UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS TWENTY-EIGHTH SESSION

Kuala Lumpur, Malaysia
5 - 11 December1995

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I. ORGANIZATION OF THE SESSION

1. The twenty-eighth session of the Typhoon Committee was held at Kuala Lumpur, Malaysia from 5 to 11 December 1995. The session was co-sponsored by the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO), and was hosted by the Government of Malaysia.

Attendance

2. The session was attended by 60 participants and observers. They represented 9 (out of 12) Members of the Typhoon Committee, namely, China, Hong Kong, Japan, Macau, Malaysia, Philippines, the Republic of Korea, Thailand and Vietnam.

3. One observer each from Brunei Darussalam, the Russian Federation, and Singapore, three each from the United States of America (U.S.A.) and from Indonesia attended the session. In addition, one observer each from the United Nations Development Programme (UNDP), United Nations Educational, Scientific and Cultural Organization (UNESCO), the Department of Humanitarian Affairs (DHA)/International Decade for Natural Disaster Reduction (IDNDR) Secretariat, the WMO Commission for Atmospheric Sciences (CAS) and the WMO, ESCAP and Typhoon Committee Secretariat (TCS) also attended. The list of participants is attached as Appendix I.

Opening of The Session (Agenda item 1)

4. Mr. Cheang Boon Khean, Director-General, Malaysian Meteorological Service extended a very warm welcome to all the participants at the session. He presented a succinct account of the interaction of various weather systems over the country. He stated that Malaysia's membership in the Typhoon Committee had been justified by the indirect but significant impacts of the typhoons in the South China Sea on the weather in Malaysia. He also said that Malaysia had gained many benefits through participation in the Committee's activities and that his country would continue to play its role actively. He suggested that, to the developing countries, various activities would be more useful if they included the components of technology transfer and training. He noted that the Committee was at the threshold of meeting more complex demands from specialized users of meteorological, hydrological and social welfare services in view of rapid development in the region. The Typhoon Committee definitely had an important role to play in assisting its Members in improving their services to meet this demand. He ended by wishing everyone a successful session and an enjoyable stay in Malaysia.

5. The representative of ESCAP delivered the message of the Executive Secretary of the United Nations ESCAP. He expressed appreciation to the Government of Malaysia for hosting the session and for playing a leading role in the efforts to achieve the objectives of the Committee. The Committee was informed that the Commission at its fifty-first session in 1995 had noted with appreciation the progress achieved in the implementation of the activities of the Typhoon Committee. The Committee was also informed that the Commission had urged continuing cooperation among its members on activities related to natural disaster reduction since natural disasters transcended national boundaries, and undertaking natural disaster

reduction activities was a duty of all the countries. The representative of ESCAP thanked those Members that had been supporting the activities of the Typhoon Committee, as well as the WMO, the DHA, the IDNDR Secretariat, and the International Federation of Red Cross and Red Crescent Societies (IFRCS), and acknowledged the significant contribution made by UNDP to the progress of the work of the Committee in the past. He presented a brief account of ESCAP's activities on natural disaster reduction in the past year and informed the Committee that project documents had been drafted to solicit extra budgetary funds for further activities in this field. The representative of ESCAP assured the Committee that ESCAP would continue to undertake activities in support of the Typhoon Committee within the framework of its own programme of work and available resources.

6. The representative of WMO Secretariat, Mr. Eisa H. Al-Majed, addressed the session on behalf of Professor G.O.P. Obasi, Secretary-General of WMO. He expressed the appreciation of WMO to the Government of Malaysia for hosting the session and for the excellent facilities provided. He extended a warm welcome to all participants. He highlighted the WMO's Tropical Cyclone Programe's (TCP) objectives. He informed the session that the Twelfth WMO Congress in May/June 1995 adopted the section on the TCP of the Fourth WMO Long-term Plan for the decade 1996-2005.

7. The representative of WMO expressed the appreciation of WMO to the Members of the Committee for their contributions to the Typhoon Committee Trust Fund (TCTF) and to the various donors who have been providing ready support towards the implementation plans of the Committee and TCS. He assured the session that WMO within its available resources would continue to support the Committee to the extent possible, in its efforts to ensure the safety of life and property of the citizens in the region. He wished the participants a successful session.

8. In his opening address, Mr. V. Danabalan, the Secretary-General of the Ministry of Science, Technology and the Environment of Malaysia, noting that this was the first Typhoon Committee session to be organized by his country, expressed that Malaysia's increasing involvement in this regional entity was timely and in tandem with the correct trend in regional, as well as global efforts, in addressing issues concerning natural disasters. He said that the Committee provided an important forum to discuss ways and means to mitigate loss of lives and damage to properties inflicted by typhoons, especially through the joint efforts of its Members. He noted that the Typhoon Committee Members had been suffering great losses not only in lives but also to their economies and that the losses were increasing in the recent years in the countries of the Asia and the Pacific region. He stated that typhoons could not be prevented from occurring, but it was possible to reduce their adverse impacts by providing more timely prediction and warning. Only through persistent scientific research to better understand the behaviour of typhoons that more timely prediction and warning could be issued. He said that accurate forecast of the movement of typhoons and timely warning of their landfall were important but would not be very useful without sufficient support in terms of mitigation measures and relief services. He stated that the Typhoon Committee had evolved into a strong binding force between meteorological and hydrological services and other disaster relief communities. He commended the increase in membership, and establishment and satisfactory functioning of the TCTF. He also suggested that the Committee seek additional funding support to sustain its activities. He concluded by wishing the twenty-eighth session all the success.

9. The Committee witnessed the awarding of the ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award for 1995. The 1995 award was given to the Department of Social Welfare of Malaysia. The award was presented by Dr. Roman L. Kintanar, Chairman of the Typhoon Committee Foundation Incorporated (TCFI). The citation of the award read:

In recognition of its outstanding services in the promotion of natural disaster prevention and preparedness through its efficient administration in the preparation of evacuation centres, delivery and distribution of relief goods, and rehabilitation of flood victims in Malaysia.

Election of Officers (Agenda item 2)

10. Mr. Antonio Pedro F. da Costa Malheiro, the outgoing Chairman of the 27th Session of the Typhoon Committee declared the meeting open. Mr. Cheang Boon Khean (Malaysia) and Dr. Patipat Patvivatsiri (Thailand) were unanimously elected as the Chairman and the Vice-Chairman respectively. Mr. Robert Lau (Hong Kong) was elected as the Chairman of the Drafting Committee and Mr. Toshiyuki Ono (Japan) as its Vice-Chairman.

Adoption of The Agenda (Agenda item 3)

11. The Committee adopted the agenda as shown in Appendix II.

II. THE COMMITTEE'S ACTIVITIES DURING 1995 (Agenda item 4)

12. The Committee reviewed and evaluated in detail its activities undertaken during 1995 under five components as elaborated below. The Committee was pleased to be informed that Members continued to maintain, with the assistance of TCS, ESCAP and WMO, activities called for by its Regional Cooperation Programme.

(a) Meteorological Component (Agenda item 4 (a))

13. The Committee noted that the 4th edition of the Typhoon Committee Operational Manual (TOM) was published by WMO by March 1995. However, paragraph 4.5 in Chapter 4 as proposed by the rapporteur, Mr. Shingo Osano (Japan), and International Civil Aviation Organization (ICAO) during the 27th Session of the Committee in Macau is yet to be included in the next version.

14. The Committee further took into account the proposals and suggestions for amending the TOM. The Committee approved the proposed amendments submitted by rapporteur (see Appendix IV) and requested the WMO Secretariat to issue a new edition of the TOM by March 1996. The Committee expressed its gratitude for his excellent work and for the offer of JMA for his continued task as rapporteur.

15. The Committee further noted that all the Members continued their sustained efforts in undertaking the programme of work under the Meteorological Component. Special attention was addressed to the fields of tropical cyclone analyses, forecasting and warning systems, information dissemination and the improvement of telecommunication facilities and services.

16. The Committee continued to urge its Members to give priority consideration on enhancing the coverage of upper air observation data with the view of improving typhoon and rainfall analysis. In line with this endeavour, the Committee is in full support to the CAS Aerosonde Project as a possible data source to augment the density of upper-air observations in the future. The Chairman of the CAS Working Group of Rapporteurs on Tropical Meteorology Research (WGRTMR) (speaking through representations) provided an update on the CAS Aerosonde Project (Paragraph 51).

17. The Committee during the past year has continued to solicit inputs from its Members for further promoting the visits of experts under the Technical Cooperation among Developing Countries (TCDC) for the purpose of facilitating the exchange of knowledge and experience in typhoons and floods.

18. The Committee also acknowledged the receipt of gridded data from the Regional Specialized Meteorological Centre (RSMC) in Tokyo through the Internet or Integrated Services Digital Network (ISDN). With the grid-point data, some Members were able to eliminate subjectivity in the analysis in the data-sparse region. Some members also expressed their concern on the weakness of the Internet for real-time applications.

19. The Committee expressed its appreciation on the exemplary work of the RSMC Tokyo-Typhoon Centre and its continued provision of numerical weather products to other Members.

20. After some deliberation on the importance of the doppler radar to the weather service, the Committee requested WMO to conduct a regional seminar/workshop on the operation and use of doppler weather radar. Plans are underway to hold the workshop tentatively in April 1997 to be hosted by the Thailand Meteorological Department.

21. The Committee noted with concern the shortage of data from Laos and Cambodia. In this regard, the Committee urged WMO as soon as possible, in collaboration with TCS, to prepare the UNDP national project proposal for development of typhoon forecast and warning services which could be a solution to this problem (Subparagraph (k) of Paragraph 83).

22. The Committee was informed that the United Kingdom (U.K.) Meteorological Office will routinely provide advisory messages on the forecast tracks of tropical cyclones to meteorological centers in the Asia-Pacific region wishing to receive such messages. The Committee welcomed the offer of the U.K. Meteorological Office to provide such advisory messages to other national meteorological services in the region (Appendix V).

23. A summary of the reports of the individual members in relation to the meteorological component activities during 1995 is given in Appendix III.

(b) Hydrological Component (Agenda item 4 (b))

24. Based on the programme for 1995 as agreed upon during the last session of the Typhoon Committee, the Members continued their sustained efforts in undertaking the programme of work under the hydrological component. A summary of the reports of the individual Members on their activities related to the hydrological component during 1995 is included in Appendix VI.

Activities of ESCAP

25. ESCAP continued to provide support to the Members in their endeavours on flood protection. The Typhoon Committee noted that the project on Comprehensive Flood Loss Prevention and Management had been concluded and a new project proposal on flood risk analysis and mapping had been formulated. Two ESCAP training workshops on Flood Risk Analysis and Mapping, in Myanmar and Nepal, had been planned to be held before the end of 1995 with the participation of the Typhoon Committee Hydrologist, but due to current financial constraints of the United Nations, had to be postponed to 1996 for implementation. The Members wishing to benefit from such training workshops might place their requests to ESCAP for possible implementation in 1996.

26. In the field of hydrology, training had been arranged for some Cambodian technical personnel at various institutions in the Philippines and Thailand through a country project supported by the World Bank/UNDP. Advisory services had been provided to Brunei Darussalam on hydrological network improvement and planning of dam safety programmes. A paper on Flood Forecasting and Warning Systems in the ESCAP Region was prepared and presented at the International Seminar on Water Induced Disasters held in Kathmandu in March 1995.

Activities of WMO

27. The Committee recalled that the Hydrological Component of the Typhoon Operational Experiment (TOPEX), had been undertaken from 1979 to 1983 under the auspices of the ESCAP/WMO Typhoon Committee, concentrated on the assessment, in real time, of the performance of existing flood forecasting systems. After TOPEX, monitoring and forecast accuracy reports continued to be submitted by Members of the Committee. An analysis of these reports was undertaken and the results were presented in the publication "Some Aspects of Flood Forecasting Systems in Asia 1984 to 1988" (WMO Technical Document No. 327, 1989). This report raised the question as to whether to continue with the past monitoring and forecasting reports in the present form. As an alternative, a new monitoring system, the "Management Overview of Flood Forecasting Systems" (MOFFS) was proposed. It was designed so as to enable the facilities and annual performance of individual flood forecasting systems to be described and monitored using a three-part point-scoring system.

28. MOFFS Version 2C, October 1990, was presented to the WMO regional tropical cyclone bodies. They all recommended that it be used by their members. Following an invitation circulated in April 1991, a number of these countries designated flood forecasting systems to be monitored on a regular basis using the rating system described in MOFFS Version 2C.

29. Since 1991, the WMO Secretariat has kept on file a register of all systems so designated, including the results of their performance. Following regional consultation meetings on the applications of MOFFS held in Malaysia in 1992 and in Mexico in 1994, minor modifications to Version 2C have been introduced to make MOFFS more user friendly.

30. The Committee noted with satisfaction that the new edition, MOFFS Version 3, had been issued as report No. 51 in the series "Technical Reports in Hydrology and Water Resources" (WMO/TD-No. 715). It also noted the points weighting method which enables

the facilities and performance of individual flood forecasting systems to be simply described, monitored and assessed for management purposes.

31. The Committee urged Members to study the new edition and to apply MOFFS Version 3, to the extent possible.

Hydrologists' Meeting

32. Prior to the Typhoon Committee session the pre-session meeting of the hydrologists took place. The report of the hydrologists' meeting with the list of participants is presented in Appendix VII. The hydrologists formulated a set of recommendations which were adopted by the Committee as reflected under Agenda item 7.

(c) Disaster Prevention and Preparedness Component (Agenda item 4(c))

33. Typhoon Committee Members continued their sustained efforts in undertaking the programme of work under the disaster prevention and preparedness component and also in line with the goals of the IDNDR. A summary of the reports of the individual Members on their activities related to the disaster prevention and preparedness component and IDNDR during 1995 is included in Appendix VIII.

Activities of ESCAP

34. ESCAP at its last session in 1995 noted that through the natural disaster reduction activities, it was possible to reduce the loss of life, and cost of material damage, thus directly contributing to the economic and social development of the members and associate members of the Commission. The Commission had also noted that, since natural disasters transcended national boundaries, undertaking natural disaster reduction activities was a duty of all the countries. The Commission had considered the impetus given to natural disaster reduction activities through the IDNDR, and was pleased to note that some countries had given great importance to such activities and developed important policies. The Commission had urged continuing cooperation among its members on activities related to natural disaster reduction.

35. The ESCAP Secretariat continued its work on disaster prevention and preparedness. The project on Assessment of Current Preparedness Programmes, Forecasting Systems and Operational Methods for Water-related Natural Disaster Reduction in the ESCAP Region has been concluded. A new project proposal on land use planning and practices in watershed management and disaster reduction has been formulated and submitted to potential donors for funding.

36. A publication on natural hazards and natural disaster reduction in Asia and the Pacific has been prepared reflecting the natural hazards experienced since the beginning of the IDNDR, the disaster prevention and preparedness activities being undertaken by the countries and areas in the region, and the response required to natural disasters. This was a follow-up publication on the earlier two volumes of Natural Disaster Reduction in Asia and the Pacific launching the IDNDR.

37. ESCAP continued its cooperation with the IDNDR Secretariat in Geneva.

Activities of WMO

38. The Committee noted with satisfaction that WMO actively supports the work of the bodies involved in the Decade and has been represented at all sessions of its Scientific and Technical Committee (STC) and Inter-Agency Working Group. These bodies play a useful role in co-ordinating the work of the various United Nations (UN) agencies involved and in ensuring that their work is relevant to the wider aims of the Decade.

39. The Committee was pleased to note that the Twelfth WMO Congress (Cg-XII) adopted the revised WMO Plan of Action for the IDNDR, with a view to emphasizing that a major proportion of WMO's regular programme of activities is directed, and has always been directed, to reducing natural disasters of meteorological and hydrological origin. It was also pleased to note that the Secretary-General of WMO was requested to provide all possible assistance to the implementation of the Plan.

40. The Committee noted that there would be a need for better international co-ordination and agreement on protocols for the exchange of warnings. In this regard, the Committee noted with satisfaction that WMO should co-ordinate the supply of meteorological and hydrological information for disaster mitigation and take an active role in co-ordinating the meteorological and hydrological support to humanitarian and relief efforts of the United Nations, during and after natural disasters and other crises.

Other discussions

41. Dr. Roman L. Kintanar as the Chairman of the STC of the IDNDR and on behalf of the DHA and the IDNDR Secretariat recalled to the session the relevance of the Disaster Prevention and Preparedness Component of the Typhoon Committee to the overall IDNDR effort. He also recalled the Typhoon Committee initiative in 1970 which had led to the establishment of the WMO TCP. He proposed that the Typhoon Committee Members instruct their representatives to the UN General Assembly to actively support any effort to increase the financial resources available to the IDNDR.

(d) Training Component (Agenda item 4 (d))

42. The Committee noted that Members continue and will continue to take every opportunity to further improve development of their human resources through the facilities available both inside and outside the region in cooperation with relevant bodies if appropriate. They also took advantage of the various training events, such as symposia, workshops and training courses.

43. The Committee expressed its gratitude to various governments which have offered financial support and/or facilities to these workshops, training courses and symposia.

44. A summary of the reports of the national activities in relation to the training component during 1995 is given in Appendix IX.

(e) Research Component (Agenda item 4 (e))

45. Research work continued to be an integral part of the three major components of the Members' activities.

46. The Committee noted with satisfaction the progress made in SPECTRUM by Members. Recent advances in the SPECTRUM research were presented.

47. The Committee recognized the fine efforts of Mr. M. Nagata of the Japan Meteorological Agency (JMA), coordinator for research studies under cooperation of correspondents in meteorological component, for compiling and distributing research activities of the Members for the period from October 1994 to September 1995. One of the most important objectives of this report is to encourage exchange of views and research activities.

48. A summary of the reports of the individual Members in relation to the research component of its activities in 1995 is given in Appendix X.

Activities of CAS

49. The Chairman of the CAS WGRTMR, through representations, informed the Committee of its group's continued commitment to the promotion of close interactions with the operational community, in the strong belief that research and operations can work very well together in a spirit of mutual cooperation. The recent interactions on International Workshop on Tropical Cyclones (IWTC)-III, the production of the Forecast Guide, the new book entitled "Global Perspectives on Tropical Cyclones", interactions on the SPECTRUM, TCM-90, Typhoon-90 field programmes and associated research provide excellent examples of the benefits from such interaction (Appendix XI).

50. He also brought to the attention of the Committee, progress with the first CAS Priority Mission with the aim of providing an enhanced effort on the following priority areas.

51. Two initial foci of this Priority Mission are the development of the autonomous Aerosonde for operational application and development of a CAS statement on climate change aspects of tropical cyclones. The Chairman informed the Committee that he had recently established a committee chaired by Professor Ann Henderson-Sellers, Deputy Vice Chancellor, Research at the Royal Melbourne Institute of Technology, whose task will be to gather all available evidence and produce a draft statement. The Committee recognized the importance of that CAS statement and agreed to participate in the related works as requested.

52. The Chairman also informed the Committee that following the successful format of the IWTC series, plans are underway for a similar series of quadrennial monsoon workshops, to be known as the International Workshop on Monsoon Studies. The first of these workshops is planned for November-December 1996.

53. The Committee expressed its gratitude to CAS for maintaining active cooperation and support to the activities of the Typhoon Committee.

III. REVIEW OF THE 1995 TYPHOON SEASON/ANNUAL PUBLICATIONS (Agenda item 5)

Review of the 1995 Typhoon Season

54. The RSMC Tokyo-Typhoon Centre provided the session with a summary of the 1995 typhoon (Appendix XII).

Annual Publications

55. The Committee expressed its appreciation of the Typhoon Committee Annual Review (TCAR) 94, 1995 Typhoon Committee Newsletter, and annual report on activities of RSMC Tokyo-Typhoon Centre 1994. TCAR 94 marked the third time that camera-ready manuscripts were prepared in-house at the Hong Kong Royal Observatory while the WMO Secretariat coordinated the most economical strategy for printing and distribution with the use of TCTF.

56. The Committee thanked the Chief Editor provided by Hong Kong and the national editors from other Members for their contributions to the publication of the TCAR 94. It also thanked the WMO Secretariat for the prompt printing and distribution.

57. The Committee was informed by the delegation of Hong Kong that this will be the last time that they can provide the services of a Chief Editor for the TCAR. The Committee after deliberations agreed that in the interim period, publication of the TCAR shall be done by the TCS. The delegation of Hong Kong then assured the Committee that they will assist the TCS with the preparation of the TCAR 95.

58. The Committee agreed that the publication of the Typhoon Committee Newsletter should continue.

IV. CO-ORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (Agenda item 6)

59. The considerations under this agenda item were based mainly upon the information contained in the twenty-first status report on the implementation of the WMO TCP and supplementary information presented verbally in depth at the session by the WMO representative. The Committee expressed its appreciation for the detailed information provided at the session on the implementation of the TCP. It noted with satisfaction the publication of a booklet entitled "Fifteen Years of Progress and Achievement of the WMO Tropical Cyclone Programme (1980-1994)".

60. The Committee was pleased to learn that the Seventh Training Course on Tropical Meteorology and Tropical Cyclone Forecasting was being organized by the Florida International University, Florida State University, National Hurricane Centre of the National Oceanic Atmospheric Administration (NOAA), USA, in co-operation with WMO from 18 March to 24 May 1996.

61. The Committee noted with appreciation the wide distribution of the publication entitled "Global Perspectives on Tropical Cyclones" issued in September 1995 as a WMO Technical Document (WMO/TD-No.693) in the TCP series (TCP-38).

62. The Committee was pleased to note that the second TCP RSMCs Technical Co-ordination Meeting and an Expert Meeting on the TCP Sub-project No. 19: Estimation of Amount of Precipitation Associated with Tropical Cyclones by Using Satellite Data will be held in Miami, USA at the RSMC-Hurricane Centre from 13 to 19 November 1996 and from 20 to 22 November 1996, respectively.

