moving westwards, it developed into a tropical storm (TS) at 18UTC, 20 September, severe tropical storm (STS) at 18UTC, 21 September, and typhoon (TY) over the sea northwest of Guam at 18UTC, 22 September. Keeping the direction to the northwest, it attained the peak strength with maximum sustained wind of 90kt over the sea southeast of Okinawa Island at 06UTC, 24 September. It approached Miyakojima Island and then turned abruptly toward the northeast over the waters north of Miyakojima Island on 26 September. Meari made landfall on Kyushu before 00UTC, 29 September. Then it moved northeastwards over Kyushu, Shikoku, and Honshu on that day. It weakened into a TS over Honshu at 15UTC, 29 September, and transformed into an extratropical cyclone around the northern part of Honshu at 00UTC, 30 September. After it left Honshu, it moved southeastwards and turned abruptly toward the south around 00UTC, 2 October. It dissipated over the sea east of Japan at 00UTC, 3 October.

APPENDIX XIV

PROPOSED TERMS OF REFERENCE (TOR) OF THE COMMITTEE AND ITS WORKING GROUPS AND RULES OF PROCEDURE OF THE TYPHOON COMMITTEE

1. Objective

This document presents the review, evaluation, and proposals/options for the Terms of Reference (TORs) for Typhoon Committee (TC), TC Chairperson, TC Vice-Chairperson, TC Secretary, TC Secretariat, TC Advisory Working Group (AWG), Working Groups (WGs) on Meteorology, Hydrology, and Disaster Prevention and Preparedness (DPP), and Typhoon Research Coordinating Group (TRCG) and also a review of ***Statute of the Typhoon Committee*** **and** ***Rules of Procedure of the Typhoon Committee.***

2. Introduction/Background

The Interim Working Group (IWG) of the Regional Cooperation Programme Implementation Plan (RCPIP) submitted a preliminary proposal (hereafter referred to as the IWG proposal) on these subjects, as detailed in the Report of the IWG RCPIP to the 36th session of Typhoon Committee. This paper is a further study into the proposed TORs for the positions and working groups, and also the statute and procedures identified in paragraph 1 above.

3. Discussions.

3.1 Typhoon Committee (TC). The TC serves as the assembly of all participating members and it is the supreme body of the TC. Some of the primary functions of the Committee are to promote and to co-ordinate the planning and implementation of measures required for minimizing typhoon damage in the ESCAP region.

3.2 TC Chairperson and Vice-Chairperson. The TC shall, at its annual meeting, elect from its representatives a Chairperson and a Vice-Chairman, who shall hold office until their successors are elected. They shall be eligible for re-election. Some of the primary functions of the Chairperson, or in his place the Vice-Chairperson, are to preside over the Sessions of the Committee; direct the resource mobilization programme; approve disbursement of funds; consider and approve the TC work plan as submitted by TCS; and provide guidance to TCS, if necessary, on implementation of the work plan.

3.3 TC Secretary. The host Member of the Typhoon Committee Secretariat will nominate a TC Secretary and the Typhoon Committee will confirm by a majority of the voting Members. The term of office of the Secretary of the Typhoon Committee shall be for four years from the end of the session at which they were elected to the end of the session closest to four years after their election. The Secretary shall be eligible for one consecutive re-election if nominated by the host Member. In the event of the post of Secretary becoming vacant in the interval between two sessions of the Typhoon Committee, the host Member will nominate an Acting Secretary and the TC Chairperson is empowered to approve the Acting Secretary's nomination whose term of office shall not extend beyond the next session of the Typhoon Committee. The Secretary shall be seconded by the host Member but shall receive an honorarium from the TCTF as determined by the Committee. Some of the primary functions of the Secretary is to direct and supervise the work of the Secretariat, including the preparation of the annual TC work plan; promote maximum participation of Members of the Typhoon Committee in the implementation of the decisions of the Committee; maintain accounts of expenditures; and prepare and submit a draft rolling 4-year strategic plan, a draft annual budget, a report of actions

and activities taken by TCS, integrated financial report of the utilization of Trust Fund, and detailed expenditures (statement of accounts) of the Secretariat, since the last session to the TC.

3.4 TC Secretariat. The Typhoon Committee Secretariat is the Secretariat for the TC which is mandated to logistically support the Committee in its day-to-day work. Its main function is to advise and assist Members on the implementation of improvements needed in the mitigation of typhoon damage. Other functions include such items as serve as the administrative, documentary, and information centre of the Typhoon Committee; implement the TC decisions; coordinate the administration of the TC's budgets; monitor the implementation of the annual TC work plan; prepare and distribute official publications of the Typhoon Committee, including TC Annual Reports and Newsletters; and management of the TCS website. . The Secretariat personnel shall be seconded by the Host Member but shall receive an honorarium from the TCTF as determined by the Committee.

3.5 TC Advisory Working Group (AWG). As stated in the **Statute of the Typhoon Committee**, the Committee shall be assisted, when necessary, by an AWG consisting of qualified experts. It is recommended that an AWG be formed to act as a "steering group and think tank" as directed by the Typhoon Committee, coordinate the various components (Meteorology, Hydrology, and DPP) for the TC, offer advice and assistance as requested by the TC and TC Chairperson, provide assistance with budgeting issues if needed, and perform other duties as requested by the TC and the TC Chairperson.

3.6 Working Groups on Meteorology and DPP. The WG ROSTY noted the very successful activities and achievements of the Working Group on Hydrology (WGH) and the Typhoon Research Coordinating Group (TRCG) and therefore recommends two additional working groups, one on Meteorology and one on DPP. Because TRCG has been addressing research and training issues and that research and training have been incorporated into the TC's 3 main components, it was not recommended to have a separate WG on Training. It was believed that the WGs would assist in facilitating effective implementation of programmes and activities. Each group will be headed by a Chairperson and a Vice-Chairperson appointed by the TC, and except for the AWG, appointed representatives and representatives of other concerned Members. Much of the work of the WGs would be done by emails or other communication methods. If possible without financial support, the WGs members should meet during the pre-session period.

3.7 ***Statute of the Typhoon Committee*** and ***Rules of Procedure of the Typhoon Committee.*** The WG ROSTY reviewed the ***Statute of the Typhoon Committee.*** The WG found no substantial changes were required. Any changes identified were minor in nature, and because of the difficulty associated with changing this Statute (approval of UN legal department, ESCAP, WMO, and all Governments), the WG ROSTY recommends that the Typhoon Committee not change the ***Statute of the Typhoon Committee***.

The ***Statute of the Typhoon Committee*** states in Article 7, "The Committee shall adopt its own rules of procedures." Therefore any changes recommended for the ***Rules*** can be approved by the Typhoon Committee. Thus, WG ROSTY recommends several changes as highlighted in the Annex I. One of changes proposed is to add another rule to the ***Rules of Procedure of the Typhoon Committee*** stating, "In implementing Article 3 of the Statute, the Typhoon Committee established a TC Secretary and a TC Secretariat." The Typhoon Committee is invited to review, discuss, and act upon on the proposed ***Rules of Procedure of the Typhoon Committee*** changes.

4. Detailed Options/Proposals. The WG ROSTY proposals/options are shown in the following Annexes and are based upon ***Statute of the Typhoon Committee*** and ***Rules of Procedure of the Typhoon Committee*** and other guidance***:***

4.1 Annex A Proposed TORs for Typhoon Committee
4.2 Annex B Proposed TORs for Chairperson
4.3 Annex C Proposed TORs for Vice-Chairperson
4.4 Annex D Proposed TORs for Secretary
4.5 Annex E Proposed TORs for Secretariat
4.6 Annex F Proposed TORs for AWG
4.7 Annex G Proposed TORs for WGs on Meteorology, Hydrology, and DPP and Typhoon Research Coordinating Group
4.8 Annex H Proposed TORs for WG Chairpersons
4.9 Annex I Proposed Changes to the ***Rules of Procedure of the Typhoon Committee***.

ANNEX A

Proposed Terms of Reference of the Typhoon Committee

The Committee shall:

1. Serve as the assembly of all members and it is the supreme body of the TC;
2. Consider and approve its internal organization and regulations relating to its operation;
3. Elect Chairperson and Vice-Chairperson of the Committee;
4. Recommend to the participating Members plans and measures for improvements in minimizing typhoon damage;
5. Consider and approve the TCS's draft Work Plan;
6. Consider and approve programmes, activities and budget for implementation in the subsequent one year period;
7. Coordinate resource mobilization activities and technical support for its plans and programmes;
8. Prepare and submit, at the request and on behalf of the participating Members, request for technical, financial, and other assistance offered under the United Nations Development Programme and by other organizations and contributors;
9. Review regularly the progress made in the various fields of typhoon damage prevention;
10. Establish working groups or ad-hoc panels and appoint Chairpersons and Vice Chairpersons of the WGs or panels;
11. Review annual reports from Members and review and approve the annual report from TCS;
12. Promote the establishment of programs and facilities for training personnel from Members of the region in typhoon forecasting and warning, flood hydrology and control within the region and arrange for training outside the region, as necessary;
13. Promote, prepare, and submit to participating Members and interested organizations plans for co-ordination of research programmes and activities concerning typhoons;
14. Determine the location of the secretariat;
15. Confirm nomination of the Secretary of TC; and
16. To promote international cooperation in the three components of Meteorology, Hydrology, and Disaster Prevention and Preparedness. Training and Research are incorporated as part of each of these three.