63. The Committee expressed its interest in the participation of the Typhoon Committee Members in the joint Seminar on Meteorological and Hydrological Risk Assessment to be organized by WMO, ESCAP, DHA, the IDNDR Secretariat and UNDP (New Delhi, India, 16 to 19 March 1996).

V. REVIEW OF THE PROGRAMME FOR 1996 AND BEYOND (Agenda item 7)

Regional Cooperation Programme Implementation Plan (RCPIP)

64. The Typhoon Committee, drawing attention to the vital importance of the activities included in the Committee's Regional Cooperation Programme included in the Committee's Regional Cooperation Programme Implementation Plan in the reduction of loss of lives and of damage to property and infrastructure, urged the Member governments to provide the required levels of funding and other resources to enable implementation of the plan. The Committee adopted the revised RCPIP which is contained in Appendix XIII.

Meteorological Component

(a) Future Activities of the RSMC Tokyo - Typhoon Centre

65. The Committee took note of the future activities of the RSMC Tokyo - Typhoon Centre which are contained in Appendix XIV.

(b) RSMC Data Serving System

66. The Committee was informed by the delegate of Japan of the establishment of an RSMC Data Serving System through Internet or ISDN which distributes data and products including the Grid Point Value (GPV) being prepared by RSMC Tokyo-Typhoon Centre to Members of the Typhoon Committee. (Appendix XIV).

(c) Study Tour in China for Typhoon Operational Forecasters

67. The Committee, accepted with appreciation, the invitation extended by China to host a study tour, possibly in December 1996 for typhoon operational forecasters of Typhoon Committee Members, aimed at the exchange of experience and knowledge in operational typhoon forecasting and increasing the capability of operational forecasts using the results of recent research studies. In this respect, China has offered to cover all the local expenses of all the participating experts including representatives from TCS and WMO.

Hydrological Component

68. The Committee adopted the following recommendations which had been formulated at the pre-session meeting of the hydrologists for implementation :

(a) The Committee to continue to solicit the assistance from the Members in dispatching a hydrologist to TCS. As a last resort, the Committee to request the Philippine Government to provide a hydrologist covering the period of vacancy as a temporary measure.

(b) TCS to evaluate the requirements of the Members and formulate proposals of future activities for the hydrological components.

(c) The Committee to consider providing financial support using the TCTF for the Members to participate in the Second Expert Meeting on MOFFS which will be held in the Typhoon Committee region in 1996 or early 1997.

Research Component

69. The Committee noted with interest the report of the SPECTRUM Research Coordinating Group (SRCG) prepared by its Chairman and the proposed organization of the Typhoon Research Coordinating Group (TRCG) as a spin-off working group from the SRCG, which will continue with the work started by the SRCG but with a wider range of research activities related to operational tropical cyclone analyses and forecasting.

70. The Committee, in principle, approved the recommendation of the Fourth Technical Conference on SPECTRUM with some amendments and established the Terms of Reference of the new TRCG (Appendix XVI). The Committee noted that a new Chairman and research programme should be identified by the group as early as possible after the group is established through the initiation of TCS in cooperation with WMO, and the technical conference on typhoons should be organized at the Committee's request and within the funds available. In addition, it further noted that both the improvement of operational observation and the further exploration of new methods of observation such as Aerosonde are important.

71. The Committee noted that the TRCG will welcome the nominations for memberships from the Typhoon Committee Members, preferably those who had served in the SRCG and Typhoon-90 (Vietnam).

Other Discussion

72. Hong Kong proposed that the Typhoon Committee should be the body to assign names to tropical cyclones in the Western North Pacific and the South China Sea. This can lead to standardization of the usage of names for tropical cyclones by Members in the Typhoon Committee region. The Committee recognised that this is a long term process which required collaboration with other bodies and requested its Members to consider this issue for further discussion during the forthcoming sessions.

VI. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (Agenda Item 8)

73. The Committee expressed its gratitude to the Government of the Philippines for hosting the TCS and for providing a full time meteorologist and a part-time expert on disaster prevention and preparedness. The Committee was pleased to note that the Government of the Philippines would continue to facilitate the functioning of the TCS in Manila through a similar arrangement during the next period.

74. The Committee expressed its gratitude to Dr. Roman L. Kintanar in his capacity as TCS Co-ordinator for the dedication and continuous services extended by him.

75. The Committee also expressed its appreciation to the Government of Japan for having provided the services of a hydrological expert at the TCS for more than twenty years.

76. The Committee welcomed Ms. Nanette C. Lomarda, Supervising Weather Specialist of PAGASA who was designated as TCS Meteorologist succeeding Mr. Gabriel S. Monroy from 2 January 1995. The Committee expressed its appreciation to Mr. Toshio Okazumi (Japan), for the valuable services he rendered to the Committee as hydrologist and flood forecasting expert of TCS.

77. The Committee expressed its appreciation for the kind offer of the Government of the Philippines to second on a temporary basis an expert on hydrology to the TCS for the interim period until an offer is received from a member of the Typhoon Committee to provide a hydrologist on a long-term basis.

78. The Committee was informed that ESCAP would continue to undertake activities in support of the Typhoon Committee within the framework of its own work programme. This might also include undertaking of projects on substantive issues relating to mitigation of damage from typhoons, floods and droughts in Asia and the Pacific, which would be drawn up in close consultation with TCS. The project proposals on land use planning and practices in watershed management and disaster reduction and training workshops on flood risk analysis have been prepared for submission to potential donor countries for funding consideration.

79. The Committee was pleased to note that ESCAP could provide advisory services on flood protection, drainage and other hydrological work through its Regional Adviser on Water Resouces and that TCDC funding could be made available to support exchange of experts among developing countries in the fields of hydrology and disaster prevention and preparedness.

80. The Committee welcomed ESCAP's efforts to increase the manpower resources available to undertake work on natural disaster reduction, and appealed to donor countries and agencies to provide additional manpower and adequate extra-budgetary support for implementation of activities on natural disaster reduction.

81. The Committee reviewed the financial report on the TCTF (see Appendix XVII). The Committee was pleased to note that a certain degree of self-reliance had been achieved through the establishment of the Trust Fund which provides for the financial requirements of the Committee. The Committee urged its Members to continue and enhance their contributions to

the TCTF. The Committee was pleased to note that several Members pledged their contributions to the Fund. The Committee was informed by the delegation of Vietnam that their Government had approved the annual contribution to the TCTF.

82. The Committee agreed to the use of the TCTF for the following purposes until the twenty-ninth session:

(a) Augmentation of travel funds for TCS staff missions;

(b) Support for organizing symposia, technical conferences and workshops related to typhoons;

(c) Publishing the Typhoon Committee Newsletter periodically;

(d) Support to the TCS, including representation expenses;

(e) Printing and distribution cost of documents for the twenty-ninth session;

(f) Support to the publication of TCAR 95;

(g) Support to the attachment of typhoon experts to advanced centres;

(h) Support to hydrologists of Members for such activities as exchange visits, attachment of experts to advanced centres, consultation missions and others;

(i) Support to attendance of experts to the joint Seminar on Hydrological and Meteorological Risk Assessment, New Delhi, 16-19 March 1996;

(j) Support to attendance of hydrological experts to the Second Expert Meeting on MOFFS ;

(k) Support to a mission team of the Typhoon Committee to the Cambodian Meteorological Service in Phnom Penh and the Laos Meteorological and Operational Hydrological Office in Vientiane in July 1996;

(l) Support to the attendance of typhoon experts to a study tour in China;

(m) Any other emergency case that can be justified for the use of the TCTF, requiring concurrence of both the TCS Coordinator and the Typhoon Committee Chairman.

83. With increasing demand on the use of TCTF, the Committee agreed that there would be a need in the near future to prepare indicative year to year budget estimates on activities that require support under the TCTF for consideration at annual session.

84. The Committee requested its Chairman to make the necessary arrangement for a representative of the Typhoon Committee to attend the next ESCAP Commission session and present the report of this session of the Typhoon Committee and solicit funding and other support for the activities of the Committee on natural disaster reduction in Asia and the Pacific.

85. The Committee recognized the need to approach additional sources of support for its actvities. It agreed that efforts continue to be made by the TCS, WMO and ESCAP to enlarge the number of contributors to the TCTF, by approaching other sources such as countries which are not members of the Committee. It also agreed to submit proposals to other possible sources such as the UNDP, Asia Pacific Network, Asian Development Bank (ADB), Global Environment Facility (GEF) and other institutions. In this regard, the Committee urged the National Governments concerned to request financial assistance from the ADB for the new inter-country project on reducing national disasters related to typhoon and to accord the highest priority preferably linked with environmental issues.

86. The Committee noted the importance of TCDC as a means of promoting and strengthening collective self-reliance. It was pleased to note that a number of TCDC activities were carried out by some of its Members. The Committee urged its Members to take an active part in this important activity.

87. The Committee reiterated the importance it attached to assistance on a bilateral basis from developed countries to its activities. The Committee was particularly pleased to note with appreciation Japan's continuous support to developing countries in the Typhoon Committee region.

88. The Committee was informed on the status of the WMO Voluntary Co-operation Programme (VCP). The TCS members were encouraged to update their requests for VCP assistance to WMO.

VII. AGENDA FOR THE SECOND JOINT SESSION OF THE TYPHOON COMMITTEE AND THE PANEL ON TROPICAL CYCLONES (Agenda item 9).

89. A provisional agenda for the second joint session of the Typhoon Committee and the Panel on Tropical cyclones (see paragraph 91) will be prepared by WMO after consultation with ESCAP, TCS and Technical Support Unit (TSU).

VIII. DATE AND PLACE OF THE SECOND JOINT SESSION OF THE TYPHOON COMMITTEE AND THE PANEL ON TROPICAL CYCLONES (Agenda item 10)

90. The representative of Thailand extended an official invitation to the Committee to hold the second joint session of the Typhoon Committee and the Panel on Tropical Cyclones in Thailand. The joint session will be hosted by Thailand in the early part of 1997 subject to the final approval of its Government. The Committee in accepting the kind invitation, expressed its thanks and deep appreciation to the Government of Thailand. The exact dates and its venue would be determined later based on consultation between WMO, ESCAP, Thailand, TCS, and TSU.

IX. SCIENTIFIC LECTURES (Agenda item 11)

92. The following scientific lectures were presented:

(a) An Outline of the New JMA Global and Typhoon Prediction Models and Examples of their Typhoon Prediction.

By : Mr. Toshiyuki Ono (Japan)

(b) Airborne Systems Integrator

By : Mr. Harold E. Ice (USA)

(c) 1995 Atlantic Hurricane Season

By : Dr. Richard J. Pasch (USA)

(d) The Necessity of Enforcement Plan for the Introduction of Evaluation System of Disaster Effect.

By : Mr. Heung Soo Cheong (Korea)

(e) A Scheme to Estimate the Intensity of the Tropical Cyclone in the North Western Pacific Based on Stretched-Visible Infra-red Spin Scan Radiometer (S-VISSR) Data Methodology, Test and Application.

By : Mr. Qiu Guoqing (China)

(f) Overview of the Systematic Approach to Tropical Cyclone Track Forecasting being tested at the Joint Typhoon Warning Centre (JTWC), Guam.

By : Prof. Russell L. Elsberry (USA)

(g) Recent Advances on Numerical Typhoon Prediction at The Korea Meteorological Administration.

By : Dr. Kyung-Sup Shin (Korea)

92. Video Tape Presentations

(a) Are you prepared for an earthquake?
- Learning about the great Hanshin / Awaji Earthquake -

Courtesy of Mr. Tsutomu Honda (Japan).

(b) Rivers Run Through Them
- Cities and Their Rivers Today -

Courtesy of Mr. Katsumi Seki (Japan).

93. The Committee expressed its thanks to the lecturers and to those who provided the video tapes.

X. ADOPTION OF THE REPORT (Agenda item 12)

95. The Committee adopted its report on 11 December 1995.

APPENDIX I

LIST OF PARTICIPANTS
MEMBERS OF THE TYPHOON COMMITTEE

CHINA

Representative : Mr. Yan Hong, Deputy Administrator, China Meteorological Administration.

Alternates : Mr. Zhang Guocai, Director General, Department of Operation Development and Weather, China Meteorological Administration.

Mr. Qiu Guoqing, Deputy Director, National Meteorological Center, China Meteorological Administration.

Mr. Xin Xianhua, Division Director, International Cooperation Department, China Meteorological Administration.

HONG KONG

Representative : Mr. Robert Lau Chi Kwan, Director Royal Observatory Hong Kong.

Alternate : Mrs. Elaine Koo, Assistant Director, Royal Observatory Hong Kong.

JAPAN

Representative : Mr. Toshiyuki Ono, Director General, Forecast Department, Japan Meteorological Agency.

Alternates : Mr. Tsutomu Honda, Deputy Director, Anti-Disaster Measures Operation Division, Disaster Prevention Bureau, National Land Agency.

Mr. Katsumi Seki, Senior Officer, River Planning Division, River Bureau, Ministry of Construction.

MACAU

Representative : Mr. Antonio Pedro F. da Costa Malheiro, Director, Meteorological and Geophysical Service, Macau.

Alternates : Mr. Oscar Antonio Gomes Da Silva, Secretary General, Security Coordination Office, Quartel De S. Francisco, Macau.

Mr. Antonio Viseu, Meteorological Division Head, Meteorological and Geophysical Service, Macau.

Mr. Fernando Augusto Sales Crestejo, Meteorological Forecaster Center Chief, Meteorological and Geophysical Service, Macau.

MALAYSIA

Representative : Mr. Cheang Boon Khean, Director-General, Malaysian Meteorological Service.

Alternates : Dato' Mohamad bin Hussain, Director-General, Department of Social Welfare Malaysia.

Dr. Lim Joo Tick, Deputy Director-General (I), Malaysian Meteorological Service.

Mr. Selamat bin Hj. Dahalan, Deputy Director-General, Civil Defense Department.

Tengku Hashim bin Long, Director, Prevention, Investigation and Enforcement Department of Social Welfare.

Mr. Ooi See Hai, Director, Research Division, Malaysian Meteorological Service.

Ir. Hj. Ghazali bin Omar, Director, Division of Hydrology, Drainage and Irrigation Department.

Ir. Chong Sun Fatt, Senior Hydrology Engineer, Division of Hydrology, Drainage and Irrigation Department.

Mr. Abdul Khadir bin Othman, Deputy Director, Crisis and Disaster Management Unit, National Security Division, Prime Minister's Department.

Mr. Md. Rashid bin Ismail, Assistant Director, Department of Social Welfare.

Col. (R) Tony Joseph, Director, Emergency Response, Malaysian Red Crescent Society.

PHILIPPINES

Representative : Dr. Rosa T. Perez, Supervising Weather Specialist, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Alternate : Ms. Margaret P. Bautista, Senior Weather Specialist, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

REPUBLIC OF KOREA

Representative : Mr. Moon Il Kim, Director General, Forecast Bureau, Korea Meteorological Administration.

Alternates : Mr. Heung Soo Cheong, Director-General, Disaster Prevention and Preparedness Bureau, Ministry of Home Affairs.

Dr. Kyung-Sup Shin, Director, Numerical Weather Prediction Division, Korea Meteorological Administration.

Mr. Choong-Soo Lim, Director, River Planning Division, Ministry of Construction and Transportation.

THAILAND

Representative : Mr. Smith Tumsaroch, Director General, Meteorological Department.

Alternates : Dr. Patipat Patvivatsiri, Deputy Director General, Meteorological Department.

Mr. Narong Piyabhan, Director, Studies and Research, Meteorological Department.

Mr. Paichit Thimthong, Assistant Director, Relief Division, The Thai Red Cross Society.

Dr. Manoj Mukati, Assistant Head, Relief Department, The Thai Red Cross Society.

Mr. Vitchan Busapavanich, Chief of Planning and Practicing Branch, Civil Defense Division, Department of Local Administration, Ministry of Interior.

Mr. Chainarong Vasnasomsithi, Chief of Planning Section, Civil Defense Division, Department of Local Administration, Ministry of Interior.

Mr. Somporn Wangwongwiroj, Flood Information Subdivision Chief, Department of Drainage and Sewerage System, Bangkok Metropolitan Administration.

Mr. Maitree Rattanaphong, Chief of Survey and Development Channel, Department of Drainage and Sewerage System, Bangkok Metropolitan Administration.

Mr. Rungsan Sirayayon, Hydrologist, Hydrology Division, Royal Irrigation Department.

VIETNAM

Representative : Prof., Dr. Trinh Van Thu, Deputy Director General, Hydrometeorological Service.

Alternates : Prof., Dr. Le Bac Huynh, Vice Director, National Centre for Hydrometeorological Forecasting, Hydrometeorological Service.

Mr. Dang Quang Tinh, Deputy Director, Standing Office of Vietnam Flood and Typhoon Committee.

OTHER STATES [1]

BRUNEI DARUSSALAM

Representative : Mr. Hj. Sidup bin Hj. Sirabaha, Meteorologist, Meteorological Service, Department of Civil Aviation, Ministry of Communication.

[1] Participated in the capacity of observer.

INDONESIA

Representative : Mr. Karjoto Sontokusumo, Director General, Meteorological and Geophysical Agency, Department of Communications, Jakarta.

Alternates : Dr. Paulus Agus Winarso, Chief of Forecasting and Services Division, Meteorological and Geophysical Agency, Department of Communications, Jakarta.

Mr. Bambang Suprihadi, Staff of Planning Division, Meteorological and Geophysical Agency, Department of Communications, Jakarta.

RUSSIA FEDERATION

Representative : Mr. Alexei Borodavkin, Minister-Counsellor, Deputy Permanent Representative of Russian Federation to ESCAP, Russian Embassy, Bangkok, Thailand.

SINGAPORE

Representative : Mr. Lam Keng Gaik, Meteorologist, Meteorological Service Singapore.

UNITED STATES OF AMERICA

Representative : Dr. Richard J. Pasch, Hurricane Forecaster, Tropical Prediction Center / National Hurricane Center, National Weather Service, National Oceanic and Atmosphere Administration, Department of Commerce, Miami, Florida.

Alternates : Mr. A.E. (MAC) McCaskey, Director of Government Programs, E-System, Greenville Division.

Mr. Harold Edward Ice, Deputy Director of International Programs, E-System, Greenville Division.

UNITED NATIONS SECRETARIAT

Department of Humanitarian Affairs (DHA) /IDNDR Secretariat — Dr. Roman L. Kintanar, Chairman, IDNDR Scientific and Technical Committee

United Nations Development Programme (UNDP)	Ms. Ameerah Haq, Regional Representative.
United Nations Educational, Scientific and Cultural Organization (UNESCO)	Dr. Michio Hashizume, Programme Specialist, UNESCO Office, Jakarta.

OBSERVER

WMO Commission for Atmospheric Sciences (CAS)	Prof. Russell L. Elsberry, WMO CAS Representative, Professor of Meteorology, Naval Postgraduate School.

TYPHOON COMMITTEE SECRETARIAT

Dr. Roman L. Kintanar	Coordinator, Typhoon Committee Secretariat.
Ms. Nanette C. Lomarda	Meteorologist, Typhoon Committee Secretariat.
Mr. Toshio Okazumi	Hydrologist / Flood Forecasting Expert, Typhoon Committee Secretariat.

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Mr. Cengiz Ertuna	Chief, Water Resources Section, Environment and Natural Resources Management Division.

WORLD METEOROLOGICAL ORGANIZATION

Mr. Eisa Hussain Al-Majed	Director, Regional Office for Asia and The South-West Pacific.
Mr. Katsuhiro Abe	Chief, Tropical Cyclone Programme Division, WWW Department.

LOCAL SECRETARIAT

Mr. Kang Thean Shong	Chief
Mr. Wan Azli Wan Hassan	Deputy Chief
Mr. Goh Hee Leng	
Mr. Tan Kah Poh	
Mr. Osman Kamaruddin	
Ms. Rahimah bte Khalid	
Ms. Lim Mae Ai	
Mr. Zainal Abidin	
Mr. D. Anpuraj	
Mr. Mohd. Din bin Ibrahim	
Mr. Abu Hassan bin Rashid	

APPENDIX II

AGENDA

1. Opening of the session
2. Election of officers
3. Adoption of the agenda
4. The Committee's activities during 1995:
   (a) Meteorological component;
   (b) Hydrological component;
   (c) Disaster prevention and preparedness component;
   (d) Training component;
   (e) Research component.
5. Review of the 1995 typhoon season/annual publications
6. Coordination with other activities of the WMO Tropical Cyclone Programme
7. Programme for 1996 and beyond
8. Support required for the Committee's programme
9. Agenda for the second joint session of The Typhoon Committee and the panel on Tropical Cyclones
10. Date and place of the second joint session of The Typhoon Committee and the panel on Tropical Cyclones
11. Scientific lectures
12. Adoption of the report

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

In **CHINA**, the NMC/CMA added a second CPU to its CRAY C90 supercomputer in February 1995, which upgraded the CRAY's peak performance to 2000 Mflops.

An IBM SP2 parallel computer was installed at NMC/CMA in early June. This is the first Massively Parallel Processing (MPP) computer purchased by CMA. The SP2 system consists of 32 high performance processing nodes, interconnected by a high speed switching network. Peak performance of each node is 266 MFlops, and the total peak performance exceeds 8500 Mflops. The SP2 system will be used as a development platform for various NWP parallel versions.

Also installed in 1995 are 3 SGI Indigo2 multimedia workstations and 15 SGI Indy desktop workstations. They enhanced NMC's visualization and network computing environment.

Two S-band pulse-pulse coherence Doppler Radars (714 SD, 10 cm), which were designed and made in China, were installed in Xiamen, Fujian Province and Shantou, Guangdong Province to replace weather radar 713 (c-band) and 714 (s-band), in November 1994 and September 1995 respectively. Meanwhile the weather radar 714 in Changle, Fujian Province was improved and is now capable of providing the performance of a Doppler Radar.

A new version of the NWP model for typhoon track prediction was developed by the staff of the NWP division of NMC in 1995 and has been in operation since summer. Compared to the old version, the new one has a higher resolution of 50 km and a new physical parameterization package which includes the following physical processes:

- deep convection
- shallow convection
- vertical turbulence diffusion
- surface physical processes
- under-ground thermal conductivity
- radiation
- modification of the "negative" moisture fields
- large scale condensation

The results of the typhoon forecasts this summer using the new version showed encouraging results. For the 24h and 48h forecasts the mean errors of typhoon center positions are 187 km (31 cases) and 368 km (21 cases) respectively.

The typhoon and torrential rain forecast and service system developed in the NMC, integrated all research achievements of typhoon and torrential rain forecast methods achieved during the "Eighth Five-year Plan" period. With such a system, forecasters can obtain information more easily and rapidly and have more choices of forecast tools and methods to facilitate their work. As a result, forecasters may concentrate on making and improving the forecast of typhoon and torrential rain.

Another forecast system developed in NMC is the Meteorological Interactive Process System (MIPS). This system provides forecasters a powerful tool with the capability of mancomputer interaction, processing and displaying graphs, images, various kinds of data and guidance products. It can perform the analysis of conventional weather charts, display and modify forecast charts, satellite images, and radar echo pictures. The system has speeded up the production of various charts. As a result, forecasters may then concentrate on the production of forecasts and consequently improve forecast accuracy.

In **HONG KONG**, a replacement ground station for the reception of satellite pictures from the Geostationary Meteorological Satellite (GMS-5) was delivered in late 1995. The station scheduled to be operational in early 1996, will receive the additional split-infrared and water vapour pictures available from the satellite.

The Royal Observatory started operating a new Doppler Weather Radar installed in 1994. Located at Tate's Cairn at 577 meters above Mean Sea Level, the 10-cm wavelength (S-band) radar is capable of measuring reflectivity to a range of 550 km. It measures the velocity of approach and departure (i.e. Radial velocity) of rain areas. Scanning the atmosphere every six minutes, the radar transmits data to the Observatory Headquarters in Kowloon via a highspeed telephone line, while at the Observatory's Central Forecasting Office, a computer Workstation processes the data and displays various radar products to the forecaster. A separate wortkstation at the Airport Meteorological Office at the Kai Tak International Airport taps some products from the main workstation. The radar system is capable of controlling radar operations remotely and monitor its status. Some system diagnoses can be performed at the Observatory Headquarters, and this facilitates troubleshooting by saving considerable travel time.

Professional meteorologists from the Observatory continued to present weather programmes for all three local television stations. A studio at the Observatory headquarters was put into operation during the year for the production of television weather programmes, as well as for the conduct of weather briefings to the mass media during rainstorm and tropical cyclone situations.

An additional high-speed UNIX server was installed during 1995 as part of an off-site data processing center to back up the main computer system in case of disruptions.

The Dial-a-Weather service continued to gain popularity among the local public. The number of calls handled by the service now averages 60,000 a day, and the total for 1995 is expected to exceed 20 million.

During 1995, the Observatory further enhanced its Fax Manager, an automatic facsimile dissemination system. Additional fax lines were added to the system to speed up the dissemination of warning bulletins. New hardware was also installed to ensure smooth operation during hectic hours. A replacement windshear warning system was set up at the Hong Kong International Airport with added features like cross-wind warnings. During the close passage of two typhoons in 1995, strong cross-winds were the major cause of many flight diversions.

A climatological database was installed to facilitate rapid retrieval of information dating back to 1885. Work is at hand to install a database containing synoptic data within the Asia-Pacific region which would be operational next year.

A prototype Operational Tropical Cyclone Information System (OPTIS) was developed to provide at forecaster's fingertips various information on tropical cyclones. It displays eye fixes, warning positions and allows forecasters to test different forecast tracks from which parameters such as time of landfall and closest approach could be calculated.

Computer programs were developed to facilitate the running of the PC-based SLOSH storm surge model developed by Dr. C.P. Jelesnianski. SLOSH's products were used to assess the possibility of storm surge induced see flooding during the passages of tropical cyclones such as Severe Tropical Storm Helen and Typhoon Kent of 1995.

In **JAPAN**, the Japan Meteorological Agency (JMA) started operation of the Geostationary Meteorological Satellite (GMS-5) on 13 June 1995 after its launching in March on board H-II Rocket 3 at the Tanegashima Space Center of the National Space Development Agency (NASDA) of Japan.

The GMS-5, successor to GMS-4, has observational functions enhanced by the introduction of water vapor infrared split-window sensors in place of GMS-4's single infrared sensor. GMS-5 will allows JMS to obtain necessary information in analyzing meteorological phenomena, such as cloud distribution, sea surface temperature, height of cloud, satellite wind vectors and water vapor distribution.

GMS-5 is expected to contribute to the activities of National Meteorological Services in the improvement of weather forecasts, mitigation of natural disasters, and monitoring climate change. Imageries taken by the GMS are disseminated to weather services in 26 countries and territories in Asia and the Pacific region.

GMS-5 aside from obtaining imagery of the earth also relays meteorological data from data collection platforms (DCPs). Thirty six (36) DCPs are registered or will be registered by the end of 1995 from other Members of the Typhoon Committee.

GMS-4 is now at 120 E over the equator as a stand-by satellite.

All of the 19 meteorological radars operated by the Japan Meteorological Agency (JMA) are equipped with the Radar Echo Digitizing and Disseminating System (REDIS), which digitizes the observed echo and transmits the data to the Headquarters of JMA.

The Sapporo radar was moved from the Sapporo District Meteorological Observatory to the top of Mt. Kenashiyama and was operational by 1 September 1995. The radar at the new location covers a much larger area than that at its former location, from the northern part of Hokkaido and its western coast.

Eighteen (18) upper-air observation stations of JMA are in operation and all systems collect and process observational data and automatically sends reports to the Headquarters of JMA.

In March 1996, the operation of a new model of rawinsonde(RS2-91) will commence at Minamidaitojima (47945) in place of the former model (RS2-80). The deployment of RS2-91 at JMA's upperair stations will be completed except at Ishikajima (47918) where the fomer model will be replaced in 1997.

Ryofu Maru III, the flagship of the six (6) observation vessels operated by JMA was commissioned in July 1995 replacing Ryofu Maru II, which made numerous marine meteorological and oceanographic observations in the western North Pacific from 1966.

JMA made five (5) cruises with its three (3) meteorological observation vessels (Ryofu Maru, Keifu Maru and Chofu Maru) in 1995 to monitor seasonal-to-interannual variations of the oceanographic structure in the tropical waters. In addition, JMA made marine meteorological observations as well as observations of the sub-surface layer in seas south of Oknawa in August and September 1995 with Keifu Maru.

JMA currently operates eleven (11) ultrasonic ocean wave gauge stations along the Japanese coast that automatically observe and transmit hourly reports of the significant wave height and wave spectrum to the Headquarters of JMA. Among them, the equipment at Atsumi was renewed in October 1995.

In addition to 66 tide stations, JMA has plans to install new tide gauges at eleven (11) sites by the end of FY 1995 to intensify the capability to observe storm surges and tsunamis.

In April 1995, JMA developed an RSMC Data Serving System to provide Members of the Typhoon Committee with grid point values of the analysis and the forecast of JMA's Global Spectral Model.

The telecommunication circuit between Tokyo and Bangkok, which is a main regional circuit in Region II, was upgraded on 10 March 1995 from 200 bps to 1200 bps.

An asymmetrical bogus method was introduced into the operational numerical prediction on 23 August 1994. This method has reduced the mean error of 48-hour prediction of the typhoon center position with the Global Spectral Model by about 10%. Some reduction in the same error was noted in the Asian Spectral Model.

A man-machine interaction system to determine the center position of a typhoon from radar imagery is being developed by JMA. It is expected that this new system can reduce the time for determining the typhoon center compared with the present method of drawing a sketch of the Plan Position Indication (PPI) imagery.

In **MACAU**, the network of automatic weather stations (AWS) located throughout the territory including the islands of Taipa and Coloane had a great improvement to the Weather Forecasting Center informations. The observation network which links the AWOS of the Macau Meteorological and Geophysical Sciences, Guangdong Meteorological Bureau and the Hong Kong Royal Observatory in the delta region is in operation and is giving detailed information of hazardous weather condition in the Pearl River Delta.

The International Airport of Macau had test flights in June and October 1995 and is already having commercial flights (unofficial) beginning on the 9th November 1995. Official inauguration is set on 8th December 1995.

Four Meteorologists, two forecasters and eleven observers compose the operational staff of the airport. Weather observations in the airport and forecasts made in the Airport Meteorological Center will be received by SMG Weather Forecasting Center.

A "Classic" Weather Station will be installed at the "Mid" point of the airport runway to serve as back-up for the electronics Meteorological Airport system.

The use of the public PSTN telephone network to disseminate the latest weather and tropical cyclone information by facsimile machines will soon be operational. The operation of upper-air observing stations is now being planned.

A Doppler Weather Radar which would be directly linked to the mini-computer of the weather service through a direct optical fibercable will be delivered and installed in 1996.

A high resolution satellite receiver will be delivered before the end of the year and installed early next year.

A new meteorological software (Metis 2000) for forecasting activities is now in full operation at Macau's Weather Forecasting Center.

In **MALAYSIA**, installation works of 38 automatic weather stations in the state of Selangor and Federal Territory of Kuala Lumpur are to be completed by November and the system will be operational by December 1995. The Control Center for the observation network is located at the Meteorological Headquarters in Petaling Jaya.

The Control Center will interrogate each automatic meteorological station through dial-up at prefixed interval or as and when the situation warrants. The real-time meteorological information will be useful for monitoring of heavy rain and flash floods.

The Malaysian Meteorological Service (MMS) will also procure an Information Provider System with the objective of setting up a server for provision of meteorological data to users, either through dial-up or public network such as INTERNET.

MMS has acquired a radar integration system which is an enhanced version of the RAPIC system currently in use in Australia. The system would permit the automation of radar data collection, integration and distribution by linking up the weather radars at Butterworth, Subang and Kluang to the Data Collection and Processing Center at the MMS Headquarters in Petaling Jaya. The installation of the system was completed in October 1995.

The MMS embarked on a program to modernize its national telecommunication for meteorological information exchange in 1993. The first phase of the project which commenced in 1993 was aimed at creating a skeleton wide-area network computer-to--computer link connecting its 6 regional forecast centers (RFCs) and 32 principal meteorological observation stations (MSs) to a computerized National Meteorological Communication Center (NMCC) located at the MMS headquarters. In this setup, the RFCs were connected through dedicated lines at 9600 bps and using X.25 protocol while the MSs were linked through dial-up lines at 2400 bps. This phase was commissioned in March 1995. However, a few problems involving the Rapid Information Management (RIM) software developed by Lockheed still remains unsolved.

The second phase of the above project which will be implemented this year is designed to provide some fault-tolerance to the system particularly at the NMCC and RFCs. It is also designed to fully automate the plotting processes at the RFCs. The third phase involves automating some of the climate data-entry and quality-checking processes by enhancing the CLICOM facilities. It is envisaged that the project will be completed by mid-1996.

MMS is in the process of equipping 15 airport stations with AWS systems replacing the conventional meteorological equipment. Installation of the AWS is scheduled to be completed by the end of 1995.

The AWS system aside from permitting automation of observations also facilitates the sending of weather information to Air Traffic Control towers as well as channeling data into the National Computerization Network which re-distributes the data to the various Meteorological offices throughout the country.

In the **PHILIPPINES**, PAGASA coordinated with twelve (12) selected municipal agricultural officers of Nueva Ecija for the conduct of surveys aimed at a more effective farm weather forecast. In conjunction with this, a firm linkage was established with the Science Watch Action Team (SWAT) of the PCARRD for eventual dissemination of farm weather forecasts utilizing the Barangay Community Broadcasting Network of the Development of Science and Technology (DOST).

A Seminar/Workshop for Mediamen on Weather Forecasting and Tropical Warning System was conducted from 30 June to 2 July 1995 in Baguio City with 29 mediamen participants from the National Capital Region. The media practicioners with the assistance of weathermen drew up guidelines for effective dissemination of tropical cyclone and flood warning messages to the public.

Six (6) Drought Advisories pertaining to the development of El Nino Southern Oscillation (ENSO) in the tropical Pacific was issued by the Climate Change and Drought Early Warning and Monitoring Center of PAGASA.

The "Enhancement of Meteorological Delivery System to the Countryside," a French assisted PAGASA project, is now on its second phase which involves the supply, delivery, installation, testing, and commissioning of meteorological observing and communication systems. A third Integrated Meteorological Observation System (IRMOS) was installed at the Davao International Airport while a fourth IRMOS is ready for installation at the Puerto Princesa Airport.

Baler radar remained in full operation during the year while the Tanay, Guiuan and Aparri radars operate occasionally. Operations of the seven upper-air observing stations was still hampered due to lack of consummables.

To cope with the increase in the volume of data traffic, the point-to-point circuit between Manila and Singapore was upgraded to 200 bps and the circuit performed satisfactory during the year. The Japan-assisted Meteorological Telecommunication System Development Project (MTSDP) was partially turned over to PAGASA on 31 March 1995. The one-year Operation and Maintenance Agreement was also approved on the same date.

In the **REPUBLIC OF KOREA**, the Korea Meteorological Administration (KMA) has installed an automatic meteorological observation system (AMOS) at Sokcho and Mokpo airport in 1995. This is in additon to the AMOS at 3 international airports (Kimpo, Cheju and Kimhae). KMA will install two more AMOS in 1996 at Yeosu and Ulsan airports to continue automatization of airport observation system and aviation meteorological information system.

KMA has launced a project in 1995 which involves the installation of ocean buoys. This will be completed in 1998 with the installation of 5 medium-sized buoys and a large-size buoy around the Korean Peninsula. Two medium-sized buoys contracted from the Coastal Climate Company, USA will be set up in the Western Sea (Yellow Sea) in early 1996 for operational purpose. Other buoys will be installed in the Southern and Eastern Sea (Japan Sea) by 1988.

KMA is currently establishing a coastal watching system for real-time monitoring of the sea state through high-resolution CCTV.8 system at the major ocean routes. Each system consists of a color TV camera, a processor, modems, monitors and system software. The image will be transferred through high-speed dedicated circuit to local forecast office to enhance ability for coping with the sea state. Installation of the system will be completed by the end of 1995.

The Korea Meteorological Adminstration (KMA) inaugurated on 23 March 1995 the KMA Meteorological Analysis and Prediction System (KMAPS), a new supercomputer for numerical weather prediction. The KMAPS will be used to implement operational NWP system, researches, and development in KMA. Consisting of a mainframe supercomputer (Fujitsu VPX-220), server (SUN CENTER 2000), page printer, juke box and workstations, the KMAPS has peak performance of 1.25 Gflops with 1 Gbyte memory and 45 Gbyte hard disk. With its own KMAPS NWP operational system capability, the KMA will continue developing NWP system toward global model operation for medium-range forecast in the near future.

KMA has developed an NWP system using the CRAY-C90 supercomputer at other institution. KMA is currently operating three limited area models (LMAs), a regional model (F-LAM), a local model (K-LAM), and a typhoon model (KTM). KMA will continue to develop NWP systems toward global spectral model for medium-range forecast and expanding model output applications.

The current computer for database, the Miracle 20000, was upgraded by adding 2 mode CPUs and memory enhancement in 1995. This UNIX-based system is operating for

archival of domestic and global database and for supporting on-line monitoring of worldwide weather systems and statistics.

The speed of KMA's domestic meteorological telecommunication lines between the headquarters and regional/local forecast offices was upgraded to T1 level in 1995. Among the 35 regional/local forecast offices, 19 have already completed their speed upgrade from 9600 bps to 512 Kbps.

In the field of NWP, the domain of the operational regional model of KMA, the Fareast Limited Area Model (F-LAM) has been extended from 61X46 grid system to 77X63 in March 1995. The horizontal grid space and vertical layers remain the same (i.e. 80 km and 15 layers). The impact of a larger domain indicated that the threat scores of precipitation have improved, especially at 36 and 48 hour prediction by about 5%.

A barotropic typhoon model with continuous dynamic grid adaption (CDGA) technique was developed and tested for four 1995 typhoons. One feature of the model is an automatic grid function so that the grid system has better resolution around the typhoon center. Results are encouraging and this model will be used operationally in next year's typhoon season.

KMA adapted the Global Spectral Model (GSM) from JMA to support their limited area model operation and medium-range forecast system. The source codes of GMS and 4-dimensional data assimilation from JMA have been converted to KMA's computing environments and after several tests the T106L21 version will start operation in early 1996.

To cope with the new GMS-5, the satellite data receiving and analysis system in KMA was modified by its staff. KMA started routine operation with the new receiving system in June 1995 and received and stored newly added moisture channel and split IR-channels from GMS-5. The revised program can also store look-up table to calculate count values to brightness temperatures and parameters to calculate brightness tempertures to out-going radiation. Aside from satellite imagery, new analysis programs to calculate difference of split-IR channels, etc. has been developed and is now a part of routine operation. The moisture channel imagery is used for operational forecasts. Researches on the application of the new data such as differences between channels are currently in progress.

In **THAILAND**, an X-band Doppler weather radar was installed at the Head Office and has been in operation since July 1995 while the S-band Doppler radar at Hua Hin started operating in October 1995. The Meteorological Department of Thailand also purchased in 1995 four X-band Doppler weather radars for Narathiwat, Trang, Ranong, Mae Hong Son and a mobile X-Band Doppler weather radar at the Head Office. By 1977, data from 14 weather radars will be linked via the telecommunication satellite "THAICOM" to the radar network located at the Head Office.

The hardware and software of the existing satellite receiving system (GSC-METPAK at the Head Office is being upgraded as well as its capability on data retrieval and products exchange between the satellite systems and the National Data Center (NDC) and will be completed by the end of 1996.

Three sets of AWOS for Ubon Ratchathani, Udon Thani and Lampang has been in operation since June 1996 while two sets for Sakon Nakhon and Nan will be installed by the end of 1996 and six sets for Chumpton, Ranong, Phetchabun, Burirum, Trang and Nakhon Ratchasima by 1997.

The Wind Shear Alert System (WSAS) at the Chaing Mai International Airport is now in operation as well as the WSAS at the Hat Yai International Airport which was installed in mid-December 1994.

Two sets of Ozone Spectrophotometer will be set up at the Head Office and Songkhla-Regional Meteorological Center by the year 1996 while two sets of Automatic Radiotheodolite Systems are scheduled to be purchased this year. A set of OPMET Data Bank will be set up at the Aeronautical Meteorological Division also in 1996.

In operation since July 1995 is an automatic message switching system which enabled the upgrade of the Bangkok-Tokyo, Bangkok-Hanoi, Bangkok-Jeddah, Bangkok Yangon etc. circuits as well as the establishment of new GTS circuits, Bangkok-Singapore and Bangkok-Beijing.

Soon to be established are two GTS point-to-point circuit of low speed telegraph link between Bangkok-Vientiane and Bangkok-Phnom Penh. The implementation of this project is still under consideration by both Lao PDR and Cambodia.

A project on the installation of a new automatic broadcasting system for aviation is expected to be implemented by October 1996.

In operation since January 1995 is the National Meteorological Telecommunication Network (NMTN) linked to the domestic telecommunication satellite "THAICOM" which resulted to a more efficient data collection system. Eleven domestic communication satellite stations will be connected to the existing NMTN by December 1996.

On June 1996, a set of 10 Kw-Hf transmitter of RTH radio broadcasts will be installed at the Regional Telecommunication Hub-Bangkok.

The National Data Center (NDC) established in August 1993 at the Head Office retrieves data from NOAA and GMS satellites which are routinely received at the four RMCs. Since June 1994 a workstation at the Aeronautical Meteorology Division, Bangkok International Airport transmits satellite and GTS data to the 4 RMCs.

In **VIET NAM**, three sets of AWOS for Hanoi, Danang, Ho Chi Minh cities were installed in 1995.

Three sets of Ozone Spectrophotometer were also set up at Hanoi, Sapa and Ho Chi Minh cities in 1995 and additional units will be purchased next year.

In 1995, the network of 120 old wind observational instruments installed at island and coastal stations frequently affected by tropical cyclones was replaced by new digital anemometers EL1 manufacuted by a Chinese company. 20 digital Pluviographs and 60 digital

thermometers was also set up in these sites. Meteorological data will be transmitted via telephone or special telecommunication system at a regular time interval.

Two DIGICORAs were set up at Ho Chi Minh (48900) and Hanoi (48820) while four marine meteorological observation buoys were installed on the Vietnamese Sea areas in October 1995 with the assistance of Norway. Their locations are (19N, 107E; 17.45N, 107.5E; 16.4N, 109.3E and 15N 110.3E). All are in operational use.

A plan for the acquisitions of a new weather radar was approved under the assistance of the French ODA fund. This radar will replace the old one at Phulien Station in the north of Vietnam. Another one will be purchased next year for Tamky station in central Vietnam.

A project on a new message switching system toegether with the enhancement of the computer local area network in the National Center.