In carrying out these functions, the Committee will ensure that the plans/projects adopted by the appropriate bodies of the WMO as part of the World Weather Watch Programme, are fully respected at all times.

ANNEX B

Proposed Terms of Reference of Chairperson of the TC

The Chairperson shall:

1. Preside over the sessions of the Typhoon Committee.
2. Consider the work plan submitted by TCS and recommend approval, if appropriate, to the TC at its next meeting.
3. Provide guidance to TCS, if necessary, on implementation of the work plan, in consultation with the Vice-Chairperson and other guidance to the TCS as appropriate.
4. Direct the resource mobilization programme and accept grants on behalf of the Committee in consultation with TCS and parties concerned.
5. Approve disbursement of funds for the TCS.
6. Carry out such specific duties as are prescribed by the decisions of the Typhoon Committee and by the ***Statute of the Typhoon Committee*** and ***Rules of Procedure of the Typhoon Committee.***
7. Decide on behalf of the Typhoon Committee, after consultation with the Vice Chairperson, TCS and concerned parties, in accordance with the ***Statute of the Typhoon Committee*** and ***Rules of Procedure of the Typhoon Committee***, on any recommendations, when the Chairperson considers that such actions, in the interest of the Committee, cannot be deferred until the next session of the Typhoon Committee.
8. Report to the Typhoon Committee actions and activities taken by the Chairperson in support of the Typhoon Committee's decisions since the last session.
9. Represent or appoint representative(s) on his/her behalf to represent the TC at external functions, pending on availability of resources and approval of the Typhoon Committee.
10. Decide the venue and time of meetings in consultation with the Secretariat, hosting Member and parties concerned.
11. Maintain files of his/her official correspondence as Chairperson of the Typhoon Committee and send copies of this correspondence to the Secretary of the Typhoon Committee.

ANNEX C

Proposed Terms of Reference of Vice Chairperson of the TC

The Vice Chairperson shall:

1. Serve as the Acting Chairperson for a period not to exceeding the remainder of the term, with the same powers and duties as the Chairperson, if the Chairperson of the Typhoon Committee is not capable to carry out the functions of that office.
2. Assist the Chairperson in providing guidance to TCS, if necessary, on implementation of the TC work plan.
3. Perform other duties as directed by the Chairperson and the Typhoon Committee.

ANNEX D

Proposed Terms of Reference of the Secretary of the Typhoon Committee (TC)

In carrying out the duties specified in these Terms of Reference, the TC Secretary shall comply with any directives issued by the Typhoon Committee or guidance by the Chairperson of the Typhoon Committee. In addition to their duties under the ***Statute of the Typhoon Committee*** and ***Rules of Procedure of the Typhoon Committee***, the Secretary shall:

1. Direct and supervise the work of the Secretariat.
2. Promote maximum participation of Members of the Typhoon Committee in the implementation of the decisions of the Committee.
3. Prepare and submit to the plenary session a draft annual work plan of the TC, in consultation with AWG, WGs of the 3 components, and TRCG.
4. Prepare and submit to the plenary session a draft one year budget under the guidance and direction of the TC Chairperson and maintain accounts of expenditures.
5. Prepare and submit to the plenary session a report of actions and activities taken by TCS and integrated financial report of the utilization of Trust Fund and detailed expenditures (statement of accounts) of the Secretariat, since the last session under the guidance and direction of the TC Chairperson.
6. Maintain liaison and collaboration with the TC Chairperson, TC Vice-Chairperson, Chairpersons of the 3 WGs and TRCG, Members of the Committee, and with other international organizations.
7. Request and arrange for the nomination of experts by TC Members to take part in TC Working Groups and TRCG or attend meetings supported by the TC Trust Fund.
8. Designate a representative, as necessary and funds permit, to attend Working Groups and TRCG meetings.
9. Maintain registers, reports and records of the policies and decisions of the TC Sessions and AWGs; and
10. Preserve the TC's collection of heritable material.

ANNEX E

Proposed Terms of Reference of Secretariat of the Typhoon Committee -

The specific functions of the Secretariat shall be:

1. To serve as the administrative, documentary, and information centre of the Typhoon Committee;
2. To implement the TC decisions and coordinate and monitor the implementation of the TC work plan;
3. To maintain close contact with the Members by correspondence to support Members on all matters relating to implementation of recommended programmes.
4. To assist the Members in the preparation of applications for technical, financial, and other assistance for typhoon damage mitigation as directed by the Typhoon Committee Session or the Advisory Working Group;
5. To organize and perform secretarial duties at Sessions of the Typhoon Committee, the meetings of the Advisory Working Group, and the meetings of the designated working groups and TRCG, as fund permitted;
6. To manage the operation and promote the use of the TC website.
7. To enhance visibility of the Typhoon Committee in cooperation with Members;
8. To prepare the annotated provisional agenda in consultation with parties concerned;
9. To undertake surveys, complies statistics, and prepares various reports and technical notes for circulation to Members as directed by the Typhoon Committee Session, the Chairperson, or the Advisory Working Group.
10. To prepare and distribute official publications of the Typhoon Committee, including TC Annual Reports and Newsletters;
11. To maintain records of the Members' profiles; and
12. To maintain files of correspondence of the Secretariat.

ANNEX F

Proposed Terms of Reference of Advisory Working Group

Guidance

In establishment of the Advisory Working Group, the Typhoon Committee provided the following guidance for their assistance in planning and implementation of measures required for mitigation of typhoon damage.

- To improve the efficiency and effectiveness of the Typhoon Committee, the TCS, and TCS Secretary.
- To promote international cooperation in the three components of Meteorology, Hydrology, and Disaster Prevention and Preparedness. Training and Research are incorporated as part of each of these three.
- To promote the use of advanced information technology and resource sharing among Members of the Typhoon Committee.
- To facilitate the implementation of the RCPIP.
- To enhance resources mobilization.

Terms of Reference

The Advisory Working Group (AWG) will assist the Chairperson of the Typhoon Committee and the TC Secretary to coordinate the implementation of TC decisions. The AWG will also act as a "Think Tank/Steering Group" function to advise and offer options, as required, to the Typhoon Committee Members, the Typhoon Committee, the TC Chairperson, TC Secretary, and the TCS.

- To provide options and proposals to enhance the effectiveness of the Typhoon Committee, TC Chairperson, the TCS Secretary, and the TCS.
- To provide overall options for the framework of priorities for activities of the Typhoon Committee.
- To review the implementation and annual account of the approved budget, provided by the TC Secretariat.
- To assist in the consideration and coordination of prioritize project proposals and their budgets provided by the three components of TC. Training and Research are incorporated as part of each of these three.
- To provide options and assistance on mechanisms aimed at improving the implementation of the RCPIP.
- To provide options and assistance on collaborative activities among the three components of the RCPIP and priority options to the Typhoon Committee.
- To assist in mobilizing resources to achieve the goals and objectives as determined by the Typhoon Committee in the RCPIP at its Thirty-Fifth Session.
- To monitor the progress of the RCPIP objectives and goals.
- To review and provide options and assistance to further enhance activities and projects under the three components of RCPIP.
- Coordinate and harmonise activities among WGs and TRCG.
- Monitor and ensure that the projects/activities authorized by the TC are being accomplished in a timely manner.
- Provide feedback to the TC regarding the implementation and progress of activities.

Members

- Chairperson as appointed by the Typhoon Committee
- Vice-Chairperson as appointed by the Typhoon Committee

- Chairpersons of the three working groups (meteorology, hydrology, and DPP) and TRCG as core members, and
- Representatives of WMO and ESCAP (as ex-officio members)

The term of service on the AWG is 1 year subject to extension authorized by the Committee.

Operational modalities

AWG would conduct most of its work, coordination and communication through correspondence including e-mail, and would be supported by regular reporting from the TC Secretariat. As described in the above-proposed Terms of Reference of AWG, considerable amount of important issues and projects for TC and its Members will be discussed and accomplished by AWG. To enhance the efficiency of the operation of TC, it is recommended that an AWG meeting be held at least every year. At the request of the TC or TC Chairperson, the AWG will investigate and review issues, make recommendations and proposals, and if approved by the TC, assist in implementing approved projects, activities, etc.

ANNEX G

Proposed Terms of Reference of Working Groups on Meteorology, Hydrology, and DPP and the Typhoon Research Coordinating Group

1. PROPOSED TERMS OF REFERENCE OF THE WORKING GROUP ON METEOROLOGY

In order to coordinate efforts on the implementation of various activities under the Meteorological Component with the aim to better support the socio-economic development process in the Typhoon Committee Area and to help accomplish the meteorological related goals and objectives in the RCPIP, the Typhoon Committee has established the Working Group on Meteorology (WGM) with the following Terms of Reference and operational modalities.

Terms of Reference

The WGM will promote cooperation among the Members in the implementation of activities under the Meteorological 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 three components. (Training and Research are incorporated as part of these three.) Towards this end, the WGM is expected to advise and assist the Committee in:

- Identifying priority issues and areas of cooperation in the Meteorological Component;
- Promoting and facilitating the exchange of experiences and knowledge on latest developments and techniques related to the above issues and areas;
- Coordinating and implement priority activities and programmes of the Committee aiming at strengthening capacity of the Members in meteorology;
- Mobilizing resources to carry out priority activities of the Committee related to the meteorological Component;
- Reporting overall progress in the implementation of the meteorology component of the RCPIP; and
- Recommending to the Committee priority areas, programmes and activities for cooperation in meteorological research by related experts of the Members.