APPENDIX IV

Proposals for updating of the Typhoon Committee Operational Manual - Meteorological Component (1995 edition)

Page	Line	Present	Proposals for amendments
8	3	···, JGZK, ···	···, JGQH, ···
	6	···, JGZK (radar), ···	···, JGQH (upper-air), ···
	8	··· Japanese moored buoy is shown ···	··· Japanese moored buoys is shown ···
	16	··· Voluntary Ship's Scheme. ···	·· Voluntary Observing Ship's Scheme. ··
9	8~		《Insert the following after line 7》 GMS-5, which is currently operated, is equipped with a visible sensor (VIS), thermal infrared split-window sensors (IR1, IR2) and a water vapor sensor (IR3).
11	13	··· in Table 3.1(a).	··· in Table 3.1 and 3.2.
12			《Replace by Annex1》
			《Insert Annex2 after p.12》
13	12	··· in Table 3.1(b).	··· in Table 3.1 and 3.2.
	27	··· in Table 3.1(b).	··· in Table 3.1 and 3.2.
19	10	··· purpose exist.	··· purpose exist, such as GTS, Internet, ISDN.
21	6	(data) X.25 Level 3 + 4,800 bit/s (NCDF)	(data) X.25 Level 3 + 4,800 bit/s (fax)
	8	Tokyo - Bangkok Satellite, 200 bit/s	Tokyo - Bangkok Satellite, 1200 bit/s
	22	3 + 4800 bit/s (NCDF)	3 + 4800 bit/s (fax)
	25 ~26	Beijing-Seoul Satellite, V.29 9600 bit/s, 4800 bit/s (data) X.25 LAPB + 4800 bit/s (NCDF)	《Move to after line 19》
22	8	GMS-4 (140°E)	GMS-5 (140°E)
Appendix 1-A			《Replace by Annex3》
Appendex 2-D			《Replace by Annex4》
Appendix 2-E, p.1			《Replace by Annex5》

Page	Line	Present	Proposals for amendments
Appendix 2-E, p. 2		· · Detection range km 600 Scan mode in observation 1. Fixed elevation 2. CAPPI 3. Manually controlled 1 DATA PROCESSING · ·	· · Detection range km 600 Scan mode in observation 1. Fixed elevation 2. CAPPI 3. Manually controlled 2 DATA PROCESSING · ·
Appendix 2-E, p. 4		··· Sapporo ··· 47412 ··· 43°03'N 141°20'E ··· Unit m 72.1 ··· · ·	··· Sapporo/Kenashiyama ··· 47415 ··· 43°08'N 141°01'E ··· Unit m 72.1 ··· · ·
Appendix 2-F, p. 1	23	WEFAX alone is transmitted.	《Delete line 23》
	25	- 4-sectorized full disk (IR) :00, 03, ... & 21 UTC	- 4-sectorzed full disk Image A, B, C, D (IR1) : 00, 03, ... & 21 UTC Image K, L, M, N (IR3) : 00, 12 UTC
	28	Image H (IR) : hourly	Image H (IR1) : hourly
	30	or J (enhanced IR) : hourly ···	or J (enhanced IR1) : hourly ···
Appendix 2-F, p. 2			《Replace by Annex6》

Page	Line	Present	Proposals for amendments
Appendix 2-F, p. 3		A picture	A or K picture
		B picture	B or L picture
		C picture	C or M picture
		D picture	D or N picture
Appendix 2-F, Annex, p. 1	11 ~i2	··· for Infrared sensor's data in which two(2) sectors are reserved for future expantion, and four(4) ···	··· for three Infrafed sensor's data, and four(4) ···
Appendix 2-F, Annex, p. 3	2	··· consist of three blocks ···	··· consist of four blocks ···
	33~		《Insert the following after last line》 4.4 Calibration information block This block consists of calibration tables for VIS, IR1, IR2 and IR3, and calibration coefficients for IR1, IR2 and IR3. These tables and coefficients are used to extract brightness temperature and radiance from S-VISSR data.
Appendix 2-F, Annex, p. 4			《Replace by Annex7》

Table 3.1: Chart form output products transmitted by RSMC Tokyo - Typhoon Center for regional purposes

(a) Analysis

Description of product	Observation time (UTC)	Area
Sea level pressure*	00, 12	A
500 hPa height*	00, 12	A
850 hPa streamline	00, 12	A
850 hPa isotach*	00, 12	A
850 hPa vorticity*	00, 12	A
850 hPa divergence*	00, 12	A
850 hPa temperature*	00, 12	A
850 hPa dew point depression*	00, 12	A
200 hPa streamline	00, 12	A
200 hPa isotach*	00, 12	A
200 hPa vorticity*	00, 12	A
200 hPa divergence*	00, 12	A
Sea surface temperature	10-day mean	B
Ocean waves	00	B

(b) Forecast

Description of product	Forecast time (hour)	Area
Sea level pressure*	24, 48	A
500 hPa height*	24, 48	A
850 hPa streamline	24, 48	A
850 hPa isotach*	24, 48	A
850 hPa temperature*	24, 48	A
200 hPa streamline	24, 48	A
200 hPa isotach*	24, 48	A
Sea surface temperature	10 days	B
Ocean waves	24	B

Area: A: 80°E - 160°W, 20°S - 60°N
B: 100°E - 180°E, 0°N - 60°N

* These may be omitted due to limitation of the capacity of the telecommunication line.

Some of them may be superimposed on one chart.

Table 3.2: Grid point value output products transmitted by RSMC Tokyo - Typhoon Center for regional purposes

Description of products	WMO headings	ii
Sea level pressure	$HPDA_2$ii RJTD	89
Geopotential height	$HHDA_2$ii RJTD	85, 70, 50, 30, 25, 20, 15, 10
U-component of wind	$HUDA_2$ii RJTD	98, 85, 70, 50, 30, 25, 20, 15, 10
V-component of wind	$HVDA_2$ii RJTD	98, 85, 70, 50, 30, 25, 20, 15, 10
Temperature	$HTDA_2$ii RJTD	98, 85, 70, 50, 30, 25, 20, 15, 10
Dew point depression	$HRDA_2$ii RJTD	98, 85, 70, 50
Total precipitation	$HEDA_2$ii RJTD	88
Vertical velocity	$HODA_2$ii RJTD	85, 70
Relative vorticity	$HZDA_2$ii RJTD	50

A_2	Meaning
A	Analysis (initial time)
B	6 hours forecast
C	12 hours forecast
D	18 hours forecast
E	24 hours forecast
F	30 hours forecast
G	36 hours forecast
I	48 hours forecast
J	60 hours forecast
K	72 hours forecast

ii	Meaning
98	Air properties for the Earth's surface
89	Reduced to sea level
88	Ground or water properties for the Earth's surface
85	850 hPa
70	700 hPa
50	500 hPa
30	300 hPa
25	250 hPa
20	200 hPa
15	150 hPa
10	100 hPa

Area: 80°E - 160°W, 20°S - 60°N
Observation time: 00 and 12 UTC
Format of Data: FM92-VIII Ext.-GRIB

NAMES FOR TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC OCEAN AND SOUTH CHINA SEA USED BY JTWC GUAM

(Effective 01 January 1996)

The list in Table 1-A.1 contains the names prepared by JTWC (Guam) for identifying trop cyclones in the Western North Pacific region. The first name to be used in a year will be the immediately following the last name used in the previous year. Subsequent name will be assigne succession according to the list of names in Table 1-A.1. However, if a tropical cyclone acquires spe notoriety because of strength, death tolls, damages or other special reasons, its name may be withdr at the request of any Member. The Typhoon Committee will decide if the name is to be withdrawn request JTWC to provide a replacement for that name. The list will be updated by RSMC in accorda with any amendments made by JTWC.

Table 1-A.1 Names for tropical cyclones

Column 1		Column 2		Column 3		Column 4	
ANN	*AN*	ABEL	*A-bel*	AMBER	*AM-ber*	ALEX	*AL*
BART	*BART*	BETH	*BETH*	BING	*BING*	BABS	*BA*
CAM	*KAM*	CARLO	*KAR-lo*	CASS	*KASS*	CHIP	*CH*
DAN	*DAN*	DALE	*DAY-l*	DAVID	*DAY-vid*	DAWN	*DAW*
EVE	*EEV*	ERNIE	*ER-nee*	ELLA	*EL-lah*	ELVIS	*EL-v*
FRANKIE	*FRANK-ee*	FERN	*FERN*	FRITZ	*FRITZ*	FAITH	*FAI*
GLORIA	*GLOR-ee-uh*	GREG	*GREG*	GINGER	*JIN-jer*	GIL	*G*
HERB	*HERB*	HANNAH	*HAN-ah*	HANK	*HANK*	HILDA	*HIL-d*
IAN	*EE-an*	ISA	*EE-sah*	IVAN	*I-van*	IRIS	*I-*
JOY	*JOY*	JIMMY	*JIM-ee*	JOAN	*JOAN*	JACOB	*JAY-k*
KIRK	*KIRK*	KELLY	*KEL-ee*	KEITH	*KEETH*	KATE	*KA*
LISA	*LEE-sah*	LEVI	*LEE-vi*	LINDA	*LIN-dah*	LEO	*LE*
MARTY	*MAR-tee*	MARIE	*ma-REE*	MORT	*MORT*	MAGGIE	*MAG-*
NIKI	*NI-kee*	NESTOR	*NES-tor*	NICHOLE	*nik-KOL*	NEIL	*NE*
ORSON	*OR-son*	OPAL	*O-pel*	OTTO	*OT-tow*	OLGA	*OL-g*
PIPER	*PI-per*	PETER	*PEE-ter*	PENNY	*PEN-ee*	PAUL	*PA*
RICK	*RICK*	ROSIE	*RO-zee*	REX	*REX*	RACHEL	*RAY-ch*
SALLY	*SAL-lee*	SCOTT	*SCOTT*	STELLA	*STEL-lah*	SAM	*SA*
TOM	*TOM*	TINA	*TEE-nah*	TODD	*TODD*	TANYA	*TAHN-y*
VIOLET	*VI-uh-let*	VICTOR	*vik-TOR*	VICKI	*VIK-ee*	VIRGIL	*VER*
WILLIE	*WIL-lee*	WINNIE	*WIN-ee*	WALDO	*WAL-doh*	WENDY	*WEN-d*
YATES	*YATES*	YULE	*YOU-lee*	YANNI	*YAN-nee*	YORK	*YO*
ZANE	*ZANE*	ZITA	*ZEE-tah*	ZEB	*ZEB*	ZIA	*ZEE-*

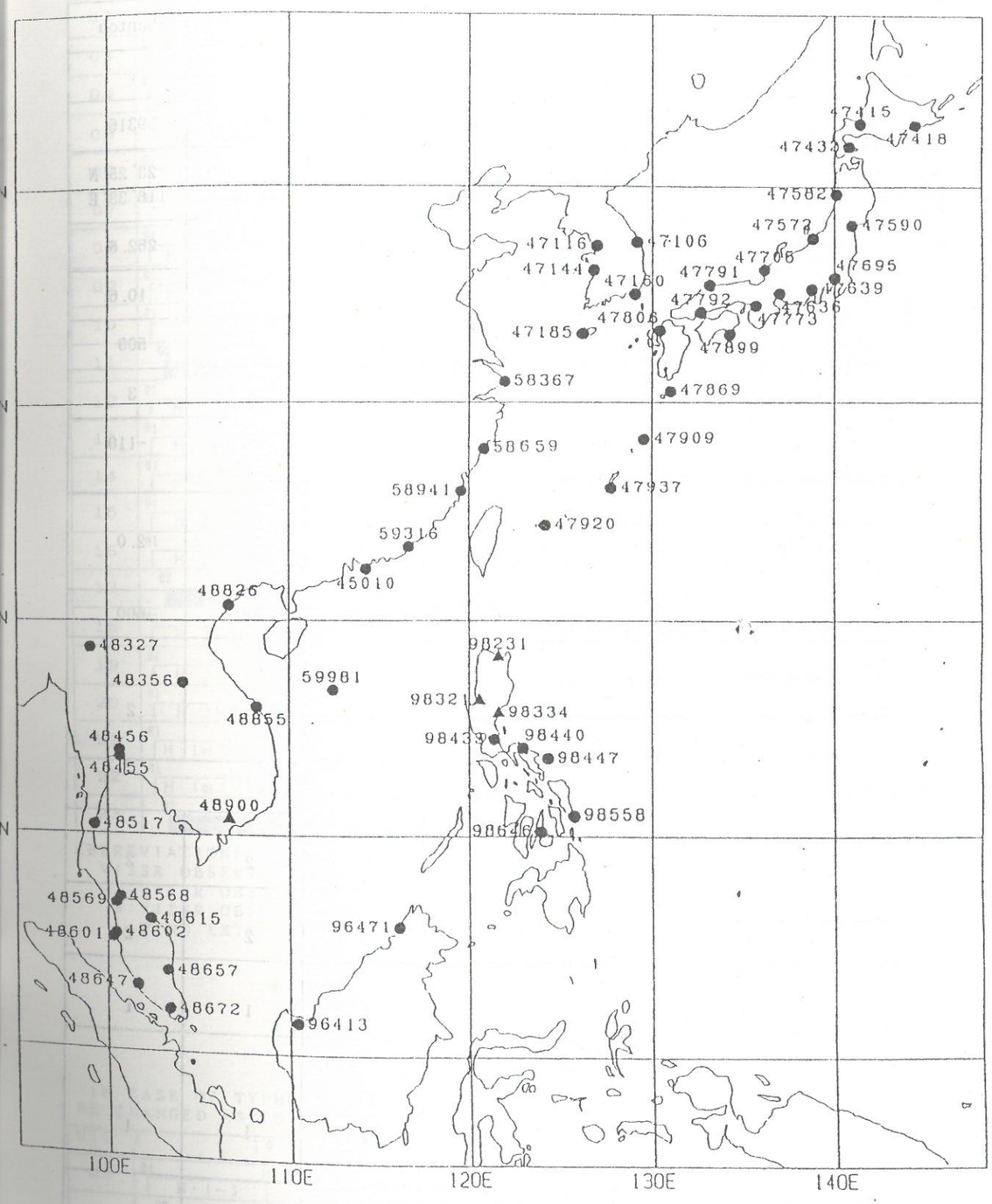
Notes:

1. Assign names in rotation, alphabetically, starting with (ANN) for first tropical cyclone of 1 When the last name in Column 4 (ZIA) has been used, the sequence will being again with first name in Column 1 (ANN).

2. Pronunciation guide for names is italicized.

3. Names for tropical cyclones reaching storm or hurricane intensity in the National Hurri Center's area of responsibility or the Central Pacific Hurricane Center's will be assigned fro lists published in the National Hurricane Operations Plan.

Distribution of the radar stations of Typhoon Committee Members



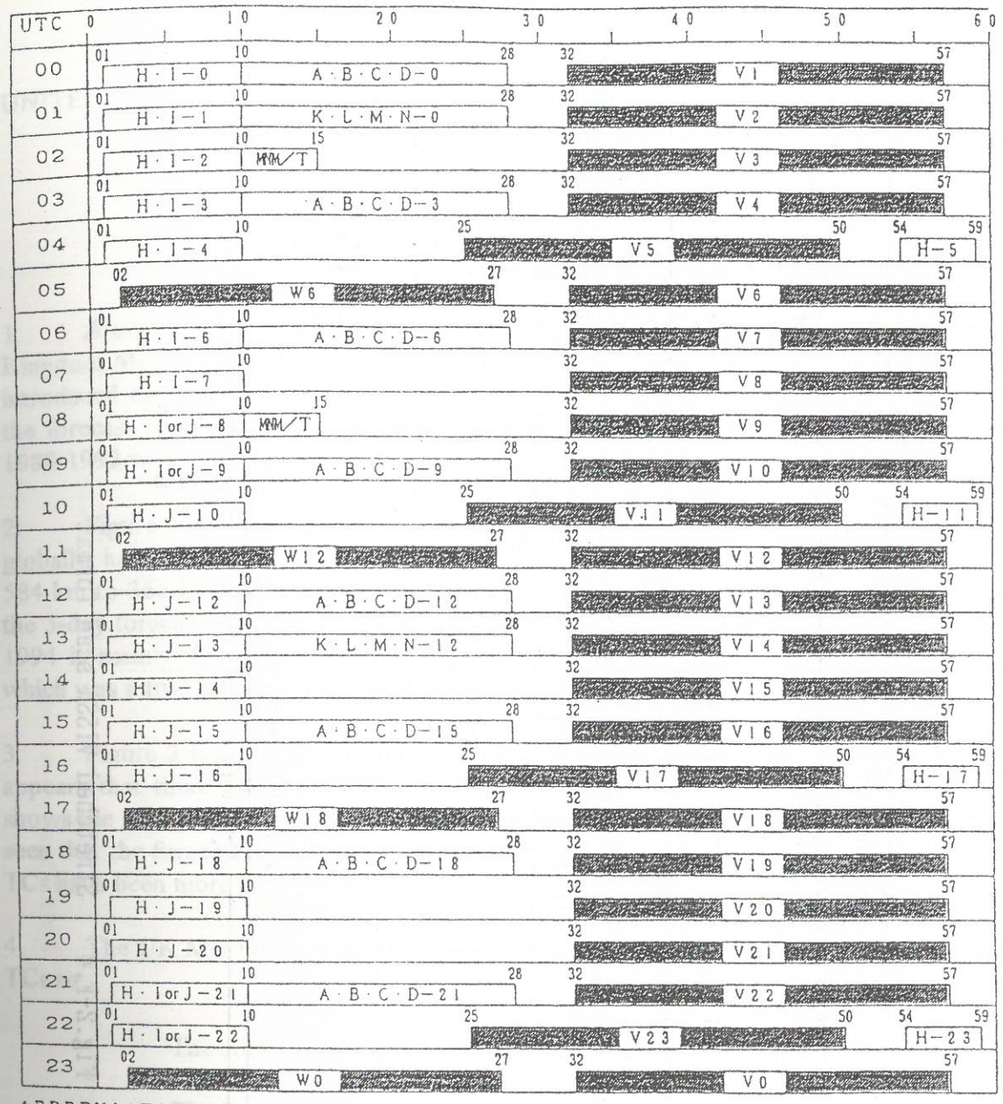
▲ : Not operating

Technical specifications of radars of Typhoon Committee Members

Name of Member China – 1

NAME OF STATION		Shanghai	Wenzhou	Fuzhou	Shantou
SPECIFICATIONS	Unit				
Index number		58367	58659	58941	59316
Location of station		31° 02' N 121° 57' E	27° 58' N 120° 44' E	25° 59' N 119° 32' E	23° 25' N 116° 38' E
Antenna elevation	m	50	294	652.5	262.6
Wave length	cm	10.6	10.6	10.6	10.6
Peak power of transmitter	KW	500	500	500	500
Pulse length	μs	3	3	3	3
Sensitivity minimum of receiver	dBm	-110	-110	-110	-110
Beam width (Width of over -3dB antenna gain of maximum)	deg	2.0	2.0	2.0	2.0
Detction range	km	600	600	600	600
Scan mode in observation 1. Fixed elevation 2. CAPPI 3. Manually controlled		2	2	2	2
DATA PROCESSING					
MTI processing 1. Yes, 2. No		2	2	2	2
Doppler processing 1. YES, 2. No		2	2	2	2
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	1	1	1
PRESENT STATUS 1. Operational 2. Not operational (for research etc)		1	1	1	1

SCHEDULE OF OBSERVATION AND DISSEMINATION



ABBREVIATIONS

VISSR OBSERVATION
V: VISSR OBSERVATION
W: VISSR OBSERVATION FOR WIND EXTRACTION

WEFAX DISSEMINATION
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
K~N: WATER VAPOR 4-SECTORIZED PICTURE OF FULL-DISK IMAGE
MNM: MANUAL AMENDMENT "MANAM"
T: TEST PATTERN

IN CASE OF TYPHOON SPECIAL OBSERVATION, SCHEDULE OF 03~05UTC WILL BE CHANGED AS FOLLOWS.

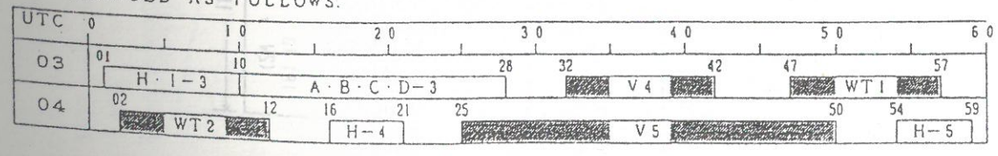


Fig.2-F.1 Current VISSR/FAX schedule

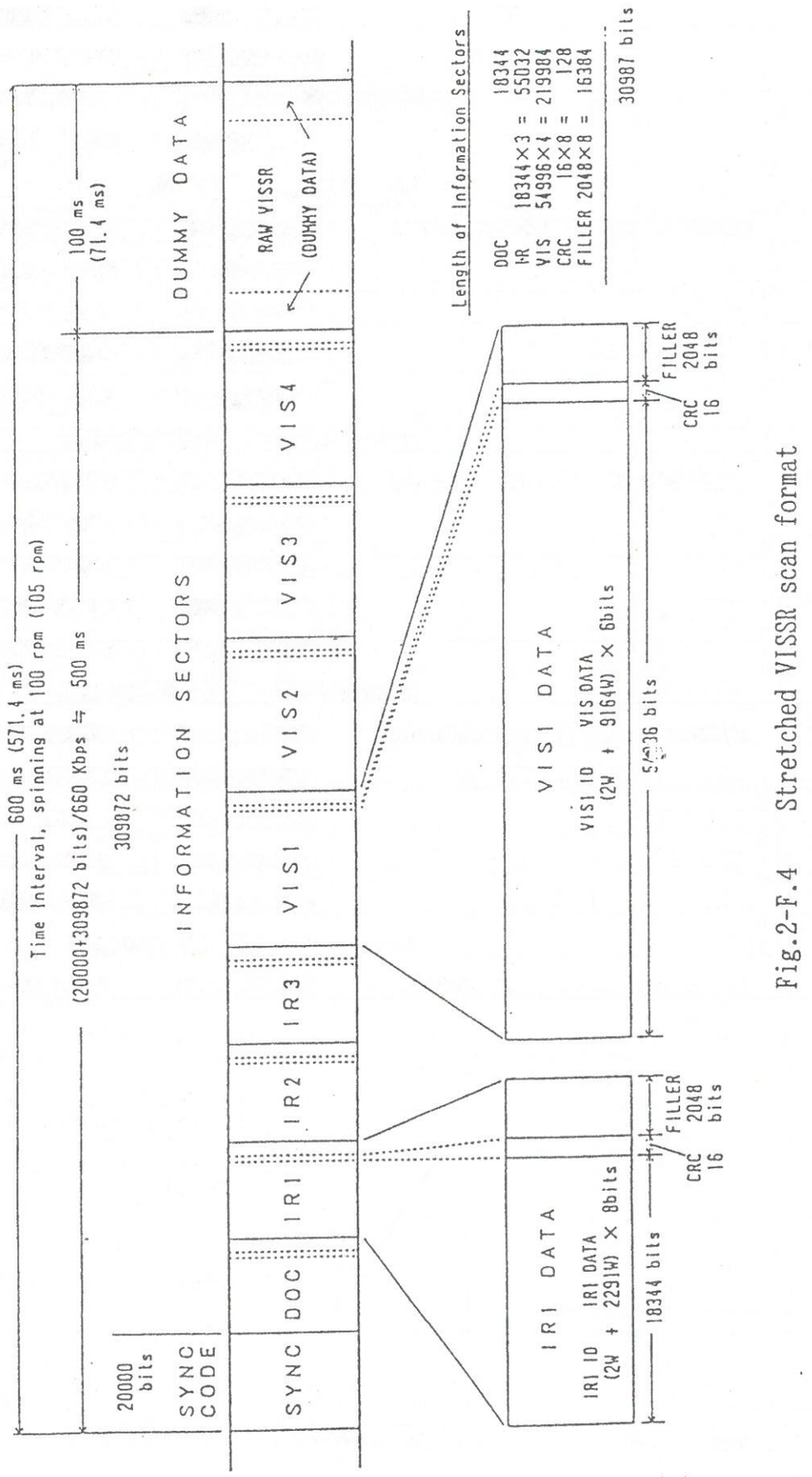


Fig.2-F.4 Stretched VISSR scan format

APPENDIX V

UNITED KINGDOM METEOROLOGICAL OFFICE

TYPHOON COMMITTEE 28TH SESSION
Kuala Lumpur, 5 - 11 December 1995

1. A new scheme for initializing or "bogusing" tropical cyclones (TCs) in the United Kingdom Meteorological Office (Met Office)'s numerical weather prediction model was introduced on 25 October 1994. The accompanying graphs (figures 1-2) illustrate how the forecast performance has improved year-on-year since 1993 (Statistics for the years 1988-1992 were very similar to 1993).

2. Figure 1 shows that the mean Direct Positional Error (DPE), measured for TCs globally, has improved dramatically. For instance, the 3-day error has been reduced from 584 km to 366 km (37% improvement), and the 5-day forecasts are now as accurate as the 3-day forecasts were in 1993. It is probable that the improvement between 1993 and 1994 is mainly due to the enhancement made to the physics parameterisation scheme, which was introduced into the model in January 1994.

3. Figure 2 is equivalent to Figure 1, but for the NW Pacific only. At first sight, it appears that there has been little or no improvement since 1994. However, Figure 3 shows the skill score for NW Pacific forecasts for the same three years. It can clearly be seen that the forecast skill has indeed increased over the last year, implying that the 1995 TCs have been more difficult to forecast.

4. The UK Met Office routinely provides advisory messages on the forecast tracks of TCs to:

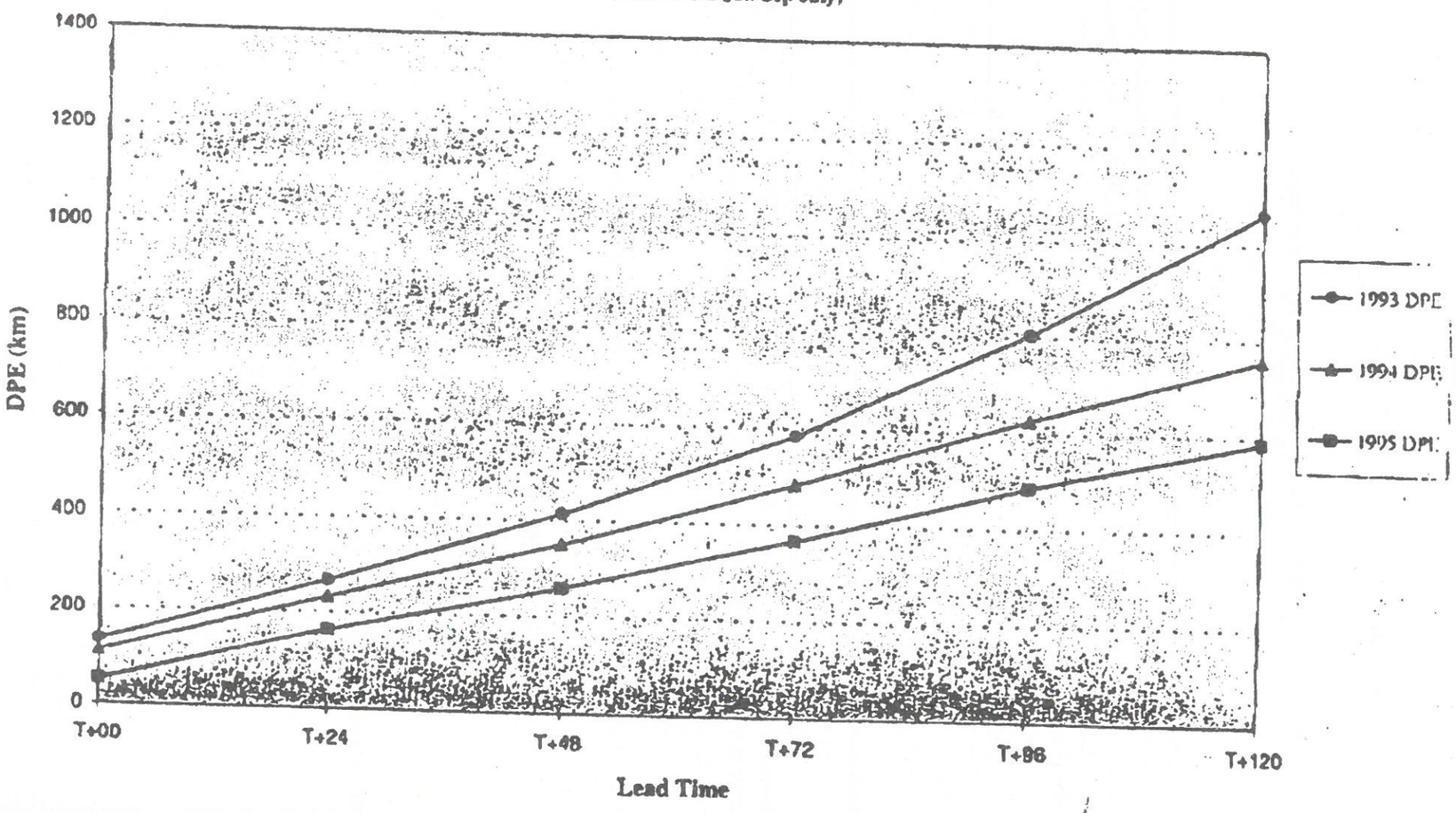
- The Joint Typhoon Warning Centre (Guam)
- The Chinese Meteorological Agency (Beijing)
- The Royal Observatory (Hong Kong)
- The Thailand Meteorological Service (Bangkok)

5. If any other national meteorological services in the area would like further information, they should contact:

Mr. Alan Radford
Forecast Automation Manager
Forecasting Systems
The Met Office, London Road
Bracknell RG12 2SZ
United Kingdom

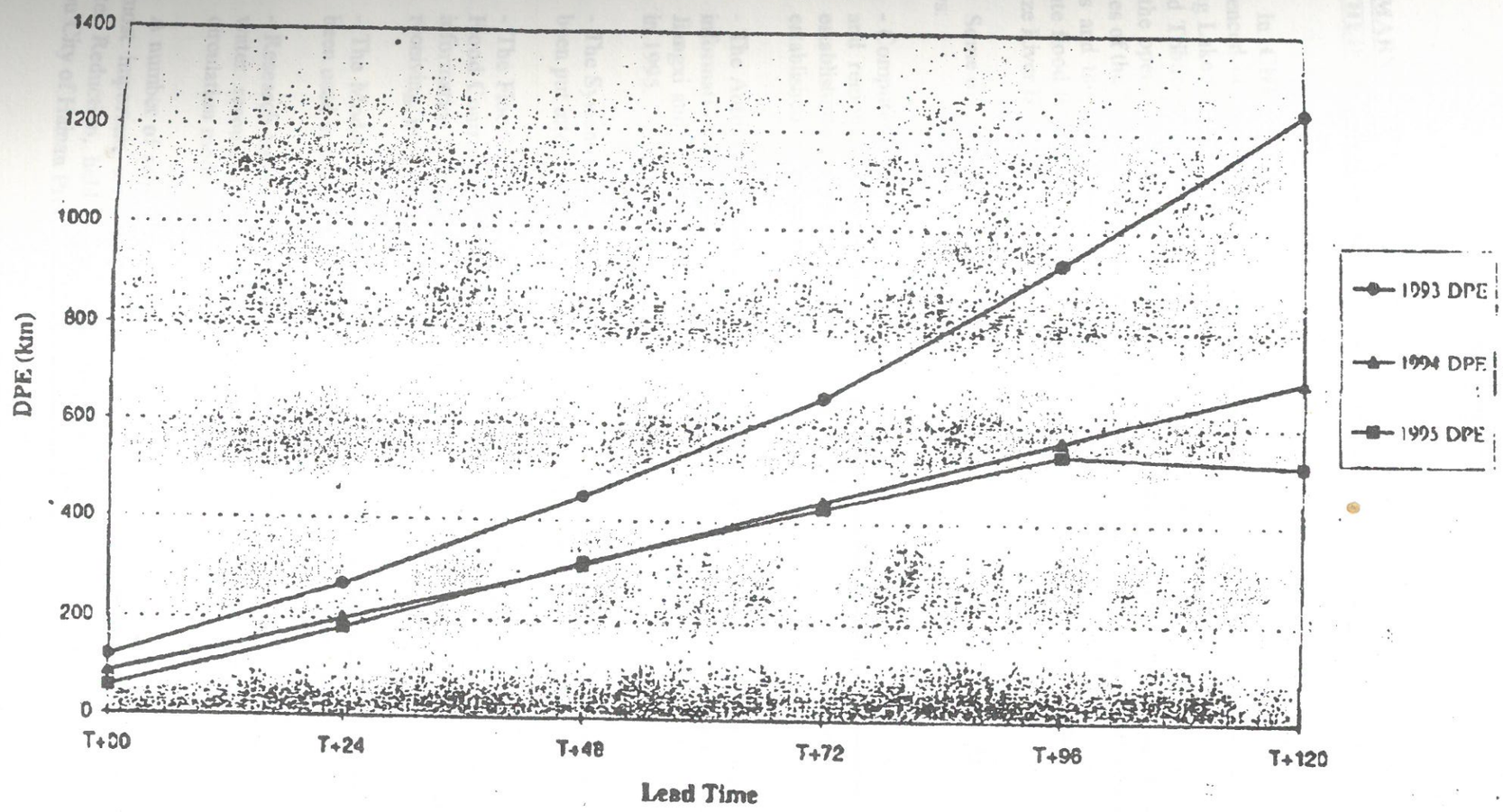
Mean TC position errors (global) 1993-1995

(N.B. 1995 is Jan-Sep only)



Mean TC position errors (NW Pacific) 1993-1995

(N.B. 1995 is Jan-Sep only)



APPENDIX VI

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

In **CHINA**, from June to August 1995, 20 year return period floods were experienced in the middle and lower reaches of the Yangtze River, Dongting Lake and Boyang Lake while 100 year return period floods occurred in the Hunjiang River and the Second Tributary of Songhua River in the Northeast China. During the flood period by using the operational System of Real-time Flood Forecasting for the Middle- and Lower-Reaches of the Yangtze River, the lead-time for short term forecasting was increased to 2-3 days and the lead-time for medium term forecasting reached 7-10 days. Owing to accurate flood forecasting, the economic losses were decreased by US$ 1.3 billion in the Yangtze River Basin.

Some of the main activities in China regarding the hydrological component were as follows:

- Computer connection of the State Flood Control Office with eight key provinces and regions for flood control and three river basin administrative offices was established. A computer network for hydrological data transmission was also established in Jiangsu Province.

- The Automatic observation, processing and transmission systems of hydrological information have been put into operation in the provinces of Heilongjiang, Hebei, Jiangxi and Guangdong contributing to decrease in the losses from flood damage in 1995.

- The System of Flood Forecasting and Dispatching for the Huaihe River Basin has been put into operation in the mainstream of the Huaihe River.

- The Flood Control Office for the Yangtze River has established the System of Flood Control Information for the Yangtze River and a data base of hydrological information, so that the automation was realized for the hydrological information receiving, processing, retrieving and displaying all over the basin.

- The Model of Astronomical Tide and Storm Surge Numerical Forecasting has been used in the operational forecasting in the coastal provinces of China.

- Research has been made on the influence of climate change on hydrology and water resources and the response strategy concerned using the atmospheric circulation model.

A number of seminars and meetings were organized during the reporting period. The most important was the 95 China Symposium of Hydrological Forecasting and Disaster Reduction, held by the Hydrology Committee, Chinese Hydraulic Society in Haikou City of Hainan Province, 20 - 23 November 1995.

In **HONG KONG**, development of a Rainfall Display System (RDS) was completed. This PC-based system gives forecasters real-time information on rainfall from about 70 automatic rain-gauges installed around the territory as well as audio and visual alarms for the operation of the rainstorm, flood, and landslip warnings.

Enhancement of the data interrogation software for the Automatic Water-level Reporting System (AWRS) developed to monitor heavy rain and water levels in the New Territories, was completed in early 1995.

Drainage Master Plan Studies will be carried out by the Drainage Services Department starting 1996. The aims of the Studies are to assess the conditions and inadequacies of the stormwater drainage systems and to formulate a comprehensive master plan for implementation.

About four kilometeres of the River Indus have been embanked by the Drainage Services Department in the Indus Basin of the New Territories of Hong Kong. There is also a programme to embank the rest of the river and the whole project is scheduled for completion by the year 2001.

In **JAPAN**, as a *baiu* (seasonal rain in Japan) front was hovering over the Niigata area, moist air masses moved in from the south, thus reactivating the front and causing heavy local rains.

The Minamiotari rain gage station in an upper reach of the Hime River registered the start of the rain at 14:00 on July 14 and during the period 17:00-22:00 recorded rainfall intensities of 18 to 42 mm per hour. The cumulative rainfall during this period reached 217 mm.

Later that day the baiu front was still over the southern part of Niigata Prefecture, and heavy rains persisted in the Joetsu region. The cumulative rainfall registered at the Akakura rain gage station at 11:00 on July 12 and at the Minamiotari rain gage station at 18:00 on July 12 was 207 mm and 373 mm, respectively.

At 9.35 on July 11, the Niigata Local Meteorological Observatory issued heavy-rain, snow and flood advisories and at 15:40 upgraded the advisories to heavy-rain and flood warnings. In the meantime rainfall was not so intense, but the rain became heavy soon after the warnings were issued, and the heavy rain continued until 11:00 on July 12.

Both the heavy rain and the warnings continued for about 38 hours until 5.30 on July 13 when the warnings were downgraded to the advisory status.

The discharge of the Seki River at Takada matched the record discharge registered during the flood of September 1982. The discharge of the Hokura River at Matsumoto is thought to have exceeded the September 1982 flood level. The discharge of the Hime River at Yamamoto is thought to have been greater than the record discharge observed during the July 1983 flood.

Damages of this flood are followings;

Seki River	Missing	1 person
	Injured	2 persons
	Totally or partially colapsed buildings	23
	Partially damaged buildings	6
	Above-floor or below-floor flooding	2,954 houses
Hime River	Totally or partially collapsed buildings	57
	Partially damaged buildings	14
	Above-floor or below-floor flooding	465 houses

(Niigata figures as of July 24, Nagano figures as of July 26;
data for the municipalities involved only)

On August 8, 1995, the Committee for Deliberation of Countermeasures against Flood and Earth-Movement-Induced Disasters in the Seki and Hime River Basins was established. The objectives of the committee were to make long-term estimates and deliberations for river
channel stabilization and sediment control consistent throughout the river system so that utmost use can be made of the results thus obtained in restoration projects and future improvement projects. The second session of the committee yielded the following policies (interim report):

Policies Formulated at the second session of the Committee for Deliberation of Countermeasures against Flood and Earth-Movement-Induced Disasters in the Seki and Hime River Basins.

(1) Countermeasures consistent throughout the river system
(2) Balance of improvement and restoration plans between upper and lower reaches
(3) Early restoration
(4) Consideration to be given to regional rehabilitation plans
(5) Consideration to be given to the environment
(6) Middle-term and long-term sediment control

The committee plans to complete its deliberations by the end of December this year.

River Bureau of Ministry of Contruction implemented the following international technical cooperation

(1) Joint technical research under the auspices of international organizations, such as the United Nations, or in the form of bilateral conferences on the basis of international agreements.

(2) Dispatch of experts and study teams for provision of technical guidance in developing countries in response to requests from international organizations or the governments of developing countries.

(3) Provision of technical training for engineers/technicians from developing countries.

The principal fields covered are flood control, water resources development and erosion and sediment control (sabo)/landslide prevention. There has been an increase in recent years in the cases of cooperation in the fields of water quality conservation and river environment management.

International organizations which the River Bureau has dealings with include the WMO and ESCAP.

Among the bilateral conferences, there are the annual conferences with the Republic of Korea and the People's Republic of China and the biennial conferences with France on river and water resources development.

Dispatch of experts and acceptance of trainees take place in response to requests mainly from developing countries.

In **MACAU,** apart raingauges from telemetry network, climatology stations and digital rainfall collectors (Microlog rainfall system), one more raingauge station is to be installed in "Midpoint" of the Macau International Airport runway.

Based on the real time data transmitted from the Automatic Weather Stations a flood forecasting and warning is issued when the actual reading in a number of stations recorded over 20 mm/h of precipitation and forecasting that the trend will continue. This warning is discontinued, when all the stations record less than 20 mm/h of rainfall.

A new Meteorological Radar and High Resolution Satellite Receiving System will be installed in 1996, and development and use of techniques for Quantitative Precipitation Forecast (QPF) on routine forecast will be implemented.

Macau will host the Tenth Seminar on Hazardous Weather in 18 and 19 of December 1995 among Guangdong Meteorology Bureau, Hongkong Royal Observatory and Macau Meteorology and Geophysics Service. This Seminar will cover severe weather phenomena such as typhoons, rainstorms, floods, convective squalls and cold surges in order to enhance the capability to monitor hazardous weather in the Pearl River Delta region, to produce more accurate weather forecasts.

In **MALAYSIA**, the Department of Irrigation and Drainage (DID) has established telemetric systems in 26 river basins and 7 dam areas for the purpose of flood warning and/or forecasting. As a back up to the existing VHF telemetry, 19 important VHF telemetric stations have been equipped with telephonic telemetry. 10 state DID offices have been linked to the Flood Forecasting Centre Via Telemail System. 161 VHF radio stations have also been installed to provide additional hydrological and flood information.

The Tank Model and the Linear Transfer Function Model continued to be used by the DID for real-time forecasting of the Kelantan and Pahang rivers respectively during the 1994/1995 monsoon season with satisfactory results. Development of a flood forecasting model for the Segamat River using Neural Computing technique has been

accomplished. Malaysia has continued to use MOFFS to evaluate the performance of flood forecasting service of Kelantan river and the results submitted to WMO.

During the 1994/95 North East Monsoon season, no serious floods were reported as the monsoon rain distributed itself rather uniformly. The flood magnitude, evacuation and death tolls were less severe than the previous year. During the intermonsoonal periods, however, flash floodings have occurred more frequently in the rapidly developing areas, especially the urban centres.

With ESCAP's support under the TCDC arrangement and the mutual exchange visit programme between China and Malaysia, a Malaysian team of 4 officers visited China for a period of 12 days (3-12/9/95). The Team had the opportunity to visit flood forecasting systems of several important river basins in China. Valuable knowledge and experiences in the field of flood forecasting were also exchanged during the visit.

In the **PHILIPPINES** in line with the flood operations of PAGASA, the Flood Forecasting Branch issued 33 flood bulletins for the Pampanga, Agno, Bicol and Cagayan river basins and 4 flood situationers for Metro Manila. Three (3) post flood investigations were conducted, 2 of which occurred in Southern Philippines. Flash floods in areas not covered by the PAGASA's telemetering system became prevalent during the past year and such floods were generally caused by intense rainfall aggravated by the denudation of forests.

During the first quarter of 1995, PAGASA presented the rainfall results of the EAS-funded Philippine Project #2 entitled "Flood Assessment of the Bicol River Basin." The Project utilizes remotely sensed data to identify the flood limits of the basin.

As part of the Memorandum of Agreement between PAGASA and the International Center for Disaster-Mitigation Engineering (INCEDE) (University of Tokyo), regular reconnaissance field works were conducted in the Mt. Pinatubo area.

Improvements of the Storage Function Model (for flood forecasting) were made during the first and second quarters of 1995 with the calibration of model parameters using post-lahar data (after eruption of Mt. Pinatubo) of the Pampanga, Agno and Bicol river basins. Fairly good results were obtained on forecasting points where sedimentation/siltation was minimal. In river cross-sections greatly affected by sedimentation, particularly those in the downstream portions of the Agno and Pampanga river basins, re-survey of the river cross-sections, adjustment of assessment levels, regular discharge measurements, and update of rating curves are being carried out.

An account of the hydrometric stations installed in different areas of the archipelago revealed that among the original 60 stations, only 16 stations remain operational. Some of the raingauges were either destroyed or stolen while the defective stations were pulled out. Installation of additional raingauges in remote and flood prone areas which are not covered by the PAGASA's telemetering system is crucial in the investigation of the causes of flash floods in said areas.