Membership

The WGM will consist of the following members:

- Chairperson appointed by the Committee
- Vice Chairperson appointed by the Committee
- Members' representatives as appointed by the Committee

The Committee also requests other interested Members to take part in the working group and invite ESCAP and WMO representative to be involved in the work of this Working Group. The term of service on the WGM is 1 year subject to extension authorized by the Committee.

Operation modalities

In view of the limited financial resources of the TC Trust Fund, the WGM is expected to perform its work through email and other means. If possible without financial support, the WG members should meet during the pre-session period before the TC Session.

Reporting requirements

The Chairperson of the WGM is required to submit an annual report on meteorological activities to implement RCPIP meteorology priority goals through the TCS to the TC Chairperson and the TC Members for their consideration under the framework of the Committee. This report will include recommendations related to priority activities to be undertaken in the coming years.

2. TERMS OF REFERENCE OF THE WORKING GROUP ON HYDROLOGY

In order to coordinate efforts on the implementation of various activities under the Hydrological Component with the aim to better support the socio-economic development process in the Typhoon Committee Area and to help accomplish the hydrological related goals and objectives in the RCPIP, 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 three 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:

- Chairperson appointed by the Committee
- Vice Chairperson appointed by the Committee
- Members' representatives as appointed by the Committee

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 Chairperson of the WGH is required to submit an annual report on hydrological activities to implement RCPIP hydrology priority goals through the TCS to the TC Chairperson and the TC Members for their consideration under the framework of the Committee. This report will include recommendations related to priority activities to be undertaken in the coming years.

3. PROPOSED TERMS OF REFERENCE OF THE WORKING GROUP ON DPP

In order to coordinate efforts on the implementation of various activities under the Disaster Prevention and Preparedness Component to better support the socio-economic development process in the Typhoon Committee Area and to help accomplish the DPP related goals and objectives in the RCPIP, the Typhoon Committee has established the Working Group on Disaster Prevention and Preparedness (WGDPP) with the following Terms of Reference and operational modalities.

Terms of Reference

The WGDPP will promote cooperation among the Members in the implementation of activities under the Disaster Prevention and Preparedness Component of the Committee's RCPIP with the aim to support the socio-economic development process and enhance cooperation among the Members in all three components. Towards this end, the WGDPP is expected to advise and assist the Committee in:

- Identifying priority issues and areas of cooperation in the Disaster Prevention and Preparedness Component;
- Promoting and facilitating the exchange of experiences and knowledge on latest developments and techniques related to the above issues and areas;
- Coordinating and implement priority activities and programmes of the Committee aiming at strengthening capacity of the Members in Disaster Prevention and Preparedness ;
- Mobilizing resources to carry out priority activities of the Committee related to the Disaster Prevention and Preparedness Component;
- Reporting overall progress in the implementation of the DPP component of the RCPIP; and
- Recommending to the Committee priority areas, programmes and activities for cooperation in Disaster Prevention and Preparedness research by related experts of the Members.

Membership

The WGDPP will consist of the following members:

- Chairperson appointed by the Committee
- Vice Chairperson appointed by the Committee
- Members' representatives as appointed by the Committee

The Committee also requests other interested Members to take part in the working group and invite ESCAP and WMO representative to be involved in the work of this Working Group. The term of service on the WGDPP is 1 year subject to extension authorized by the Committee.

Operation modalities

In view of the limited financial resources of the TC Trust Fund, the WGDPP is expected to perform its work through email and other means. If possible without financial support, the WG members should meet during the pre-session period before the TC Session.

Reporting requirements

The Chairperson of the WGDPP is required to submit an annual report on Disaster Prevention and Preparedness activities to implement RCPIP DPP priority goals through the TCS to the TC Chairperson and the TC Members for their consideration under the framework of the Committee. This report will include recommendations related to priority activities to be undertaken in the coming years.

4. TERMS OF REFERENCE OF THE TYPOON RESEARCH COORDINATING GROUP

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 of the Chairpersons of the TC Working Groups can take part in the deliberations of the TRCG in their ex-officio capacity. The term of 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 Chairmen. If possible without financial support, the TRCG members should meet during the pre-session period before the TC Session.

Reporting requirements

The Chairperson of the TRCG is required to submit an annual report on research and training activities to implement RCPIP three components priority goals through the TCS to the TC Chairperson and the TC Members for their consideration under the framework of the Committee. This report will include recommendations related to priority activities to be undertaken in the coming years.

ANNEX H

Proposed Terms of Reference of Chairpersons of the Three Components Working Groups and Typhoon Research Coordinating Group

The Chairpersons will:

- Under the guidance and the TORs approved by the Typhoon Committee, will formulate the WG's/TRCG's work plan, strategies to accomplish the work plan, the activities of the WG/TRCG, and coordination of meetings.
- Oversee the implementation of the WG's/TRCG's programmes and activities approved by the Typhoon Committee.
- Act as an overall coordination function based on inputs provided from Members and as directed by the Typhoon Committee.
- Report to the Committee the progress carried out under the framework of priorities and cooperation undertaken by the WG/TRCG.
- Will seek inputs/requests in close consultation with the Members' focal points concerned on the framework of priorities.

ANNEX I

Proposed Updated *Rules of Procedure of the Typhoon Committee.*
(Changes are noted in bold, italic)

RULE 1

The Committee shall hold at least one session annually***.*** The venues and dates of its sessions shall be decided by the Committee.

RULE 2

The ***Typhoon Committee Secretary*** shall, in consultation with the ***Executive Secretary of ESCAP***, Secretary-General of WMO, and the Chairman of the Committee, issue a notice convening each session of the Committee, together with copies of the provisional agenda ***at least three months*** before the commencement of the session.

RULE 3

The Typhoon Committee Secretary and TC Secretariat with guidance by the Chairperson of the Typhoon Committee shall, ***in consultation with representatives of the Executive Secretary of ESCAP and Secretary-General of WMO*** provide the necessary servicing of the Committee's meeting.

RULE 4

All meetings shall be held in private unless the Committee shall decide otherwise.

RULE 5

English shall be the working ***language*** of the Committee.

RULE 6

The Committee shall ***at each Session*** elect from its representatives a ***Chairperson and Vice-Chairperson***, who shall hold office until their successors are elected. They shall be eligible for re-election.

RULE 7

A simple majority ***of the Members*** of the Committee shall constitute a quorum.

RULE 8

Decisions of the Committee shall be made by a majority of the ***Members*** present and voting.

RULE 9

In the event of any matter which has not been foreseen by the present Rules, the pertinent rules of the United Nations Economic and Social Commission for Asia and the Pacific shall be applied.

RULE 10

In implementing Article 3 of the Statute of the Typhoon Committee, the Typhoon Committee established a TC Secretary and a TC Secretariat.

APPENDIX XV

PROCEDURES IN PREPARATION OF STRATEGIC PLAN AND ANNUAL WORK PLAN

1. Objectives

This document presents:

a. The review, evaluation and proposals/options for frequency of Typhoon Committee sessions;
b. Development of a strategic plan and an annual work plan (hereafter referred to as the Strategic Plan and Annual Work Plan respectively) jointly by the Advisory Working Group (AWG) and TCS, approved by the Typhoon Committee for guiding Members in accomplishing the goals and objectives of the RCPIP (Regional Cooperation Programme Implementation Plan) and for guiding the TCS in providing support for Members to achieve the RCPIP goals and objectives; and
c. This document presents the review, evaluation and proposals/options for developing a more effective method to seek and obtain feedback/input from and among TC Members.

2. Background

The Interim Working Group (IWG) of RCPIP had submitted a preliminary proposal on the frequency of the Typhoon Committee sessions and a Revised RCPIP to the 36th Session of TC (Annexes I and II, respectively, of the Report of the IWG on the Regional Cooperation Programme Implementation Plan). Building upon the IWG proposal and as requested by the Typhoon Committee, this paper presents a further study into the frequency of the Typhoon Committee sessions, the preparation of a Strategic Plan and an Annual Work Plan for Members' consideration; and proposals/options for developing a more effective method to seek and obtain feedback/input from and among TC Members.

3. Discussion and Options/Proposals

3.1 **Frequency of Typhoon Committee Sessions.** At the Typhoon Committee's 36th session, the Interim Working Group (IWG) on the Regional Cooperative Programme Implementation Plan (RCPIP) of TC submitted a preliminary proposal to change the frequency of the TC sessions to every two years, instead of yearly. Each session would alternate years with an AWG meeting. The Typhoon Committee requested further review and evaluation of the IWG's proposal and the submission of a more detailed proposal to the 37th session.

The benefits of biannual sessions are:

a. Allow the Members more time to work on and implement RCPIP goals and objectives between Sessions and thus have more significant results to report.
b. Reduce the cost of the sessions by meeting every other year rather than yearly.
c. Increased efficiencies (introduced at the 36th session) have allowed more time at the sessions to focus on important issues before the TC.
d. Similar to the WMO Congress and Executive Council alignment.