In the **REPUBLIC OF KOREA** among the twelve state control rivers, five major rivers are equipped with modern flood forecasting system with help of telemetrized rainfall

gauge and water stage stations. There are 218 rainfall gauges and 148 river stages telemeterized stations under the Ministry of Construction and Transportation (MOCT) which is charged with flood forecasting and dam operation for mitigation of flood damage. The average density of rainfall gauge station in the five river basins is one in 313km^2, which is below the recommendation by WMO. Thus, the MOCT had set up a 5 year plan to install additional 111 rainfall gauge stations and 37 river stage stations from 1994 to 1998 (Table 1). In 1995, the MOCT has installed 15 rainfall gauges and 9 river stage stations in accordance with the plan. The rest of the plan are expected to be implemented as scheduled and then the average density of rainfall gauge station will be one in about 200km^2, which meets the WMO recommendation.

The MOCT has developed a hydraulic routing model for the downstream of Han river which runs the capital Seoul in 1994 using the storage function method which is adopted hydrological flood routing model in Korea, to improve the accuracy of forecasting and to get more detailed water stage information.

Han River Flood Forecasting Office has developed the interactive model operation system under the graphic user interface (GUI) circumstance for more convenient model operations and a search system of informations concerning control of the historical large floods.

Korea is located in the monsoon area and most of precipitation occurs by typhoons and depression storms during summer season. Korea has 1,274 mm of annual mean precipitation, among which about 65% concentrated June to September.

The 1995 rainfall was serious with regional unbalances in amounts; mainly concentrated in the central region of Korea.

The flood occured from August 19 to 30 in 1995 in the central part of Korea brought a total 65 deads and missings caused by inundation and destruction of rail road, land slides, and flooding by embankment breaks. US$ 600 million of property damage was estimated. The flood was caused by the depression storm and the typhoon "JANIS".

The recent flood record of Korea showed that the damages in the small basins (basin area : 1,000 ~ 1,500 km^2) by local heavy storms are more severe than at the large basins, which are covered by a flood forecasting system. The MOCT has set up a plan to expand the flood forecasting systems to small basins in 1993. In 1995 install station of a system for Ansung river basin, located near Seoul with the basin area of 1,670 km^2 was completed, and it will be operational starting next year. As a new project, the detailed design for the flood warning system on Hyungsan river is under going and is expected to be established next year.

Research work for improvement of the runoff model of the Nakdong river basin is under way, analyzing the temporal characteristics of rainfall, calibrating of the parameters in runoff model and modification of the stage-discharge rating for low flow etc.

The MOCT has started to survey the hyfrological conditions for the Imjin river basin this year (two thirds of the total basin area is located in the D.P.R. of Korea). The

preliminary survey including the established of some rainfall gauge and water stage stations are planned toundertaken in about three years. In 1995, 4 water stage stations were installed and observation will start the next year.

In **THAILAND** within 3 - year Development Plan (1994-1996), the following 5 hydrometeorological stations were planned to be established:

1) Chawang station, Nakhon Si Thammarat Province
2) Phrasaeng station, Surat Thani Province
3) Kamalasai station, Kalasin Province
4) Sadao station, Songkhla Province
5) Sa Kaeo station, Sa Kaeo Province

The Management Overview of Flood Forecasting System (MOFFS) has already been applied to the flood forecasting system for Prachin Buri river basin and the rating results for the flood events of 1993 and 1994 were provided to the WMO Secretariat.

The flood forecasting and warning system in the designated Pasak, Prachin Buri and Nan river basin are monitored on routine basis.

The establishment of flood forecasting models for Thailand was carried out under the agreement between the Government of Denmark and the Royal Thai Government (RTG) since August 1993. The inception phase of the project has been completed with preparation of the detailed project plan in 1993. Two groups of RTG staff from six participating institutions received in-depth training held at Asian Institute of Technology (AIT) in 1994 and 1995 respectively. Computer hardwares and softwares of flood modelling and flood forecasting techniques using the MIKE11 modelling system were transferred to the six institutions in November 1995.

Ten Thai delegates participated in a training course on Flood Modelling programme in Thailand held at AIT, Bangkok, Thailand from 1 May to 31 October 1995.

VIETNAM has a very complex river network. Information systems maintained for this network are not adequately equipped with modern equipment and up to data facilities. The Vietnam Hydrometeorological Service (HMS) surface observing network totals 1762 sites and consits of:

- 228 Hydrological, mainly manually-read river level gauges;
- 788 rainfall stations;
- 21 Seasonal Typhoon warning stations;
- 3 Weather Radars. etc.

In Vietnam presently, 140 VHF Radio Stations have been installed to provide additional hydro-meteorological and flood information for flood monitoring and forecasting purposes.

The plan of forming an observation network that observes the weather conditions and water regime in the main rivers of Vietnam is implemented.

The Vietnam HMS in the co-operation with the assistance of some overseas companies is developing a new flood warning and forecasting system based on PC and telemetry stations.

Major technical activities undertaken in Vietnam during the last year are as follows:

- The Project on improvement of rainfall and flood inundation forecasts for the main rivers in the Central Vietnam will be completed by the end of 1985.

- Vietnam Government with the assistance from international and UN agencies has drawn up Comprehensive Programmes for flood control with a view to reduce the damages and human miseries. Non-structural measures like advance warning and forecasting can also reduce the damage and sufferings of the affected people.

- The activities for improvement of hydrological measurement network and data collection system are carried out in the Central Vietnam to ensure better quality data and their timely collection for running hydrological and flood forecasting models.

- Improvement of the present system of monitoring Hydrometric Stations in the Red and Thaibinh River System, the Ca, the Ma Rivers and other river systems.

- Development and application of guidance on hydrological technology models for tropical cyclone regions for flood forecasting in some river in the Central Vietnam.

- Establishment and operation of flash flood forecasting and warning system in Hatinh Province (in the Central Vietnam).

During the period of September - November 1994 the largest flood occurred in the Cuu Long River Delta, causing floods over 2,000,000 hectares. In the wet season of 1995, several large and very large floods occurred in the Red River, Thaibinh River in the North, and in the Gianh, Kiengiang, Quangtri, Huong, Thubon, Trakhuc, Con and Cuulong Rivers.

The main forecasting and warning activities undertaken were:

- Operational Flood Forecast models are being run experimentally for the several major river basins using microcomputer system in association with the computer switch system.

- Hydrological forecasts made by Vietnam HMS warned the population a one to three days in advance in the North and Central Vietnam, and 5-10 days in advance in the South of Vietnam. The accuracy of the forecast was adopted.

- Daily Hydrological information and forecasts for effective operation of Hydroelectric plants are provided for Hoabinh, Thacba in the North, and at Trian, Dautieng, Danhim and Yaly in the South of Vietnam. The forecasts with high accuracy for a given lead-time of 24-36 hours was made for the operation and

management of several reservoirs in Vietnam, such as Hoabinh, Thacba, Dautieng, Trian and Yaly etc.

- Medium- and long- term flood flow forecasting and warning were made for the flood control and water resources management of the main river basins in Vietnam, such as the Red River, the Cuulong River, the Thaibinh River and some others.

The comprehensive flood loss prevention and management activities in Vietnam were:

- Various alternatives of a set of structural and non-structural measures that meet the planning objectives, legislative and legal constraints and the planning criteria are being carried out in Vietnam.

- Determination of flood-prone areas subject to heavy damages in the main river basins in the Central Vietnam, such as Ca, La, Gianh, Guangtri, Huong, Thubon, Trakhuc, Con, Caty, Darang and Cuulong River Basins etc.

- Preparation of flood risk maps (1: 100,000 and 1: 50,000).

- Preparation and application of a manual and guideline for integrated river basin management on the mountainous regions of Vietnam, especially in Northern and Central Vietnam.

- Channel modifications of various types were done before and during the flood season in several down streams of the river, such as Darang, Phanrang, Caty, Laigiang, Cuulong and Con rivers.

APPENDIX VII

REPORT OF THE PRE-SESSION MEETING OF HYDROLOGISTS

1. INTRODUCTION

1.1 The pre-session meeting on the hydrological component of the Typhoon Committee's Programme was convened by TCS in cooperation with WMO in Kuala Lumpur on 4 December 1995. This was attended by representatives of the TC Members from China, Japan, Malaysia, the Philippines, Republic of Korea, Thailand and Vietnam. Mr. Toshio Okazumi (TCS Hydrologist) was elected Chairman while Mr. Chong Sun-Fatt (Malaysia) acted as the Rapporteur of this meeting.

1.2 The Chairman on behalf of TCS expressed its thanks to Malaysia for hosting this Pre-session Meeting. He explained that this meeting was important for hydrologists to freely exchange views and experiences on hydrological component.

1.3 The Chairman presented the provisional agenda which was accepted by the meeting.

2. RECENT ACTIVITIES OF EACH TC MEMBER

2.1 Most TC Members expressed that the recent activities were contained in the country report and would be reported during the main session on 5 December 1995.

2.2 The meeting was informed that severe floods had occurred in China, Japan, Republic of Korea, the Philippines and Malaysia in 1995. Consequent to the severe floods, Japan and Republic of Korea would soon embank on the preparation of flood hazard maps. The Philippines and Malaysia would continue to upgrade their telemetric network and forecasting models.

3. REVIEW OF RECOMMENDATIONS MADE DURING THE LAST PRE-SESSION MEETING

3.1 *Preparation of the Medium-term TC hydrological Programme*

The Chairman reported that TCS had circulated a questionnaire to TC Members with a view to evaluate Members' requirements.

3.2 *TCS Hydrologist*

The Chairman informed that his term of office as TCS hydrologist would expire by June 1996. He also informed that TCS had circulated a letter on 26 June 1995 seeking alternate TC Member to dispatch a hydrologist to TCS, but no positive response had been received to date.

3.3 *Regional Cooperation through TCDC or other arrangement*

The meeting took note that the following activities were carried out during the review period;

- On the job training for 3 Cambodians (1 Meteorologist and 2 Hydrologists) in the Philippines on February 1995 under TCDC arrangement.

- Visit of 4 Malaysian hydrologists to China on flood forecasting systems from 4 to 14 September 1995.

- Visit of 12 Chinese experts on flood control to the Philippines from 12 to 20 October 1995 under their own funds.

3.4 *Use of TC Trust Fund*

The meeting took note that the TC Trust Fund had not been utilized for any hydrological programme during 1995 even though such usage had been approved during the 27th TC session.

4. FUTURE ACTIVITIES UNDER THE TC HYDROLOGICAL COMPONENT

4.1 The meeting deliberated future activities based upon the requirements of TC Members. Emphasis was given on topics related to the need to upgrade national hydrometric/ telemetric system, flood forecasting models, flood loss prevention and management system.

4.2 In connection with the circular on the upgraded version of the MOFFS (version 3). Mr. Abe from WMO proposed to hold a second meeting of experts from TC and Tropical Cyclone Panel. The meeting welcome the proposal and further suggested that the expert meeting be held in 1996 to be supported by TC Trust Fund.

4.3 The Chairman informed that PAGASA & JICA planned to organize a Seminar/Workshop on Flood Loss Prevention and Mitigation. This seminar/workshop would welcome participants from other TC Members.

4.4 During the meeting, it was recognized that the hydrologists had little opportunity to discuss sufficiently the common areas of concern. It has also noted the need to exchange effectively experiences and technology in the domain of hydrology. To meet the above requirements the meeting proposed that bi-annual seminar/workshop on specialized topics related to flood hydrology should be organized.

5. RECOMMENDATIONS FROM THE PRE-SESSION MEETING OF HYDROLOGISTS

The meeting deliberated on problems concerning the implementation of flood loss prevention programme. Future activities were also discussed and a set of recommendations were drawn up as follows:

1. Typhoon Committee to continue to solicit the assistance from TC Members in dispatching a hydrologist to TCS. As a last resort, Typhoon Committee to request the Philippine Government to provide a hydrologist covering the period of vacancy as a temporary measure.

2. Typhoon Committee Secretariat to evaluate the requirements of TC Members and formulate proposals of future activities for the hydrological component.

3. Typhoon Committee to consider providing financial support using the TC Trust Fund for TC members to participate in the Second Expert Meeting on MOFFS which will be held in 1996.

6. CLOSING OF THE MEETING

The Chairman thanked all Members who attended the pre-session meeting.

APPENDIX
LIST OF PARTICIPANTS
PRE-SESSION MEETING OF HYDROLOGISTS

CHINA

Mr. Xin Xianhua	Division Director, Department of International Cooperation China Meteorological Administration, Beijing

JAPAN

Mr. Katsumi Seki	Senior Officer, River Planning Division, River Bureau Ministry of Construction, Tokyo

MALAYSIA

Mr. Hj. Ghazali Bin Omar	Director, Hydrology Division, Department of Irrigation and Drainage, Kuala Lumpur
Mr. Chong Sun Fatt	Senior Hydrology Engineer, Department of Irrigation and Drainage, Kuala Lumpur
Mr. Azmi Bin Mohd. Jafri	Hydrologist, Department of Irrigation and Drainage, Kuala Lumpur
Ms. Norlida Bte Mohd. Dom	Hydrologist, Department of Irrigation and Drainage, Kuala Lumpur

PHILIPPINES

Ms. Margaret P. Bautista	Senior Weather Specialist, Flood Forecasting Branch Philippine Atmospheric Geophysical and Astronomical Services Administration, Quezon City

REPUBLIC OF KOREA

Mr. Lim, Choong-Soo	Director, River Planning Division, Office of Water Resources Bureau, Ministry of Construction and Transportation, Seoul

THAILAND

Mr. Rungsan Sirayayon	Hydrologist, Royal Irrigation Department, Ministry of Agriculture and Cooperatives, Bangkok

VIETNAM

Dr. Le Bac Huynh	Vice Director, Nationl Centre for Hydrometeorological Forecasting, Hanoi.

WORLD METEOROLOGICAL ORGANIZATION (WMO)

Mr. Eisa H. Al-Majed	Director, Regional Office for Asia and the South-West Pacific, WMO, Geneva.
Mr. Katsuhiro Abe	Chief, Tropical Cyclone Programme Division, World Weather Watch Department, WMO, Geneva

TYPHOON COMMITTEE SECRETARIAT

Mr. Toshio Okazumi	Hydrologist, Typhoon Committee Secretariat, Manila
Ms. Nanette C. Lomarda	Meteorologist, Typhoon Committee Secretariat, Manila

OBSERVER

Mr. Hiroyuki Shindo	JICA expert, River Engineering Division, Department of Irrigation and Drainage, Kuala Lumpur

APPENDIX VIII

SUMMARY OF THE REPORTS OF THE TYPHOON COMMITTEE MEMBERS ON THEIR ACTIVITIES RELATED TO THE DISASTER PREVENTION AND PREPAREDNESS COMPONENT

In **CHINA,** the main disaster prevention and preparedness activities were as follows:

- Weather office of Zhejiang Province and Ocean Fishery Weather Office provided marine meteorological service in winter fishing season from November 1, 1994 to January 31, 1995. Although more than 200 thousand of fishmen were at sea, none of the fishing boats capsized due to meteorological causes due to the accurate weather forecast and timely service.

- In order to further improve the marine meteorological service around Nansha area, weather forecast of Nansha archipelago has been added to the weather forecast programmes of CCTV and Central Radio Station since May 1, 1994. Meanwhile, the forecast of marine meteorology and oceans status of Nansha area is also developed. The above forecast has significantly reduced disasters at sea.

- Since July 10, 1995, China has undertaken the production and issuance of meteorological forecast and warning for responsible area XI under the WMO GMDSS Marine Broadcast System. Weather and sea bulletins are issued two times a day when there are no tropical cyclone activities in the responsible sea area, otherwise two more are added.

- With the aim of supporting and participating in "helping the poor" drive actively and responding to the disaster reduction day activities 1994, the national conference on the disaster reduction in poor areas was held by China Disaster Prevention Association and Guangyuan municipality government of Sichuan Province during September 21-24, 1994. 150 experts participated in the conference.

- The Chinese Committee of IDNDR drafted and submitted formally to the conference on Asian and Pacific Cooperation held in October 1995 the Recommendation on the International Cooperation in Meteorological Disasters Reduction in Asian and Pacific, in which an organization serving both China and Asian and Pacific countries was proposed.

- "China Disaster Reduction Programme" and "Priority Projects in China Disaster Reduction Programme" were drafted and compiled from October 1994 to February 1995 by the Chinese Committee of IDNDR with financial support from the UNDP. International workshop on the above two documents was held by the Chinese Committee of IDNDR during February 16-17, 1995. The two documents were discussed again and some amendments were suggested at the workshop.

- The sixth plenary session of Chinese Committee of IDNDR was held in Beijing on Nov. 22, 1995. Role played by relevant departments and benefit achieved this year

were exchanged and summarized at the meeting. Work plan and implementation measures were discussed and drafted.

Eight tropical cyclones landed on the southeast coast of China from September 1994 to August 1995. A tropical storm (9429, Seth) which recurved to the north at the offshore of eastern coast brought strong winds and torrential rain that caused considerable economic loss and injury and death of people. About 100 people were killed and 71 people injured. Direct economic loss was estimated to be about US$ 1034.40 million.

In **HONG KONG**, an agreement for the three meteorological services to jointly establish an Integrated Observing Network on Hazardous Weather for the Pearl River delta region was signed by directors of the Royal Observatory, the Guangdong Meteorological Bureau and the Servicos Meteorologicos e Geofisicos Macau on 11 November 1994. The real-time exchange of radar information and the building of additional automatic weather stations are some of the important elements of this agreement. As of 2 December 1995, an AWS is being implemented on an outlying Chinese island.

During severe weather and tropical cyclone situations, the Observatory continued to provide regular weather briefings to the mass media to ensure up-to-date information is disseminated and members of the public are advised of the appropriate precautions to take against injury and damage.

Television announcements on the colour-coded Rainstorm Warning System continue to be aired regularly on the local television channels to familiarize the public with the System and to give advice on what to do when the Red or Black Rainstorm Warning is issued.

The warning system of natural disasters in Hang Kong, including tropical cyclones, rainstorms, floods and landslips, is being kept under review and improved upon.

During the period of report of 1 September 1994 to 30 September 1995, nine persons died due to natural disasters and forty-five were injured due to heavy rainfall, flash floods and landslides in Hong Kong.

The Government of **JAPAN** established the Government Headquarters for the IDNDR in May 1989, and has been vigorously undertaking various activities for the Decade as a leading proponent of the IDNDR. For the purpose of promoting the international exchange of experience and information in the field of disaster reduction, the Government has held series of international conferences and seminars on natural disaster reduction in Japan, e.g., "the IDNDR International Conference 1990 Japan", "the IDNDR Summit Conference on Earthquake and Natural Disaster Countermeasures 1991", "the IDNDR Chiba International Conference 1992" and "the IDNDR Aichi/Nagoya International Conference on Natural Disaster Reduction 1993." Japan has played an active role in promoting related activities at international level, making contributions to the IDNDR Trust Fund 500 thousand U.S. dollars every year since 1990, and providing Japanese staff members to the IDNDR secretariat. Furthermore, for the World Conference on Natural Disaster Reduction convened by the United Nations, held at Yokohama in May 1994 with participants from 148 countries, the Japanese Government contributed additional funds to promote the participation of developing countries in the Conference.

The Japanese Government Headquaters for the IDNDR is preparing to convene the Asian Natural Disaster Reduction Conference in December 17-18,1995 in Kobe City. The Conference invites ministers from Asian countries who are either implementing or considering implementing policies for reducing disasters from earthquake, volcanic eruptions, typhoons, floods and other natural calamities, as well as ministers of other countries interested in disaster-reduction issues in Asia. The Conference is intended to strengthen cooperative policies for disaster reduction in Asia and to promote discussion of ways to enhance international efforts at disaster reduction. The agenda of the Conference is as follows;

(a) Lessons of the Great Hanshin-Awaji Earthquake.

(b) Disaster Reduction Measures and International Corperation in Asia

(c) Conference Summary

The Government of Japan has prepared the video tape related to the Great Hanshin-Awaji Earthquake which describes experiences of the citizens of Kobe and their responses to the disaster. The Government of Japan is also preparing to publish the brochure titled "Disaster countermeasures in Japan (1995 version)" which describes Japan's past expiriences of natural disasters and the countermeasures.

In the **REPUBLIC OF KOREA**, the period from February 20 to May 30, 1995 is kown as the Period of Disaster Preparedness Program. During this period the following main activities are undertaken :

- Checking and Maintenance of Dangerous Areas
- Securing of Equipment for Emergency Treatment in Occurance of Disaster
- Disaster Preparedness Education, training and Public Awareness

Disaster Prevention Education :

Civil servants across the country who are responsible for disaster prevention and preparedness participated in various educational programs. The Programs were prepared for the '95 rainy season.

Disaster Prevention Training :

Command post exercise and field training for natural disasters were carried out intensively just before the beginning of the rainy season. Civil servants, civilians, soldiers, official rescue workers, dozens of helicopters and many different kinds of heavy equipment were also mobilized in the field training which were held from April 25 to May 25.

Public Awareness to People about Importance of Disaster Preparedness :

A comprehensive public awareness plan was prepared and carried out for the rainy season including various mass media coverage as listed below:

- 2,185 broadcasts of 421 different advertisements through the mass media.

- 65,247 broadcasts through special media and government agencies. The public was guided with nation-wide practical disaster education through T.V., radio, newspapers, booklets, etc.

- Organization of the National day for disaster prevention (25 May each year)

- Overseas Training

- Carrying out "Prearranged Sheltering Plan"

- Reinforcing of Institutional Framework

- Revision of "Storm and Flood Disaster Countermeasures Act"

- Firming up earthquake disaster countermeasures

The permanent countermeasures against disasters are as follows in the Republic of Korea:

- *Disaster prevention and preparedness plans*

At present, there is a tendency for disasters to be both varied and large in scale so the government is establishing mid term plans (1992-1996) for disaster prevention. It is executing them on a yearly basis. During the period the government would invest U.S. $9.5 billion for 17 key fields such as flood control, forest conservation, research work, etc..

- *Improvement of disaster prevention technology for flood prone area*

In 6 years (1993~1998), the government would invest U.S. $236 million in phases in 213 regions. As of the end of 1995, U.S. $37 million were invested in 130 regions.