The benefits of yearly sessions:

a. Provides Members the opportunity of exchanging their experiences and

possible problems sooner, particularly on recent significant events/disasters.

b. Facilitate more immediate adjustments to programmes and activities and to take any required decisions.
c. Update the committee more frequently on Members' accomplishments, goals, and objectives for the RCPIP.
d. Create more positive effects from frequent sessions to solve and deal with various matters affecting or facing Members.
e. Provide more frequent opportunities for Members to get benefits from each other.
f. Easier to get funding to attend Typhoon Committee sessions each year rather than every other year for many Members.
g. Provides an opportunity for Members to review the budget more frequently and to monitor contributions to the Trust Fund.

Based upon the benefits identified for the yearly sessions, the WG ROSTY recommends that the Typhoon Committee continue to meet yearly.

3.2 **Strategic Plan.** The Revised RCPIP prepared by IWG has identified the direction and destination for the TC in the near and longer terms. It covers Members' goals, objectives, target dates of completion, and indications of performance measures for each of the technical components. Thus, it is proposed that the RCPIP be reformatted to form a Strategic Plan to serve as the roadmap for future Typhoon Committee activities. It is also proposed that the draft Strategic Plan be prepared jointly by AWG and TCS based on the revised RCPIP for approval by the 38th Session of TC.

As priorities and specific needs vary among Members, the TCS and AWG should regularly conduct surveys to gauge the current status and needs of Members in different components for the purpose of prioritization (see Annex A for recommended prioritization criteria) and updating the Strategic Plan (RCPIP). The Strategic Plan should be reviewed regularly and/or as deemed necessary by the AWG. Annex B is the proposed schedule for the development of the Strategic Plan and the Annual Work Plan.

3.3 **Annual Work Plan.** It is proposed that the AWG and TCS jointly develop an Annual Work Plan in close consultation with TC Members and international organizations to be submitted for review and, if appropriate, approval by the TC Session. This Work Plan can be prepared to provide detail concrete measures/actions to assist the Members to meet the established goals and objectives in the Strategic Plan (RCPIP)

Success of the plan depends critically on active participation of TC Members. Members are encouraged to own the plan and therefore should be involved from the very beginning of the planning process. In this respect, the draft Annual Work Plan should be circulated to Members for comment at least 3 months before the TC Session with comments due at least 60 days before the session. The final draft plan which should address Members' comments, views, and concerns as far as practicable, should be send to the Members at least 30 days prior to the Session. The Typhoon Committee will then be invited to review, and if appropriate, to approve the
Annual Work Plan (see Annex B for timeline).

3.4 **Seeking and Obtaining Feedback/Input.**

a. For the proposals recommended below to achieve success, the WG ROSTY strongly believes that the Members must commit to the implementation and monitoring of a system to provide requested feedback/input. The Members are

also invited to consider a process for the Typhoon Committee where Members or TC Chairperson will help in reminding and helping to obtain the requested feedback/input.

b. The TCS, Working Groups, TRCG, and Members currently receive very little feedback or input on documents, questionnaires, requests for information, or any other items sent to Members for responses. The WG ROSTY proposes that each Member appoint one specific person for each the 3 components of meteorology, hydrology, and DPP~~,~~ and TRCG (research/training) for receiving, distributing, seeking comments/feedback, and forwarding information back to the TCS, Working Groups, TRCG, and other Members. Then all requests for information will be sent to the appropriate specific person for the three components and TRCG named above with an informational copy to the Permanent Representative. It is requested that each Member create a monitoring system to ensure timely responses.

c. These requests for information and inputs are done to facilitate communications among TC Members, the AWG, the TCS, the Working Groups for the three components, and the TRCG and are often required to evaluate the status and priority of activities identified in the RCPIP. Therefore, the responses to the request for information and input are vitally important to ensure all Members' requirements and ideas are included as the goals and objectives in the RCPIP are completed.

d. To facilitate Members in providing comments and feedback, the design of the questionnaires should be simple as well as easy-to-understand and reply. Guidelines to assist Members in filling the questionnaires should be included. Some examples and options for Members to choose and decide upon should be incorporated as far as possible. In addition, project proposals, plans, studies and reports will also be made available at the TCS website for Members, Advisory Working Group, Working Groups for the three components and the Typhoon Research Coordinating Group to enable easy access to the material for review and monitoring.

e. There is also a need to improve and enhance TCS website by including items in Annex C.

Annex A – Proposed Prioritization Criteria

To facilitate prioritization of projects/activities, the following criteria are proposed:

1. Proposed scientific or technical content be:

    a. Scientifically rigorous,
    b. Applicable to many Members, and
    c. Contribute to capacity building of Members.

2. Relevance to improving analysis and forecast of tropical cyclones:

    a. Substantially address goals and objectives of the Strategic Plan,
    b. Respond to the needs of Members, and
    c. Have direct impact on TC Members' operational mission of protection of life and property.

3. Well-defined objectives and targets:

    a. Have clearly identifiable goals/objectives and milestones for Members and
    b. For TCS to conduct periodic assessment with appropriate measures/indicators for performance monitoring and documentation of progress, and

4. Cost and value

    a. Address the stated goals and objectives in a cost-effective way in terms of time and money, and specify the required TCS support,
    b. Provide value-added products to improve analysis, forecast of tropical cyclones and decision support in forecasting operation. Such activities would be accorded higher priority, and
    c. Contain a description of the resource required and how it is to be funded. Priority would be given to projects with identified funding.

Annex B – Proposed Schedule for Development of Annual Work Plan

May to July	AWG/TCS to prepare the preliminary draft of Annual Work Plan, including proposed actions and performance targets taking into consideration of Members' comments. Members' requirements and TCS' assistance for achieving goals/objectives should be appropriately addressed. Difficulties and concerns of Members in achieving the targets of the plan and TCS' difficulties in supporting Members' achievement of objectives should also be covered with proposals to address them, if any.
August	AWG/TCS sends draft of the Annual Work Plan to Members for comment.
September	Members submit their comments to the AWG/TCS on the Annual Work Plan
October	AWG/TCS submits final draft of the Annual Work Plan to Members for consideration by the 38th Session of TC.
November	Approval by the 38th session of TC of Annual Work Plan.

Annex C – TCS Website Improvements

It is proposed that an expansion and reorganization of the current TCS website be completed by the TCS and possible volunteer support from Members to assist in both vertical and horizontal communications among TCS and TC Members. It is proposed that enhancements will include:

1. A Member's corner for posting notes of interest,
2. A special web-page for TC sessions and AWG deliberations and documents,
3. Capacity building information; advances in TC forecasting techniques,
4. Exchange of ideas and comments on various sub-components of the TC for the enhancement of TC activities,
5. A virtual library for TC publications, operational guidelines and studies, forecasting rules, official forecasts and warnings, and other relevant reference materials,
6. Timely exchange of information related to typhoons; as well a links to WMO's SWIC,
7. A TC forecaster's corner to share operational experience and address needs and concerns, and
8. A TC Research News page on latest research findings.

Project proposals, plans, studies and reports will also be made available at the TCS website for Members and management groups to enable easy access to the material for review and monitoring.

The target is to establish a portal site for tropical cyclones which not only facilitates sharing of opinion/experience but also boosts the image of the TC as the world-class centre for tropical cyclone information and activities.

APPENDIX XVI

AN EFFECTIVE AND EFFICIENT BUDGETARY PROCESS OF THE TYPHOON COMMITTEE AND RESOURCE MOBILIZATION GROUP

Review and Proposals/Options for:

a. **An Effective and Efficient Budgetary Process of the Typhoon Committee**
b. **Resource Mobilization**
c. **Strategies and One/Two Detailed Projects Proposals to be Used for Resource Mobilization**

1. Objectives

This document presents the review, evaluation, and proposals/options for an effective and efficient budgetary process of the Typhoon Committee (TC), resource mobilization strategies, and one/two detailed projects proposals to be used for resource mobilization.

2. Background

At the 36th Session of the Typhoon Committee held in Petaling Jaya, Malaysia, from 15 – 20 December 2003, the Chairperson of the Interim Working Group (IWG) on the Regional Cooperation Programme Implementation Plan (RCPIP) presented the IWG's report (Appendix XXIII). After consideration of the report, the Committee requested further evaluation of the options and proposals in the IWG report regarding the operations and structure of the Typhoon Committee and the submission of detailed proposals for adoption, if appropriate, at the 37th session.

To further evaluate the IWG report, the Committee decided to establish a Working Group on the Review of the Operations and Structure of the Typhoon Committee (WG ROSTY). Based upon the guidance provided by the Typhoon Committee, the TC requested detailed proposals and options regarding an effective and efficient budgetary process of the Typhoon Committee (TC), resource mobilization strategies, and one/two detailed projects proposals to be used for resource mobilization. These detailed proposals and options were to be presented prior to the 37th session of the Typhoon Committee.

3. Discussion and Detailed Options/Proposals.

3.1 Effective and efficient budgetary process of the Typhoon Committee (TC). The present budgetary process which was instituted several years ago, has basically served most of the needs of the Typhoon Committee (TC). However, with changing requirements and situations and concerns voiced by some Members, it is an appropriate time to reassess and review the process for changes/improvements to increase the effectiveness and efficiency of the budgetary process. Specifically, this document seeks to achieve the following objectives:

a. To establish a budgetary process that will effectively and efficiently determine the right amount of budget needed in the implementation of the Typhoon Committee's programs, activities and projects, and how the said budget be allocated/ prioritized for the attainment of the TC's goals/objectives.
b. To ensure that funds be used solely for the specific purposes for which they are appropriated.
c. To develop a monitoring mechanism that will evaluate on a continuing basis the Committee's financial and physical accomplishments.

The budgetary process generally has three components:

a. Budget preparation
b. Budget execution
c. Budget monitoring

Budget preparation is when project proposals are analyzed, an estimated cost of the projects and proposals is determined, and a proposed budget is prepared based upon this information and analyses. Budget execution is the approval of the proposed budget by the TC; the expenditure of funds as approved by the Typhoon Committee or as required by the TC Chairperson; and to ensure the accounts balance and any differences are fully explained and justified. Budget monitoring is to ensure that the costs of activities, proposals, and projects fall within or less than the approved allotted budget item and to ensure that the expenditures of the allotted funds and emergency items not in the planned budget but approved by the TC Chairperson and TC Secretary do not exceed the amount authorized by the TC.

In the opinion of some Members, the current budgetary process has not met the needs of the Typhoon Committee. Therefore the TC requested the WG ROSTY to offer proposals/options to improve/strengthen the effectiveness and efficiency of the current system. Detailed options/proposals on improving the effectiveness and efficiency of the budgetary process of the Typhoon Committee are contained in Annex A. The ESCAP/WMO Typhoon Committee Trust Fund documentation is included at Annex B for reference.

3.2 Resource Mobilization. Substantial efforts have been made by the Members and the Secretariat of the Typhoon Committee (TCS) to mobilize resources other than the Typhoon Committee Trust Fund (TCTF) for its activities on its three components: meteorology, hydrology, and disaster prevention and preparedness. The major resources include the multilateral assistance from the WMO Voluntary Cooperation Programme (VCP), WMO regular budget, ESCAP, and the bilateral assistance from the national governments and relevant agencies such as Japan International Cooperation Agency (JICA) and Korea International Cooperation Agency (KOICA). In the multilateral assistance area, VCP forms a majority of the achievements with 14 projects for 5 countries during 1998-2003. Technical Cooperation among Developing Countries (TCDC) also plays a significant role in the resource mobilization activities by Members. Recent examples of such cooperative assistance funded by resources outside the TC are:

a. Provision of a VSAT system for linking NMC Vientiane to the GTS (WMO/VCP-ongoing).
b. Improvement of data communication between NMC and local centers in Democratic People's Republic of Korea in 2001 (WMO/VCP).
c. "Workshop on Integration of Risk Analysis and Management of Water-related Disasters into Development Process in the Typhoon Committee Area" held in Manila in July 2002 (PAGASA; Ministry of Land, Infrastructure and Transport of Japan; JICA; and TCS in cooperation with ESCAP/WMO).
d. Regional Consultation Meeting on Flood Management held in Manila in October 2002 (ADB and JICA).
e. "Annual Training Workshop on Weather Forecasting for Operational Meteorologists" held annually in Seoul since 1998 (KOICA).
f. "International Training Course on Radar Meteorology" held at the WMO RMTC Nanjing in 2002 (China Meteorological Administration and WMO/VCP).
g. Annual group training courses for "Meteorology", "River and Dam Engineering", "Volcanology and Erosion/Sediment Control Engineering", and "Risk Management Associated with Disaster to Infrastructure" being held in Tokyo (JICA).

h. A series of “International Seminar on MTSAT/LRIT Data Utilization” held in Tokyo from 2000 to 2002 (Ministry of Land, Infrastructure and Transport of Japan)

For resource mobilization in Typhoon Committee, it is observed that partnerships are limited with major funding agencies, banks in particular, as compared with other WMO regions.

3.3 Additional Background and Detailed Proposals/Options. See Annex C.

3.4 Resource Mobilization Group (RMG). Since it is difficult for a single Member to solicit and acquire funding support from external international/regional agencies/organizations such as EU, development banks, etc., it is recommended that the Resource Mobilization Group (RMG) be formed to lead the mobilization of resources efforts for the Members with funding agencies. The RMG, composed of the TC Chairperson, TC Vice-Chairperson, AWG, and TC Secretary as well as WMO and ESCAP representatives, shall provide assistance and expertise in these activities/efforts, as required. The RMG could present the common goal of the Members – mitigation of typhoon disasters – and take lead in the activities to get support for projects to enhance the Members’ capabilities to cope with typhoons on a regional basis.

In view of the possible changes to the hosting of TCS, the RMG will serve as the corporate knowledge of the TC in resource mobilization. The RMG shall take steps to effectively work with the funding agencies to establish good relationships as well as monitor with sufficient continuity and accountability long-term projects to the satisfaction of the funding agencies. The RMG shall regularly review the progress of the short-term projects as well as the long-term regional projects and recommend measures, when necessary, to ensure smooth integration with the approved strategic plan and annual work plan.

The Terms of Reference for the RMG, potential resources, resource mobilization database, and options/proposals are described in Annex D.

Annex A - Detailed options/proposals on improving the effectiveness and efficiency of the budgetary process of the Typhoon Committee

1. The proposed financial cycle is a 1-year period starting on 1 January of the year following the TC Session which will generally be held around mid to late November.

2. As most expenditures are project and activity based, greater financial responsibility should be given to the Chairperson and the Secretary of the Typhoon Committee including the authority of the Chairperson to approve the audited Statement of Account and to approve the draft budget in consultation with the AWG which will be presented at the next session of the TC Meeting..

3. Financial responsibility is transferred immediately from the outgoing to the new Chairperson and TCSG once elected. Before close of the Session, the TCS will inform WMO Secretariat in writing of the name of the new Chairperson and TCSG and provide their sample signatures.

4. By 1 October of each year, TC Secretary will request WMO Secretariat to produce a Statement of Account ending 30 September, and then prepares and appends a statement of projected revenue/expenditure/ balance up to 31 December. By 1 November, the TC Secretary will forward these statements and inputs to all Members and the TC Chairperson for their consideration, review, and comment. The TC Secretary then presents these statements and inputs for discussion and comment at the Session.

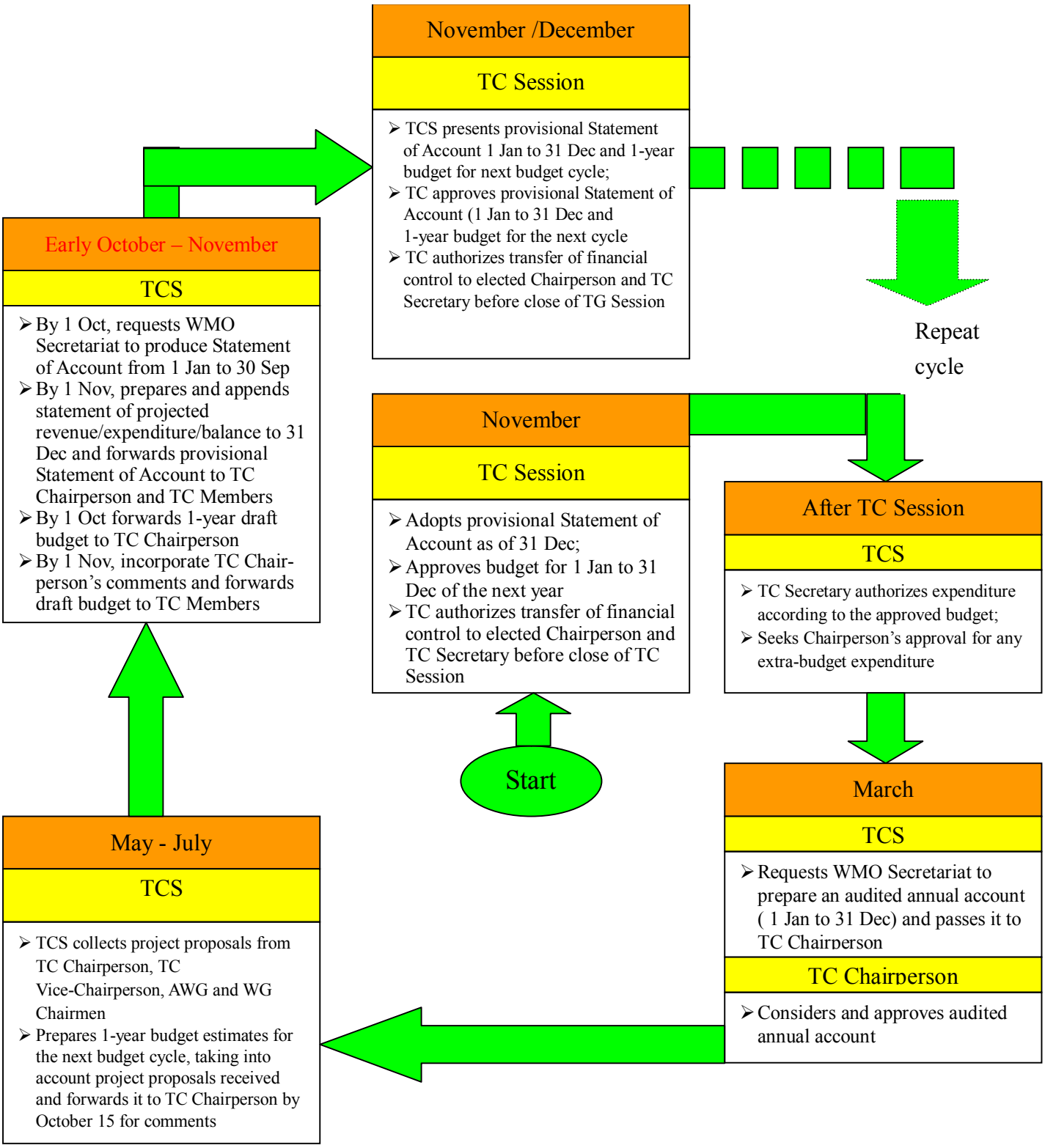
5. By 1 October of each year, TC Secretary will prepare a 1-year budget based on earlier proposals by the Chairperson, AWG, WGs on the 5 components. By October 15, the TC Secretary will forward the draft budget to the TC Chairperson for comments, requested changes, and concurrence. By 1 November, the Chairperson will complete his/her review and the TC Secretary will forward the draft budget to all members and the TC Chairperson, for their consideration, review, and comment. The TC Secretary then presents this draft budget for discussion and comment at the Session.