- *Improvement of disaster prevention technology in rural rivers*

Rural rivers in Korea are vulnerable to disaster because systematic maintenance was delayed. So systematic tools will be prepared for promotion of investment and overall maintenance. From 1995 to 2016 (for 22 years), plans are in the works to complete maintenance for 27,700km of 25,455 rivers with U.S. $7,375 million. As a part of this plan, 132km is under maintenance with U.S. $67 million in 1995, and investment will be increased for completing works within the planned period.

Research and other main activities in disaster prevention were as follow :

- Establishment of National Natural Disaster Prevention Research Institute

- Research for Policy Development

- Publication of Disaster Yearbook

The Disaster Yearbook has been published annually. In this book, lots of information, such as damage statistics (classified by cause, duration, watershed, and local government) and the activities of The National Disaster Prevention and Countermeasures Headquarters, are included. This book will play an important role as a data bank in planning disaster prevention and mitigation programmes in the future.

- On-Line Computer system for Disaster Prevention

- Computerization of damage report system.

Municipal districts can rapidly input the damage figures and emergency measures by computer terminal.

- Cities and Provinces can set up supporting system more quickly by using the information that put into in municipal districts.

- NDPCH can set up prompt countermeasure system with rapidly analyzing the situation in real time.

Nation -wide information network system for disaster prevention

- For analyzing the flood data in real time including water level, rainfall, weather forecast all around the country, on line system from main computer in MOHA will be established.

- For upgrading observation facilities in local districts, 1,006 sites with conventional type sensors will be replaced with automatic facilities. In total, 1,560 sites are equipped with automatic observation systems.

- By May 1995, automatic water gauge facilities will be set up at the 111 spots of rivers for securing water level observation net. Network system between institution will be completed by the end of 1995 for advanced management of disaster.

- Carrying out Publication of "The 30 Year History Book of Natural Disaster Prevention and Preparedness in Korea

The book will be organized in 1994 and will be distributed in 1995. An organizing committee for this book consists of authorized government officials, related scholars, and specialists. The contents are :

- Photographs of natural disaster in Korea.
- The Record of natural disaster in Korea since the dawn of history to present time.
- The history of disaster prevention and preparednessfrom 1946 to the present time.
- The precept and direction for disaster prevention and preparedness.

In the Republic of Korea, National and Local Prevention and Countermeasures Headquaters have steadily carried out various countermeasure plans to mitigate natural disaster damages. As a result measures, the number of casulties have been reduced by 52% compared with the average of last ten years (1985-1994).

During the period from Sept.1, 1994 to Aug. 31, 1995, 145 people were killed and total loss of property amounted to U.S. $734million.

In **MACAU**, no major disasters occurred in 1995. Several typhoons influenced the territory, but no significant losses or damages were registered. During the year the following main activities were undertaken.

- Exercise to test the Typhoon Plan, particularly, the communication systems and the response of the several public and private Departments involved.

- Presentations to a number of teachers and other officials of the Education and Youth Department concerning typhoon prevention.

- Seminar to discuss typhoon preparedness policies and fire prevention measures, with the attendance of the Directors of the public and private schools of Macau.

- A task-force studied the disaster prevention organization, public awareness action plan and reviewed the Typhoon Plan, and presented its report to the Secretary for Security.

- Meeting held with the representatives of the Civil Defence Organization to discuss disaster prevention and the Typhoon Plan.

- Exercise undertaken to test the Typhoon Plan, particularly, the communication systems and the response of the several public and private Departments involved.

- Public awareness campaign related to disaster prevention in radio, TV and press.

- Signature of the agreement for the use of the public and private ambulances between Security Forces, Health Department, Sports Institute, Kiang Wu Hospital, Red Cross and Macau Jockey Club.

- Edition of a booklet for typhoon disaster prevention.

The Government of **MALAYSIA**, in conjunction with the IDNR, has established the National Committee at the office of National Security Council (NSC), Prime Minister's Department. This year's IDNDR day, Wednesday 11 October 1995 was commemorated by undertaking various activities including broadcasts by the Government TV and radio stations and by other means of telecommunication, aiming at enhancing public awareness of the effects of natural disasters, and also through civic education and practical training in life saving technique for communities in the natural disaster prone areas. Presentations on lives saving during floods were made and pamphlets distributed in flood prone areas all over the country.

The NSC is coordinating activities to publicize educational material for children in Malaysia on how to prepare themselves in confronting flood.

As a result of Highland Towers tragedy on 22 December 1993 which claimed 48 lives, the Government has decided to form The Special Malaysia Disaster Assistance and Rescue Team (SMART) to carry out search and rescue operation in major disasters, and the

establishment of Major Disaster Management Committee to handle major disasters on land in a coordinated and effective manner. The Committee chaired by the Minister in charge of disaster management in the Prime Minister's Department is responsible in the overall coordination in respect to management of major disasters and the mobilisation of SMART in search and rescue operation.

SMART comprises of officers and personnel from the Fire Brigate Department, Royal Malaysia Police and the Armed Forces respectively.

With the publication of the last of a series of eighth issues of the ADMIN newsletter in August 1995, Malaysia has completed its assignment which emanated from a decision made at the 8th Meeting of the ASEAN Experts Group on Disaster Management (AEGDM) held in Langkawi, Malaysia, on 9-11 August 1993. The forthcoming meeting of AEGDM would pass the responsibility of producing the newsletter to the Philippines.

It has been an extremely rewarding experience for members of the Editorial Board, drawn wholly from staff of MMS to be involved in such a meaningful activity, particularly as it fits well in the regional initiative to enhance its contribution to IDNDR.

In the **PHILIPPINES**, the programs and activities of the Office of Civil Defense (OCD) in 1995 were geared towards disaster preparedness, response, prevention and mitigation. It provided guidance to LGUs in the organization and training of their disaster coordinating councils and preparation of their disaster plans and such other similar activities that could enhance their capacity to operate accordingly during the occurrence of disasters or other untoward incidents.

By June 1995, a total of 11 implementing/contingency plans were updated; 97 public information drives were conducted with 11,656 participating. Around 24,514 information materials were distributed. The OCD supervised 51 disaster drills/exercises with 18,370 people participating. A total of 1,137 Disaster Coordinating Councils (DCCs) and 246 Disaster Control Groups (DCGs) were organized and reorganized. Likewise, 178 DCCs and DCGs consisting of 10,724 members to include volunteer-workers were trained on disaster management.

With respect to its communications capability, the Office religiously maintains its communications network at the OCD base station in Camp Aguinaldo and its 13 regional centers and sub-stations. It continuously strengthen its communication linkages by affiliating with it civic radio clubs with communications resources and which are engaged in public assistance during emergencies/disasters. Two (2) communications groups presently affiliated with the OCD, the TIGER and the Amateur Radio Emergency Service (ARES), have installed their communications base stations at the Office. Further, a telephone set directly linked with TELOF Satellite sub-station was installed by the Department of Transportation and Communication (DOTC) at the National Disaster Management Center (NDMC). Said project is a component of DOTC under the Government Emergency Telecommunication System (GETS).

With the DCCs in place at all levels, disaster management activities during the three phases of emergency were synchronized resulting in systematic disaster operations. In effect, involvement of the community and NGOs was obtained.

In like manner, the efforts of the national government agencies were coordinated, thus, confusion as to who will do what, when and where was minimized. Relatedly, construction of the NDMC has already started. This Center is the focal point from which policies, directives, coordination and other disaster-related activities emanate.

During the period, 7 National Disaster Coordinating Council (NDCC) memoranda were issued which included, among others, policies and procedures in requesting, allocating, releasing and monitoring of Calamity Fund. With the issuance of such policies and procedure, further unification of the moves of the entire country is expected. These policies emphasize the need for agency/LGU recipients of calamity fund to report how much fund has been utilized. In effect, the use of such government fund becomes very transparent. Guidelines on the provision of NDCC financial assistance to the dead/injured/missing victims of disasters to prevent delays and/or red tape in the processing of such financial assistance were also issued. The Committee on Disaster Mitigation, a committee responsible to undertake activities/projects relevant to disaster mitigation, was created.

The NDCC thru the OCD, its functioning staff, has convened 30 meetings on disaster mitigation, relief and reconstruction (DMMRR), drainage of impounded water in the Mt. Pinatubo slopes, and inland oil spills which were all geared towards environmental protection. The OCD chairs the Sub-Committee on DMMR of the National Committee on Habitat II or Human Settlements. Habitat II focuses on urban area settlements.

The Management Information System Unit (MISU) started functioning officially last 2 January 1995. The MISU facilitates the processing and retrieval of both disaster and administrative data which are very essential in the effective implementation of disaster management programs.

Development of its human resource was also a priority activity of the Office. This resulted in the conduct of 4 in-service trainings with 110 employees attending, participation of 20 people in 13 trainings conducted by other local agencies/bodies and 2 female participants to Counter-disaster Planning Course in Australia and Disaster Management Course - 19 in Bangkok, Thailand, respectively.

In **THAILAND**, civil defence activities are governed by the Civil Defence Act 1979 (B.E. 2522). The main authority is delegated under this Act to the Ministry of Interior. According to the Act, civil defence operations cover public disasters, air threat and sabotage. Operations are undertaken before the disaster, and during the disaster, including evacuation of the people and of government facilities.

The structure of civil defence organization in Thailand is divided into three levels:

1) National Level

The Minister of Interior is the National Director - Civil Defence (NCDC) having the authority covering the whole country. Organization in this level consists of the following organizations:

a. National Civil Defence Committee

b. Civil Defence Secretariat
c. Civil Defence Division

2) Regional Level

The Regional Director - Civil Defence is appointed by the NCDC having authorities in the region as defined by the NCDC. The southern part of Thailand has been designated as the Southern Regional Civil Defence with centre at Hatyai. Other regions of the country are also being defined.

3) Responsible Areas Level

In this level there are five types of director - civil defence: Provincial Director; District Director; Municipality Director; Bangkok Metropolitan Director; and Pattaya City Director.

Thailand subcommittee for the IDNDR was established on 20 June 1990 by the National Civil Defence Committee of Thailand in response to the United Nations Resolution 42/169. The subcommittee for IDNDR is made up of 21 members from government agencies and NGO's . The subcommittee is chaired by Deputy Permanent Secretary for Interior and Director-General of the Department of Local Administration is the vice-chairman.

In Thailand, starting in August 1995 and continuing until almost the end of November, large parts of the country, including the capital city of Bangkok suffered large scale flooding, which took considerable number of lives and caused extensive damage to property. The damage assessment activities are currently continuing. Although 1994 was not a particularly flood year, due to flooding at various parts of the country 46 persons lost their lives and economic damage was estimated as more than US$ 200 million.

The Government of **VIETNAM** has set up the National Committee for IDNDR and launched an action programme. This action programme is aimed at achieving the following objectives.

- To minimize human life loss
- To mitigate damage to properties
- To mitigate the interruption of production

The National Committee for IDNDR has carried out a seris of activities in 1994-1995. It has:

- Strengthened the directing and commanding apparatus for flood and strom control at all levels (central, provincial, district and village).

- Basically completed the establishment of funds for flood and storm control in provinces and cities in Vietnam. Up to October 1995, 53 provinces and cities have set up flood and storm control funds. By the end 1994, the sum of money coming from all sources has exceeded 13 billion dongs (about 1.2 million US$). The total amount of the funds obtained in the period from 1993 to 1994 was about 2.5

million US$. The money received has been spent on strengthening structures for flood and storm control and relieving people in affected areas for rehabilitation and reconstruction work (especially in the Central and Southern Vietnam).

- Improved the quality of dikes' systems in the Red River Delta, and in the North of the Central Vietnam, the quality of the dikes along coastal line from Mongcai to Hatien, the Day river diverting system, water reservoirs like Hoabinh, Thacba and others.

- Strengthened flood combating force in all localities along river banks from provincial level donor, especially at village level.

- Completed a legal document that has become the decree on flood and storm control activities, made public by the government in the period of 1993-1995.

Water related disaster situation in Vietnam during the period 1 September 1994 to 31 August 1995 were as follows:

- Heavy rains in 1994 and 1995 caused largest and large floods in the all river basins of Vietnam. In a territory of more than 7 provinces in the South of Vietnam, 2,300,000 hectares were submerged, 524 people were killed or missing, and more than 500 others were injured. Thousand of houses were destroyed and inundated. More than 2,000,000 hectares of crop were destroyed and damaged. Many water resources, transportation and electrical structures were washed away. Hundred thousands of tons of food were damaged.

- Four tropical cyclones that affected Vietnam, heavy rains, flash floods, hails and tornadoes as well as droughts in some provinces also caused considerable loss of lives and severe damage to property.

- Total economic loss from water related disasters in the period of 1 September to 31 August 1995 is about 335 million US$, 670 people was killed or missing, more 500 people was injured, more than 1,000,000 houses were damaged, destroyed or affected, more than 4,200,000 hectares of crop were inundated or affected.

There are various other ongoing activities in Vietnam related to natural disaster reduction.

APPENDIX IX

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

In **CHINA**, the second training course on the basic theory and forecast of storm surge was held by Department of Operational Development of Operational Development and Weather of China Meteorological Administration at Nantong, Jiangsu Province 1-5 November, 1994. The main topics include: (1) basic concept of storm surge; (2) basic theory of storm surge; (3) forecast of storm surge including empirical forecast, statistic forecast and dynamic numerical forecast. Experts from coastal areas, National Meteorological Centre, major ports, oceanic weather offices, salt industry weather offices and light industry administration took part in this training course. There were 39 trainees. Lectures were delivered by the senior Chinese storm surge expert, Prof. Qin Zenghao.

A training course on the applications of numerical weather prediction was held by Department of Operational Development and Weather of China Meteorological Administration and National Meteorological Centre in Beijing 21-24 March 1995. About 68 forecast experts from province - level weather offices participated in the course. The training course includes the following five aspects: (1) features of T63 model, products provided for observatories and products time table; (2) transmission form, code form, decode form of numerical prediction products and related software; (3) technical method of the interpretation and application of numerical prediction products; (4) products processing techniques; (5) nest - scheme between the models of National Meteorological Centre and regional meteorological centres.

In **HONG KONG**, the Royal Observatory organized several in-house meteorological training courses in 1995 including:

i. Meteorology of Southeast Asia (MSEA);

ii. Meteorology Course for Aviation Forecasters (MCAF);

iii. Pre-UK Training Assessment Programme; and

iv. Initial Training Course for Scientific Assistant (ITC).

A total of 34 meteorological personnel of WMO Class I, II and III attended these courses. Two meteorologists from the Macau Meteorological and Geophysical Service also attended the MCAF.

Royal Observatory's participation in overseas training included:

i. two officers attended the "WMO training workshop on Public Weather Services" held in Singapore from 24 April to 5 May 1995;

ii. two officers attended the "Use and Interpretation of European Centre for Medium Range Weather Forecast (ECMWF) products" course at ECMWF in June 1995 and the "Application and Interpretation of Numerical Weather Prediction (NWP) products in Aviation" course at the United Kingdom Meteorological Office College (UKMOC) in July 1995 respectively;

iii. two meteorologists attended the Co-operative programme for Operational Meteorology, Education and Training (COMET) Manager's course at the National Centre for Atmospheric Research (NCAR) in July 1995;

iv. two officers participated in the COMET Mesoscale Meteorology Course and an attachment on computer-aided learning at NCAR in August 1995;

v. four officers attended the Meteorology for Graduate Course (MGC) at the UKMOC in November 1995.

In 1995, there were several aviation-related overseas training including:

i. two officers attended the Phase I training on the Operational Windshear Warning System (OWWS) at NCAR in January;

ii. one officer attended the Low-level Windshear Alert System (LLWAS) and the Wind Profiler/Rado Acoustic Sounding System (RASS) at NCAR while three officers undertook the Phase I training on the Meteorological Data Processing System (METPS) in February;

iii. two officers attended the training attachment of the Aerodrome Meteorological Observing System (AMOS) in August 1995; and

iv. three officers attended the Test Team Course for the Terminal Doppler Weather Radar (TDWR) in U.S.A. while three other officers participated in the Wind Profiler's Maintenance Training Course at the supplier's training centre in November.

In **JAPAN**, JMA continues its endeavour to expand the technical cooperation in the field of training and dispatch of experts. After the former session, JMA conducted training courses on numerical prediction and telecommunications for Members of the Typhoon Committee, as shown in Table 1, and dispatched experts as shown in Table 2.

In **MACAU**, a number of SMG staffs have been trained in the following meteorological courses:

Course	Duration	No. of Participants
Class I Met. officer	3 months	4
Class II Met. officer	6 months	4
Class III Met. officer	3 months	6
C. on Met. Obs. Proc.	2 months	6
Specialization Course on Aeronautical Obs. and Inf. Course	2 months	12
Aeronautical Inf. Course	20 hours	20
Objective Analysis	1 week	5

Local and overseas Training/Seminar/Workshop attended by SMG personnel:

Subject	Venue	Duration	No. of Participants
Met Course for Aviation Forecaster	Hong Kong	18 Apr - 6 May	2
On-Job-Training in AMO	Hong Kong	13 days	4
Training Course on the Interpretation of NWP Products	Nanjing	7 Oct - 9 Nov	1
Training Course on METIS2000 MET, software	Macau	2 weeks	15
Training visit to Singapore AMO	Singapore	1 week	2

In **MALAYSIA**, training activities on flood forecasting and warning organized during the year 1995:

Date	Activity	Venue	No. of Participants
15 March 1995	Joint Seminar on flood Forecasting and Warning Systems by DID Malaysia and IDI Japan	Kuala Lumpur	44
10 - 11 April 1995	Introductory Course on Telemail System for users	Kuala Lumpur	35
24 - 28 July 1995	Hydrology Course for technicians	Malacca	40

Date	Activity	Venue	No. of Participants
3 - 12 September	Study tour on the Flood forecasting services of China	China	4

Training provided by the Malaysia Meteorological Service to its personnel in 1995:

Course	No. of Participants
(I) Course on Radiosonde Observation	9
(ii) Course on Meteorological Aspect of Air Pollution	8
(iii) Basic Course on Radar and Radar Meteorology	7
(iv) Basic Course on Electronics	15

Overseas training/seminar/workshop attended by Malaysian Meteorological Service Personnel in 1995:

Subject	Venue	Duration	No. of Participants
Joint Research Project on Analysis of Rainfall Data and GMS Satellite Data	Tsukuba, Japan	23.1.95 - 22.2.95	1
Fifth WMO/IMD Regional Workshop on Asia/African Monsoon Emphasizing Training Aspects	New Delhi, India	30.1.95 - 3.2.95	2
Training Course on Tracking Forest Fire Using NOAA Satellite Data	Singapore	6.3.95 - 10.3.95	3
Training Course on Weather Forecasting and Radar Operation	Taiwan	5.6.95 - 16.6.95	2
International Training Course in the Interpretation and Application of Numerical Weather Prediction Products	Nanjing, China	9.10.95 - 9.11.95	1
Training Workshop on Public Weather Services with Particular Emphasis on Television Weather Presentation and Communication Skills	Singapore	24.4.95 - 5.5.95	1
Workshop on Scientific Plan for South China Sea Monsoon Experiment	Beijing, China	5.6.95 - 8.6.95	1
Workshop on Methods to Assess Greenhouse Gas Mitigation Options for Developing Countries in Asia	Pattaya, Thailand	3.8.95 - 5.8.95	1
Regional Workshop on Greenhouse Gas Emission and Mitigation Assessment for Asian and Pacific Countries	Seoul, Korea	25.9.95 - 29.9.95	1
Training Course in Marine Meteorology	Melbourne, Australia	2.10.95 - 20.10.95	1

In the **PHILIPPINES**, international trainings, conferences and courses attended by PAGASA personnel in 1995:

Field/Course	No. of Participants	Place
Storm and Flood Forecasting	6	Philippines
Group Training Course on Measures to Reduce the Use of the Ozone Depleting Substances	1	Japan
Group Training Course in Environmental Engineering (Air Pollution Control)	1	Japan
Training Course on Meteorological Telecommunication	2	India
Global Training Seminar on Data Quality	1	France
Instrumentation Course	2	India
2nd International Study Conference on GEWEX in Asia and GAME	2	Thailand
International Post Graduate Course in Hydromet	1	Israel
6th International Advanced Course/Workshop on River Flow Forecasting	1	Ireland
Australian Aviation Workshop on Volcanic Ash Hazards	1	Australia
Training Workshop on Public Weather Services (TV Presentation and Communication Skills)	1	Singapore
International Workshop on Limited Area and Variable Resolution Models	1	China
International Conference on Meteorological and Hydrological Technology and Management	1	Switzerland
International 12-Week Course on Aseismic Design and Construction	1	Macedonia
Conference on RS & GIS for Environmental Resources Management	1	Japan
8th International/Regional Pyrheliometer Comparison	1	Leningrad
28th Session of the Intergovernmental Oceanographic Commission Executive Council	1	France
Marine Meteorological Training Course	1	Australia

Local Trainings conducted by PAGASA:

Course	Duration
Meteorological Observer Training Course	4 July - 30 Dec 1994
On-the-Job Training on Natural Disaster Forecasting	19 Sept - 14 Oct 1994
Familiarization in Flood Forecasting Facilities	26 Sept - 6 Oct 1994
Seminars on Severe Weather Warning System of PAGASA	Nov 1994 - Feb 1995

Course	Duration
Disaster Management Course	20 Feb - 17 Mar 1995
Satellite Imagery Enhancement, Interpretation and Analysis	24 Apr - 2 May 1995
Computer Literacy Training Program	1 Mar - 6 July 1995
Operational Hydrology Training Course	22 May 1995 - 17 Jan 1996

International Workshop/Conferences Conducted in the Philippines:

- Asia-Pacific Leaders Conference on Climate Change, 17-20 February 1995
- Conference Workshop on Climate Change Issues, 3-4 August 1995
- Forest and Climate Change Council Stakeholders Conference, 29-31 August 1995

VCP Scholars at the University of the Philippines taking up Post Graduate Course on Meteorology:

- 1 Iraq
- 2 Sri Lanka
- 1 Vietnam
- 15 Philippines

In **KOREA**, 105 KMA staffs have participated in international workshops/ conferences, technical discussions, training, etc. in 1995. Among them, training related to the activities on the Typhoon Committee are listed as follow:

Period (month/day)	Country (Organization)	Contents	Financial Source
3/5 - 3/21	Japan	Global monitoring of satellite data	KMA
3/12 - 3/25	Japan (JMA)	Data assimilation symposium/NWP technical Discussion	KMA
3/28 - 4/26	Japan (JMA)	Diagnosis of climate system	KMA
9/16 - 9/24	USA (GFDL)	GFDL hurricane model technical discussion	KMA
10/7 - 11/10	China (Nanjing RMTC)	Training on application of NWP outputs	CMA
10/8 - 11/3	Japan (JMA)	GMS-5 technical training	KMA
10/22 - 11/4	China (CMA)	Limited area model workshop/ Technical discussion	CMA/ KMA
11/26 - 12/2	Japan	4th SPECTRUM workshop	WMO/ KMA

In **THAILAND**, overseas training/seminar attended by TMS personnel in 1995:

No. of Participants	Title	Host	Duration
1	Global Training Seminar on Data Quality	Singapore	20 - 25 March 1995
2	Training Course in General	India	9 Jan. - 19 July 1995
1	Training Course on Software Development for Meteorology	Singapore	1 Sept. - 31 Oct. 1995
2	Training Course on Interpretation and Application of Numerical Weather Prediction	China	9 Oct. - 9 Nov. 1995

In **VIETNAM**, training course/seminar/workshop attended by Vietnam HMS personnel in 1994 and 1995:

Year	No. of Participants		No. of Participants			Studytours
	Seminar	Workshop	Graduate	Postgraduate	Short-term training	
1994	22	22	0	13	8	29
1995	35	20	0	15	21	5
Total	57	42	0	28	29	34

APPENDIX X

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

In **CHINA**, prominent progresses have been made on the studies of tropical cyclone (TC) unusual motion, sudden change of TC intensity and sudden enhancement of typhoon precipitation, etc.