6. After the close of TC Session, TC Secretary authorizes expenditure according to the approved budget and seeks approval of Chairperson for any extra-budget expenditure.

7. Chairperson considers and approves audited annual account produced by WMO Secretariat.

8. A schematic diagram of the proposed cycle is shown on the next page to elucidate the process.

Appendix : Schematic Diagram of proposed budgetary process for Typhoon Committee
(Financial year (Jan-Dec))



ANNEX B

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND

Establishment of the Fund and its purpose

The ESCAP/WMO Typhoon Committee Trust Fund (hereinafter referred to as the Fund) was established to provide support to the Typhoon Committee to facilitate the implementation of its programme and assist in the provision of institutional support to the Typhoon Committee's programme or other support to its activities or activities of its Members related to its objectives.

The Fund was established from voluntary cash contributions by, or through, the Governments of the Typhoon Committee Members and from voluntary cash contributions through ESCAP, WMO or the Typhoon Committee Secretariat. Acceptance of contributions, other than those directly from Governments, shall be subject to the approval of the Typhoon Committee. Contributions shall normally be made in US dollars or any other readily convertible currency.

Administration of the Fund

The Secretary-General of WMO, or his authorized representative, is responsible for the management of funds contributed by or through the above-mentioned donor Governments or through ESCAP, WMO or the Typhoon Committee Secretariat.

The Fund is administered by the Secretary-General of WMO in accordance with the financial regulations of the WMO, supplemented by the provisions of the present rules and any supplementary directives or interpretation of these rules that may be decided upon by the Executive Council of WMO.

The accounting of the expenditures of the Fund is provided above as well as for any other directly identifiable charges related to the administration of the Fund (e.g., bank charges and /or commissions, communications charges, etc.). For WMO's costs which are not directly identifiable (stationery, drafting, typing, registry, mailing, preparation of reports and accounts, external audit, etc.), WMO will receive, in convertible currency, 13% of the expenditure made from the Fund. Interest accrued from any investment of the principle of the Fund will constitute an income to the Fund.

WMO prepares financial reports on the Fund in US dollars. The UN rate of exchange prevailing on the date of the transaction or report is applied for the conversion into US dollars of contributions or income received and payments made or charges incurred in any other currency. WMO submits a financial report, annually, to ESCAP and to the Typhoon Committee.

The biennial statement of income and expenditure of the Fund is incorporated into the overall audited financial statements submitted by the Secretary-General of WMO to the WMO Executive Council for approval. External audit is conducted only as provided for in the WMO Financial Regulations. The audit report is then submitted to ESCAP and the Typhoon Committee.

Procedures for the utilization of the Fund

The utilization of the Fund is based upon decisions of the Typhoon Committee and, within this limitation, upon written requests from Members of the Typhoon Committee or ESCAP or the Coordinator of the Typhoon Committee Secretariat.

Each request is prepared on a special request form.

The Secretary-General of WMO ensures that the order of priority of requirements established by the Typhoon Committee is followed in the allocation of funds.

The approving authority for granting support from the Fund rest with the Typhoon Committee, or, on its behalf, by the Chairperson of the Typhoon Committee. However, the Secretary-General of WMO, on behalf of the Typhoon Committee, is authorized to approve provision of support not exceeding US$5,000 or 10% of the available fund, whichever is the lesser amount, for each project, and he shall inform, without any delay, the Executive Secretary of ESCAP, TC Chairperson, and TC Secretary of such approval. The Secretary-General of WMO does not enter into any financial commitments unless he has received the funds required.

After approval of the request, the WMO Secretariat makes the necessary arrangements for the provision of support requested. In this connection, the beneficiary is expected to abide by the Financial Regulations and internal rules of WMO and render the accounts to the WMO in good time.

Copies of the approved requests is then returned to the requesting authority with a copy being forwarded to the Resident Representative of the UNDP office concerned, if any. If the request cannot be met, the requesting Member or organization or office is so advised.

Legal Responsibilities

Under no circumstances is the Fund made liable to pay and/or reimburse any taxes on emoluments or honorarium, or any customs and import duties, value added taxes or similar charges, demurrage and inland transportation costs for goods procured and imported under the Fund.

WMO is not held responsible for:

(i) late execution of the requests received;
(ii) delays by the suppliers in the execution of the orders placed;
(iii) damages or losses at the place of destination, including incidents which may result from inspection by the local customs authorities.

At no time will WMO, or the Secretary-General of WMO acting on its behalf, be held accountable or legally liable for any acts of omission or commission, or for failure to act on the part of the Typhoon Committee and to any third party resulting from WMO activities under its agreement.

Closure of the Fund

The Typhoon Committee can decide at any time to close the Fund established under the present Rules. Such a decision will have to be taken by the majority of all the Members of the Committee. The decision will be notified in writing to the Secretary-General of WMO together with the designation of the entity to which any cash balance of the Fund is to be transferred.

Upon notification of the decision to close the fund, the Secretary-General of WMO can not enter any more into further financial commitments and will have to proceed with the settlement of any unliquidated obligations recorded against the fund.

When the Secretary-General of WMO is satisfied that all known obligations have been liquidated by disbursement or by cancellation within the limit of time specified in the WMO Financial Regulations for such liquidation, he will prepare the final statement of account for submission to the Executive Council.

Upon approval of the final account by the WMO Executive Council, the Secretary-General of WMO will proceed with the transfer of any cash balance.

Should it be found that at the close of any accounting period, the cash balance amounts to less than US$1,000, the Secretary-General of WMO may decide without consultation to proceed with the closure of the Fund and to notify the Typhoon Committee accordingly.

Review

The Typhoon Committee, in consultation with ESCAP and WMO, may review these rules in the light of experience gained and make any changes as appropriate.

Annex C - Potential Resources, Resource Mobilization Database, and Options/Proposals for Resource Mobilization

1. **Potential Resources.** On potential resources, the primary focus should be on banks and other UN-related agencies. Consideration should also be given to other funding sources which have not yet contributed to the TC activities.

   a. Banks & UN Agencies.

   The WMO has concluded a Memoranda of Understanding (MOU) with the World Bank and the Inter-American Development Bank (IDB) in 1999 and 2000, respectively, for cooperation in areas of mutual interest that included climate change, national disaster prevention and mitigation, El Niño phenomenon, and integrated water resources management. A recent example of success is the Ibero-American Climate Project which involves 13 countries in Latin America and has raised $3.2 million to date for a feasibility study from IDB with the coordination of WMO. The project is aimed at minimizing the adverse effect of climatic events on socio-economic activities in the region by strengthening the national meteorological/hydrological services (NMHSs) and the total estimated cost is $409 million.

   A similar project entitled “Integrated System for the Mitigation of Typhoon, Flood and Environmental Disasters in the Western North Pacific Area” was proposed in 1996 for the Western North Pacific region by WMO. The overall objective of the project was to assist NMHSs of participating Members (12 of 14 TC Members) to develop the capacity to provide timely and accurate warnings for natural hazards including tropical cyclones. The regional project was to adopt comprehensive arrangements for fully modernizing the NMHSs and to improve coordination among domestic disaster-prevention authorities. It was also intended to develop close partnerships among the Members in the region so that they can better cope with natural disasters through regional cooperation. The project assumed World Bank, ADB and UNDP as principal contributors and also viewed bilateral assistance from interested countries such as Australia, Canada, Denmark, Finland, Sweden and Japan. The estimated total cost of the project was approximately US $200 million. Although the project has faded since 1999 when country plans were prepared, the concept of the project suggests an effective strategy to enhance the resource mobilization on a regional level through a concerted approach by the Members.

   b. Other Resources

   Besides banks, consideration should be given to those funding agencies which have not yet contributed substantially to TC Members but have a keen interest in supporting the NMHSs. European Union (EU) is one of these agencies who in the past have worked closely with WMO and NMHSs in other regions. An example of one of the EU projects currently in progress is the Caribbean Radar Network Project which is providing four new Doppler digital radars in Barbados, Belize, Guyana and Trinidad and Tobago for detecting and monitoring tropical cyclones in the Caribbean. EU has also undertaken joint initiatives with WMO in Africa through a series of projects related to water-resource management including the Southern African Development Community - Hydrological Cycle Observing Stations (SADC-HYCOS).

   Consideration should also be given to funding support from the private sectors or commercial enterprises. In this respect, the role of the RMG as a functional agent in resource mobilization would be crucial for a successful relationship with these enterprises.

2. Resource Mobilization Database

Many TC Members have received substantial assistance under the various bilateral schemes, ranging from training and expert services to large-scale projects which may cost millions of dollars. However, donors (countries/agencies) have different policies, criteria, procedures, and applications for the implementation of projects which present problems for some Members applying for funding support. Given this situation, detailed information on the available schemes, focus areas, preferences, and relevant procedures would be of help to the Members in increasing the possibilities for receipt of the bilateral assistance. Unfortunately, TC Members do not readily share their experiences in mobilizing resources. To facilitate the exchange of information and experiences on Members' efforts, it is recommended that a resource mobilization database (Fig 1) be established. The database would hold general information about available resources and be regularly updated by Members. The database would enable Members to identify resources and sources which most suit their objectives. Direct contact with relevant countries/agencies may be required to make the database more useful and effective. The database should include other resources which are currently outside the reach of the TC. Finally, a consulting mechanism should be established to give appropriate advice to Members based upon the database. The consultation may include partnerships with private sectors.

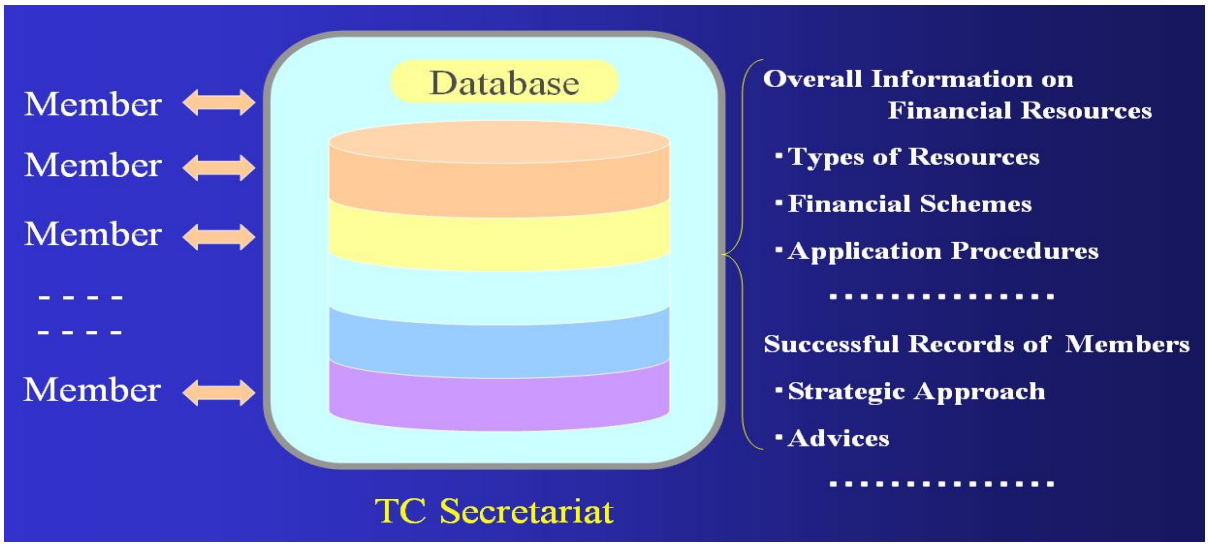


Fig. 1 *– Conceptual Design of a Resource Mobilization Database*

3. Options/Proposals

a. A RMG should be established as a matter of priority to lead and coordinate the resource mobilization efforts of Members. Development banks should be identified as main funding agencies along with other potential donors. Due consideration should be given to the prevailing budgetary conditions of the Members.

b. Since there is currently little information available on Members' resource mobilization activities, the RMG and TCS should prepare and distribute as described above a questionnaire on Members' achievements, successes and problems on mobilizing resources. This questionnaire should also ask for schemes, procedures and strategies that were successful with funding agencies. A standard resource mobilization input form or template should be prepared to facilitate input by Members.

c. Once the data from the questionnaire are collected, then the RMG and TCS with Members' support should create a database containing information on the

mobilization of resources which is accessible to Members only.

d. Consideration should also be given to funding agencies which have not yet contributed substantially to TC Members such as the European Union (EU) but have a keen interest in supporting the National Meteorological and Hydrological Services (NMHSs).
e. Resource mobilization activities should link with not only the Tropical Cyclone Programme (TCP), but also the Education and Training Programme (ETP), Technical Cooperation Programme (TCO) and Regional Associations II and V of WMO. In this respect, close liaison between the WMO and TC in the coordination, harmonization, and collaboration of tropical cyclone activities is essential for effective results.
f. Activities on mobilization of resources should be included in all Members' Country Reports.
g. At every TC Session, a major agenda item should address the mobilization of resources.
h. Presentations/lectures should be given at TC Sessions on resource mobilization activities, progress, procedures, schemes and/or available databases as appropriate, and
i. The Typhoon Committee should implement a public relations (PR) program in relation to the resource mobilization activities with a view to promoting the image of TC and/or building up confidence of funding agencies in TC through successful implementation of projects. These could include, amongst others, organizing special forums and/or donor workshops to describe and elaborate on the vision, goals/objectives, and accomplishments of the TC especially in the area of the RCPIP.

Once the RMG is established, it is recommended that resource mobilization be pursued as follows:

a. The immediate task is to build a database of funding agencies to support and facilitate the resource mobilization activities of TC Members (see Fig. 1). This database development should take into account the questionnaires' results (see Section 3.1 b). As part of the preparation for the annual TC Session, TCS shall seek input from all Members, WMO and other relevant parties, prepare/update the Resource Mobilization Database and send to RMG for consideration and approval. The RMG shall provide a brief to Members on the status of resource mobilization for discussion during the Session. The RMG and TCS will explore options to make the information in the database more readily available to all Members, such as setting up a password protected web-based interface for information download or retrieval. The RMG shall seek and maintain alternative sources of funding, alert Members of such possibilities, and offer advice/consultation upon Members' request.
b. The next task is to identify several low-cost demonstration projects for implementation with a view to building up a portfolio of "success" cases.
c. This will be followed by a public relations campaign to promote the Committee's image and enhance the confidence of funding agencies in TC.
d. The eventual task is to identify and implement regional projects in cooperation with major funding agencies. The proposed project "A Doppler Radar Network in the Western North Pacific" located at Attachment 1 is highly recommended.

For such regional projects, the following procedures are proposed:

a. AWG, in consultation with Members, WGs Chairpersons of the three components, and TRCG, would propose potential regional projects that require major resource mobilization and prepare discussion papers for communication to Members;
b. If the proposed project is considered viable by the majority of Members, a Project Design Team (PDT) would be formed, with a leader and a suitable number and

composition of members, to be nominated by the AWG and approved by the TC;

c. The PDT will undertake “needs analysis” and “basic design of project”, with the ultimate aim of producing a project brief and proposal for circulation and comments among Members, WMO, and other relevant parties.
d. The RMG in coordination with the TCS will then assess resource implications and liaise with major funding agencies to solicit potential support, with the ultimate aim of producing a consolidated report with PDT on project feasibility and viability for submission to AWG.
e. AWG to review and if appropriate, endorse the report;
f. The RMG in coordination with the TCS will take follow-up action based on the endorsed report and propose implementation schedules, funding commitment, and other logistic arrangement ahead of the TC Session.
g. TC Session will consider and, if appropriate, approve the project and associated implementation schedule, funding, and logistical arrangements and appoint a Project Implementation Team (PIT).
h. RMG in coordination with the TCS will liaise with PIT and funding agencies to launch project and related publicity events.
i. RMG in coordination with the TCS will monitor project progress and maintain contacts with PIT (e.g., through field visits) and funding agencies (e.g., through donor workshops) as well as compile progress reports for Members; and
j. RMG in coordination with the TCS will, as part of the on-going resource mobilization PR programme, update project progress on a specialized website and organize, as appropriate, special forums for Members, funding agencies, potential sponsors and senior government administrators to showcase significant achievements in connection with the implemented regional projects.

Annex D - Terms of Reference of Resource Mobilization Group

1. Contact and maintain liaison with funding agencies with a view to soliciting financial support for projects.

2. Develop, manage and maintain a Resource Mobilization (RM) Database to support and facilitate resource mobilization activities of TC Members containing information on amongst others, financial resources, potential funding agencies, application procedures, results/status of projects, economic impact of projects.

3. Upon Members' request, offer advice and consultation related to RM issues, in particular on:

   a. connection in between short-term easily-funded projects with long-term projects,
   b. ways and means of meeting donors' requirements,
   c. contractual/legal processes,
   d. funding management of projects, and
   e. seeking commitment for Members' respective Government to proposed projects.

4. Manage and maintain, in cooperation with TCS, a PR programme in RM with a view to promoting the image of and/or building up confidence of funding agencies in TC through successful implementation of projects.

5. Assess the resource implications and funding potential of projects in the strategic plan and biennial work plan.

6. Facilitate the exchange and sharing of experience and knowledge on issues related to RM in TC.

7. Develop and maintain a strategy plan for large-scale long-term regional projects.

8. Prioritize RCPIP projects in accordance with the ease of obtaining funds for demonstrating the resource mobilization process, identify and liaise with potential donors.

APPENDIX XVII

TERMS OF REFERENCE ON DEVELOPING OPTIONS FOR HOSTING TCS AND ROAD MAP

Terms of Reference

- Prepare Terms and Conditions for Hosting in Consultation with Members
- Prepare Evaluation Criteria in Consultation with Members
- Evaluate and Rank Potential Hosts
- Report Recommendations to 38th Sessions

Hosting Road Map

- November 21 – January 5 Develop Draft Terms and Conditions for Hosting and Criteria for Ranking (Space, Phones, Computers, Internet, Integration into NMHS, staffing, etc.) Get Examples
- January 5, 2005 – Draft Terms and Conditions and Criteria sent to all Members for Comment
- February 5, 2005 Members send in comments on Terms and Conditions and Criteria
- February 20, 2005 Terms and Conditions for Hosting and Evaluation Criteria sent to all Members Requesting Hosting Intent (No Commitment)
- April 30, 2005 Members Provide Hosting Intent
- May 1-31 or July 1 – August 15 Visits and Collection of Information
- August 15 – September 15 Prepare Evaluation Report
- September 15 – Evaluation Report Sent to All Members
- 38th Session – TC Consider Recommendations in Evaluation Reports

Review and Proposals/Options for Hosting of the Typhoon Committee Secretariat

1. Objectives.

The objective of this document is to review the current structure of the Typhoon Committee (TC) and to propose a revised structure that could enhance its operations. One of the proposed revised structures is the TCS hosting concepts. This document presents the review, evaluation and proposals/options regarding the hosting of the TCS.

2. Background.

The Interim Working Group (IWG) on the Regional Cooperative Programme Implementation Plan (RCPIP) of TC submitted a preliminary proposal on the operation and structure of TC to the TC 36th session, as detailed in Appendix XIII Annex I of its meeting report. The IWG proposed an option of alternating or rotating the hosting of the TCS depending upon each Member's capabilities.

The Typhoon Committee, at its 36th session, requested further review and evaluation of the IWG's proposals and the submission of more detailed proposals to the 37th session. This paper is a further study into the hosting of the TCS.

3. Revised Structure of the Typhoon Committee

The IWG's proposal suggests a considerable change in the operation and structure of TC, by having voluntary hosting of TC secretariat by different Members on some type of rotational basis.

Hosting of Secretariat. The secretariat coordinates the implementation of programmes and activities approved by the Typhoon Committee, including arrangement of training programmes, as well as collation and publications of documents. There are advantages and challenges with this proposal.

3.1 Advantages of Changing the Current TCS Host Arrangements:

- Such work would provide opportunities for members of the hosting Member to build their capacity in international coordination.
- New hosting Members could provide new insights and ideas for the TCS Hosting of the TCS may provide an opportunity for NMHSs to enhance its visibility and profile within their own country, providing a platform to attract more active support from their government, various agencies, and the public on TC-related matters.
- Sharing of responsibility through rotational hosting and going through the experience of tackling TCS matters can cultivate a sense of belonging among Members and promote active participation of Members in the activities of the TC.
- The hosting Member's resources and capability could be used for the enhancement of the TC activities and operations through participation in the operation and management of the TCS.

3.2 Challenges of Changing the Current TCS Host Agreements:

- Changing hosts may impact the continuity and knowledge of the TCS. By keeping one host, the personnel may be more involved and serve as better resource people

- Strict procedures and certification criteria are needed for Members willing to host the TCS.
- Additional resources and costs will be incurred in the changing of hosts.
- With the completion of the service of a TC hosting Member, administrative, political, and troublesome procedures to select a new hosting Member must be repeated. Also, if there are no voluntary or selected hosting Member, unexpected difficulty may occur.

3.3 Tenure of Hosting the Secretariat. The IWG RCPIP suggested a minimum period of 4 years. However, several options could be considered here.

Option 1:
Hosting of four years with a possible extension of another four years up to a maximum of eight years.

Option 2:
Hosting of four years with a possible extension of another two years up to a maximum of six years.

Option 3
Hosting of two years with possible extensions of another two years up to a maximum of six years.

To maintain continuity and smooth transfers of the TCS, The WG ROSTY recommends approval of Option 1 if changing of Host is approved.

3.4 Rotation of Host. Depending upon the number of Members volunteering and having the required resources to host the TCS, the hosting should be on rotation basis, allowing each qualified Member who has volunteered the opportunity to serve as host the TCS. In the event that no Member wishes to host the secretariat, the current hosting may be extended by another one to two years, subject to the agreement by the TC.

3.5 Obligations of Hosting Member. The TC Secretary and TC Secretariat TORs are in document Addendum 1.1. The hosting member shall provide, in kind, the required office space and equipment, supporting personnel (number and specialties), and communicating facilities such as telephone, email and fax.

3.6 Hosting Transfer Procedures. The WG recommends:
- Criteria to be set to evaluate the offers to host.
- The new hosting member's government signs an hosting agreement to specify what is required, what they agree to provide, and the time period of hosting.
- Specific procedures and mechanisms be prepared to ensure a smooth transfer of responsibilities and that a certification checklist and process be adopted to ensure the proposed host has access to all of the required resources. The transfer process should begin approximately 2 years prior to the transfer to ensure continuity and a smooth transfer.
- The Typhoon Committee prepare emergency transfer procedures and processes in the event that the hosting Member has a change in government leadership or other occurrences that would necessitate a quick change of hosting Member despite the signed agreement.
- Evaluation criteria be set for requests to extend hosting the TCS.

3.7 Offers to Host.

a. On April 5, 2004, the TCS sent an e-mail and an attached letter from Chairperson of the WG ROSTY to all 14 Members of the Typhoon Committee requesting them to complete a questionnaire on their interests in hosting the TCS and in providing the required resources. Five Members responded to this request. The responses were from Hong Kong, China; Macao, China; Singapore; Thailand; and the United States. The other 9 Members did not respond.
b. On August 2, 2004, the TCS resent the April 5, 2004 letter from the Chairperson of the WG ROSTY letter and questionnaire to the 9 Members who had not previously responded asking for a response. There were no responses to this request.
c. On September 12, 2004, the TCS again resent the April 5, 2004 letter from the Chairperson of the WG ROSTY letter and questionnaire to the 9 Members who had not previously responded asking for a response. Also, they were informed that all non-response Members would be listed in the WG ROSTY report. Republic of Korea and Japan responded to this second request.
d. See Annex A for the Members who responded and their response.

Based upon the limited responses and only one Member volunteering to host the TCS, the WG ROSTY recommends that the Typhoon Committee at its 37th Session discuss this issue and poll the Members for possible other Members willing to host the TCS. Then based upon these discussions and responses, the WG invites the Members to discuss the hosting of the TCS and to make a decision on the future direction of the hosting of the TCS.

Annex A – Members' Responses on Hosting Typhoon Committee and/or Providing Seconding Experts

Members	Responded	Hosting TCS	Seconding Experts
Cambodia	No		
China	No		
Democratic People's Republic of Korea	No		
Hong Kong, China	Yes	No	No
Japan	Yes	No[4]	No[4]
Lao People's Democratic Republic	No		
Macao, China	Yes	Yes[1]	Yes[1]
Malaysia	No		
Philippines	No		
Republic of Korea	Yes	No[2]	No[3]
Singapore	Yes	No	No
Thailand	Yes	No	No
United States of America	Yes	No	No
Viet Nam, Socialist Republic of	No		

[1] Yes, subject to the outcome of the consideration by the Committee on the Report of the WG ROSTY

[2] Not at this time, but will consider the accommodation of TCS in the long-term basis.

[3] In regards to the dispatchment of seconding expert to support TCS, the Republic of Korea is considering the issue in a favorable light.

[4]Premature to make decision before discussions at next Typhoon Committee Session. At present time, Japan holds a negative view on both hosting and seconding experts to the TCS, but very tentative view presently.

APPENDIX XVIII

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 XIX

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND
INTERIM STATEMENT OF ACCOUNT
as at 30 September 2004

			$	$
Balance of fund at 1 January 2004			558,454	
Contributions Received			126,000	
Interest Income			1,923	
Total revenue				686,377
Less: Expenditure	Liquidated	Unliquidated	Total	
Roving Seminars (MF 37045)		10,000	10,000	
Travel for TCS staff (3) to TC-37		4,500	4,500	
Bank charges	8		8	
Publication of reports (Newsletter No. 16 & TCAR 2003)	1,015		1,015	
Postage	16		16	
Transfer to MF 30841 (Intl Conf on Storms, Brisbane)	22,400		22,400	
Operating costs of TCS	16,063	10,157	26,220	
Support for two women forecasters, RSMC Tokyo MF30842	4,000		4,000	
Support for the attendance of 7 core members				
WG ROSTY Meeting, Bangkok, April 2004 MF 37036	8,252		8,252	
Support for local costs and printing ,Seoul Hydro Wkshop MF37041		3,000	3,000	
Mission travel Seoul Hydro Workshop MF 37041	5,581	7,950	13,531	
Support costs	7,454	4,629	12,082	
	64,789	40,236	105,024	
Total expenditure				105,024
Balance at 30 September 2004				581,353
Cash in bank				649,397
Less:				
Unliquidated Obligations			67,757	
Unpaid invoices			287	68,044
Balance at 30 September 2004				581,353
Contriibutions received in 2004				
China			12,000	
Hong Kong, China			12,000	
Macau, China			12,000	
Malaysia (for 2003 and 2004)			24,000	
Philippines			6,000	
Republic of Korea			12,000	
Singapore			12,000	
Thailand			12,000	
USA (for 2003)			12,000	
Vietnam			12,000	
			126,000	

*The cancellation of the unliquidated obligation in 2003 in the amount of USD 9,050 for TCS Support will be reflected in October 2004