Observational studies of target typhoons chosen in the national typhoon field experiments during 1993 and 1994 revealed many facts such as asymmetric features of landing typhoon precipitation, characteristics of stream field and activities of meso-scale systems and cloud clusters, etc. Asymmetric distribution of meso-scale systems within a basically symmetric typhoon circulation is disclosed and analysis on the development of the asymmetric structure of typhoon is conducted.

The synoptic and climatic statistical method combined with the physical climatic diagnosis scheme is adopted to study the typhoon unusual motion, sudden intensity and sudden rainfall enhancement. A related atlas will be published soon.

Response properties of typhoon moving direction to the changes of basic flow velocities are studied. A nonlinear relationship between typhoon moving direction and changes of basic flow velocities is deduced and a concept of "basic flow critical speed" is introduced.

Studies show that both linear beta term and nonlinear terms play important roles in forming the asymmetric structure of typhoon circulation. Development of wave series of typhoon vortex energy dispersion depends on the characteristics of the environment field and typhoon structure. The propagating direction of wave series is consistent with the typhoon movement and could be used as mean for the tract prediction.

Analyses reveal the positive feedback process of coupled upper/low level jets and the southerly wind of typhoon circulation. It also shows the inter-promotion role between this process and the enhancement of typhoon precipitation. The importance of the symmetric instability on rainfall enhancement is put forward.

Titles and authors of some papers are appended for reference:

Chen Lianshou (Chinese Academy of Meteorological Sciences): An overview on the theoretical study and numerical experiment on typhoon unusual motion.

Zhu Yongti and Chen Daihui (Shanghai Typhoon Institute): A numerical study on the effect of speed change of the basic flow upon tropic cyclone motion.

Chen Lianshou, Xu Xuangde (Chinese Academy of Meteorological Sciences) and Xie Yiyang (Tianjing Meteorological Laboratory) and Li Wenhong (Chinese

Academy of Meteorological Sciences): Impact of thermodynamic asymmetric structure on typhoon unusual motion.

Meng Zhiyong, Xu Xuangde and Chen Lianshou (Chinese Academy of Meteorological Sciences): Impact of Taiwan island topography on typhoon motion.

Meng Zhiyong (Chinese Academy of Meteorological Sciences), Masashi Nagata (Japan Meteorological Agency): A study on the forming and developing mechanism of island induced low and its impact on TC's structure change and motion.

Jincai Ding, Zujing Yao (Shanghai Meteorological Center) and Xinzhang Tang (Shanghai Meteorological Bureau): The analysis of the asymmetric structure of tropical cyclone DOUG and its influence on precipitation.

In Hong Kong, the following studies on tropical cyclone were completed by the Royal Observatory:

Observational studies of tropical cyclones with sheared or cold-cored characteristics.

Use of 'ECMWF 850 hPa vorticity fields in the forecasting of tropical cyclones and intense lows in June-July 1994.

Performance of a climatology-persistence technique (CLIPER) in predicting tropical cyclone motion in the Western North Pacific and the South China Sea.

The research projects below are in progress at the Royal Observatory, Hong Kong:

Comparative study of different tropical cyclone track scenarios.

An operational tropical cyclone tracking and warning system.

SPECTRUM-related research is performed on the following themes at City University of Hong Kong:

The asymmetric flow associated with tropical cyclone motion

Steering vs. propagation

Vorticity budget

Impact of bogus data on the prediction of tropical cyclone motion.

In **JAPAN**, new numerical analysis and prediction models are now being developed for operational use starting in March 1996. Various tests of the models performed include that of a typhoon track prediction model (TYM) implemented with the Arakawa-Schubert cumulus parameterization scheme. The model shows a slight

improvement of typhoon track prediction in comparison with the current operation TYM using moist convective adjustment.

COMPARE Project

JMA has shown its intention of undertaking a lead center of CASE III of the Comparison of Meso-scale Prediction and Research Experiments (COMPARE) project under WMO-CAS/JSC-WGNE where a typhoon during the SPECTRUM observational period will be chosen as a target of prediction with limited-area meso-scale models of participating institutes and groups. The Steering Committee of the project has approved the experimental plan proposed by JMA, in which an explosive development of a typhoon be studied extensively in model intercomparison. The tentative schedule approved includes the distribution of analysis data in September 1996, the submission of prediction results in May 1997, and the workshop for discussion of the results in September 1997. Analysis fields produced by MRI with the new JMA global analysis-prediction system will be used as initial fields for prediction models in the project as well as those produced by NMC of the United States.

Reanalysis of SPECTRUM Observations

The Meteorological Research Institute (MRI), has continued re-analysis with the JMA operational global data assimilation system to study the impact of the SPECTRUM observations on objective analyses and tropical cyclone forecasts. It has been found that the low performance of the prediction for T9019 (Flo) reported last year was due to positive systematic biases of sea level pressure observations y some TCM-90 buoys. This suggests importance of quality of individual observations in the tropical ocean where most tropical cyclones are generated and developed but there are few observations.

Conceptual model of quasi-uniform flow theory proposed by Elsberry has been applied broadly to baroclinic atmosphere. It shows that apart from beta gyres of typhoon circulation, there also exist certain smaller-scale dipole system within. The interaction between these two dipole systems can lead to the change of typhoon motion.

Based on a theoretical model of vortex dynamics, the contour dynamics method is adopted to study the typhoon asymmetric structure by using the dipole system with the introduction of beta effect. The meandering and looping motions of typhoon near the ideal subtropical high ridge, monsoon troughs and two-dimensional saddle environment are obtained through modeling. A mathematical model using multi-contour dynamics for predicting the typhoon motion in rotational field is derived and is designed for operational application.

Studies show that the tropical cyclone structure consists of two asymmetric parts induced respectively by dynamic and thermodynamic processes. They have an equal contribution to the typhoon unusual motion. Through composite analysis of the beta-gyre at middle troposphere and the divergence-convergence dipole at upper layer is constructed and its significance of "steering" is given as well.

Results of numerical and fluid experiments show that typhoons which approach the southern end of the Taiwan island will take an apparent right-turning and those crossing the middle or northern end of the island will turn to the left, heading to the Taiwan strait.

Studies of predictability of typhoon's complicated track using intensive observational data during SPECTRUM show that typhoon motion in the Western Pacific can be described by a low-order system. It proves that there exists the possibility for predicting such kind of unusual motion.

Theoretical studies show that beta effect and non-linear advection are two key functions to form the two-dimensional asymmetric structure of tropical cyclone. The turbulent viscosity has no contribution to the asymmetric structure forming. The inner and outer areas of tropical cyclones are controlled by different dynamical equations with rotational wind condition for the inner area and gradient wind for the outer one, respectively. Analytic solution obtained from these two control equations are similar to the profiles of real typhoon and could be used to construct the typhoon vortex.

A triple nested typhoon numerical model has been developed with better representation of topographic effect. It is used to study the typhoon heavy rain and put in pre-operational use obtained for typhoons 9413 and 9414 with respect to predictions of their tracks and precipitation distributions.

Numerical experiments show that increase of rainfall by a landing typhoon may exceed 50% when affected by topography and the convergence may increase eight times near the precipitation center. Surface drag coefficient Cd is a very important parameter and the rainfall enhancement could reach 40% when Cd is doubled. Results show that the optimum value of Cd is 0.005 for the southeast coast and the forecast accuracy for typhoon landing point and its precipitation are improved when using this value.

Impact of the reanalyzed cloud tracked wind vectors is examined. The data shows no significant positive impact on the tropical cyclone track prediction but shows improvement in the prediction of geopotential height field in the Western North Pacific where observations were enhanced.

Observational and Analytical Studies

In 1994 Typhoon Orchid (T9426) was observed in the Kanto District by the typhoon observation group of the MRI. Some omega-sondes were launched and two Doppler radars were operated at short time intervals to elucidate the three-dimensional structure within the typhoon area. In its northeast quadrant there were line-formed heavy rainfall systems at the northern part of Ibaraki prefecture.

Typhoon Fred (T9416) was observed with the Ishigakijima radar using the volume-scanning method with 14 elevation angle during its passage off the island. MRI staff members have analyzed various aspects of fine structure of rainbands near the typhoon center.

Structure of a stationary band complex (SBC) of T8913 in the Kanto district was analyzed with dual-Doppler radar data and it was compared with those simulated in

numerical experiments in literature. The SBC in T8913 was composed of a slow-moving principal band and fast-moving secondary bands which rotated around the typhoon center at a high speed of 30 degrees per hour. The slow-moving principal band had similar structure such as strong wind band and high vorticity band with the stationary rainband which formed in numerical experiments by Tuleya and Kurihara (1984). Although the principal band is smaller than Tuleya and Kurihara's band, both bands seem to be caused by the Typhoon movement. The secondary bands rotated caused by the typhoon movement. The secondary bands rotated quickly like inertia-buoyancy waves which appeared in a numerical model of non-moving tropical cyclone by Kurihara and Tuleya (1974). But the secondary bands did not have a positive correlation between tangential and radial velocity anomalies which is essential to the development of inertia-buoyancy waves. Both the principal and the secondary bands mainly consists of stratiform precipitation and no cold pool in the boundary layer. Hence, they were different from Yamasaki (1986)'s rainbands in which the cold downdrafts of convective clouds were important. The coexistence of the slow-moving and the fast-moving rainbands as in T8913 is simulated only by Jones (1986), but their results are ambiguous. This observational study indicates that the numerical models need further improvement in order to realistically simulate typhoon rainbands.

Application of Microwave Data

MSU (Microwave Sounding Unit) aboard NOAA polar orbiting satellite was used to analyze the atmospheric temperature at 250 hPa over the center of typhoon based on Velden et al (1991). The weighting function of MSU channel 3 shows a peak at 250 hPa where warm core of typhoon is generally significant. Limb corrected TBB of MSU channel 3 were analyzed for T9434. Very clear warm core anomaly was observed when the central pressure was 955 hPa, while the warm core anomaly became vague one day later when the central pressure was 990 hPa. MSU observation is promising to estimate the central pressure of typhoon qualitatively from other cases, yet further study is required for quantitative estimation.

Development of Prediction Model of Storm Surges

With a model to predict, storm surges on a real-time basis, simulation and prediction experiments of big storms surges were performed. They were caused by six typhoons which struck Tokyo Bay. A method of objective estimation of parameters prescribing typhoons based on geostationary meteorological satellite and forecaster's analyses, was developed. The storm surges in Tokyo Bay were simulated well with the method, while the model underestimates the storm surges at some ports facing open ocean, out of Tokyo Bay. This means that another generation mechanism of storm surges, which had not been included in traditional models such as the model here, must be considered.

In **MACAU**, as a new Meteorological Radar and High Resolution Satellite Receiving System will be installed next year (1996), DEVELOPMENT AND USE OF TECHNIQUES FOR QUANTITATIVE PRECIPITATION FORECAST (QPF) on routine forecast will implemented.

Other researches in Macau:

Cooperation with University of Macau on a "Research Project on Impact Assessment of Toxic Air Pollution in Urban Areas of Macau"

Study on wind condition at MIA runway.

In **MALAYSIA**, the Malaysian Meteorological service will attempt to study the impact of ocean variability's on the weather and climate over Malaysia, especially in connection with the winter monsoon fluctuations so as to provide a better understanding of the monsoon and its associated rainfall. Meanwhile, research work on the large-scale effects of typhoons over Malaysia will continue with the inclusion of more recent case studies, particularly with respect to Typhoon Ryan which developed in the South China Sea in September 1995. Relatively strong wind surges over Peninsular Malaysia induced by the distant but relatively quasi-stationary typhoon produced a record in the rainfall over the state of Penang.

In **KOREA**, most research activities related to typhoon in the KMA have been concentrated on the improvement of numerical typhoon forecast model. Major topics are listed as follows:

Steering Current

Two alternative methods have been tested to improve background initial steering current around vortex at initial time. The current KTM applies persistent vector from the previous 6 hour movement. However, one of the new approaches is the estimation of vortex motion from local energy budget. The idea stems from the hypothesis that the movement of vortex is closely related to the local tendency of kinetic energy or vorticity. Another approach is to apply CLIPER forecast vector as the steering current. It has been shown that CLIPER estimated steering current looks superior to that from local tendency so far.

Initial Vortex Bogussing

The KTM uses initial vortex bogussing based on the Fujita's Formula. A new approach is in progress based on the initial vortex specification by Kurihara et al (1993, 1995). At first, the forecasted (or analyzed) vortex has been removed from the first guess field by applying a spatial filter. Then Kurihara's method is applied to generate more realistic initial vortex.

In the **PHILIPPINES**, the following research projects are in progress at the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA):

Statistical method of forecasting tropical cyclone recurvature in the Philippines (Dec. 1995)

Tropical cyclone rainfall nomogram for the Pinatubo area (Dec. 1995)

Southwest monsoon surge associated with tropical cyclones (Dec. 1995)

Typhoon wind profile related to warning and damage (Dec. 1995)

Tropical cyclone forecast development scheme (Dec. 1996)

In **THAILAND**, some objective technique for tropical cyclone prediction over Thailand and neighboring areas are further investigated and formulated. Tropical cyclone climatology over Thailand area of responsibility has been further studied.

The initialization schemes and boundary conditions for the primitive equation model applied for a limited region in the South China Sea and surrounding area are being studied. The formulation of cumulus parameterization and the large-scale release of latent heat are being investigated for the tropical atmosphere.

All NWP products received by GTS from ECMWF, KWBC (Washington), RJTD (Tokyo) and EGRR (Bracknell) are analyzed and graphically displaced by software developed on IBM-PC/AT, for the purpose of research and operation of weather forecast.

A working group with a close coordination of the scientists from various research institutes aiming to develop models of Numerical Weather Prediction has been established.

The existing five-level limited area model is under study and modification for use over region of Thailand and neighboring areas.

Investigation on impact caused by severe tropical storms is under way in disaster prone areas. All relevant data would be further studied in the view of developing the effective measurements for reducing natural calamities.

The other tropical cyclones are further studied such as GAY (T8929) and ANGELA (T9224) on their peculiar movement in the area of Gulf of Thailand. All available data concerned were collected elaborately. Significant aspects of the evolution and development of these disturbances are under analysis and investigation. The essential of and requirement for a limited area numerical model for forecasting purposes are on experiment and study and also the model is under formulation with additional beneficial data utilization of global model from various centres. Besides, research aspects of these severe tropical cyclones which originated in low latitudes over the tropical ocean are also attempted and being laid down for further implementation in combination with the available SPECTRUM data.

The available data are being read out and drafted from all SPECTRUM and TCM-90 tapes. DOT (T9017) is one of the typhoons which interested us regarding its significant phenomena. In a specific area, the output of disturbance movement will be further deliberated and also studied in comparison with climatological characteristics.

Some objective techniques are developed for investigation of the Thai people's attitudes towards meteorological work.

A comparative study of water inflow and storage by dam for rainfall caused by tropical cyclones passing Thailand is performed.

In **VIETNAM**, research activities listed below have been performed:

Study of variation of vertical structure of geopotential height and temperature fields over the Hanoi region under the influence of tropical cyclones landing at the northern part of Vietnam coastline.

Analysis of the test results of 24-hour forecasts of tropical cyclone tracks by making use of the vertically integrated steering flow model.

Establishing a model for computing the wind fields of tropical cyclone over the East Vietnam Sea areas.

Composing the software system for analysis and prediction of tropical cyclone intensity with the use of meteorological satellite and weather radar data.

Continued study of synoptic situations related to extremely heavy rains caused by tropical cyclones affecting the central part of Vietnam.

APPENDIX XI

ACTIVITIES OF THE COMMISSION FOR ATMOSPHERIC SCIENCES (CAS)

World Meteorological Organization
Commission for Atmospheric Sciences
Working Group on Tropical Meteorology Research
(WGTMR)

I. PURPOSE AND SCOPE

The WGTMR has responsibility for the Tropical Meteorology Research Programme (TMRP) within CAS, which is aimed at the promotion and coordination of research activities by Members in high priority areas of tropical meteorology. Our emphasis is on the weather system scale, except for monsoons and drought related studies, which emphasize variability and prediction at the regional and seasonal scale.

Specific TMRP activities are aimed at improving the scientific and forecasting capacities of Members and include: organization of symposia, conferences and workshops, arrangements for the exchange of scientists, bilateral collaboration between developing and established centres, and the training of meteorologists.

The research conducted under the TMRP will result in improved social and economic conditions in participating countries. Better understanding of the behavior of tropical weather systems and further improvements in weather forecasting will help reduce the loss of life and social disruption arising from severe weather, such as the unacceptably high impact of tropical cyclones. Reduction of overwarning arising from improved forecasts also is of economic benefit to local communities. Improved rainfall forecasting, including late monsoon onset and warning of flood producing rains has major implications for the agricultural production and economies of many tropical countries.

The TMRP will contribute to universal benefit when tropical weather systems are understood in close connection with the global-scale circulation and interactions that occur between the tropics and extratropics. Close coordination is maintained with the Short-Range and Medium-Range Prediction Groups, and with ICSU.

II. MAIN LONG-TERM OBJECTIVES

(i) To improve understanding of the behavior and physical processes of tropical systems by assisting Members in strengthening their research activities;

(ii) To develop, through improved knowledge of tropical phenomena, prediction methods and techniques relating to the following areas: tropical cyclones, monsoons, tropical droughts and semi-arid-zone meteorology, rain-producing tropical systems, interaction between tropical and mid-latitude weather systems, tropical limited-area modeling and operational use of numerical products for tropical forecasting;

(iii) To transfer scientific knowledge of methodologies and their operational application between Members to ensure the full exploitation of scientific advances to meet the socio-economic needs of tropical countries.

III. PROGRAMME ORGANIZATION

The TMRP is organized into a set of broad projects, which are:

Project 34.1 - Strengthening of research efforts to better understand tropical systems and improve their prediction

a) Tropical Cyclone Prediction Research, including meteorological research aspects of the WMO Tropical Cyclone Programme (Rapporteur, Prof. R. L. Elsberry, USA)

1. To promote research efforts in member countries, particularly those in cyclone-affected areas, to better understand the physical processes that change tropical cyclone motion on both short and longer time scales, to understand structure and structure change mechanisms, and to apply the results to improve the prediction of tropical cyclone tracks, intensity and development. High quality field experiment data from experiments such as AMEX, TCM-90, SPECTRUM and Typhoon-90 provide a substantial basis for this research;

2. To improve current techniques of operational tropical cyclone forecasting through the exchange of information among forecasting and research experts. Close liaison is to be maintained with the WMO Tropical Cyclone Programme;

3. To take advantage of the opportunities provided by the IDNDR to undertake a major, high priority research program on tropical cyclones, with emphasis on disaster mitigation (see activities under Project 34.3).

CAS XI nominated Tropical Cyclones as the first CAS Priority Mission with the aim of providing an enhanced effort on the above priority areas. One initial priority will be development on the Autonomous Aerosonde under Project 34.3

The major activity in tropical cyclone program evolves around the International Workshop on Tropical Cyclone (IWTC) Series. This series brings together forecasters and researchers in a forum for discussion of mutual problems and solutions. In addition to action on specific recommendations, outcomes of previous workshops have been: The Global View of Tropical Cyclones (Ed. R. L. Elsberry) and the Global Guide to Tropical Cyclone Forecasting (Ed. G. J. Holland). Currently Professor Elsberry is editing the update to the Global View. The IWTC and related actions are organized by the International Committee for Tropical Cyclones (ICTC), which consists of: Dr. J. D. Jarrell (USA, Chairman), Mr. D. F. Best (RA-IV, Barbados), Professor L. Chen (ESCAP/WMO TC, China), Professor R. L. Elsberry (TC Rapporteur, USA), Professor K. Emanuel

(ICSU, USA), Dr. G. J. Holland (Past Chairman and Chairman, WGTMR, Australia), Mr. S. Ready (RA-V, New Zealand).

Currently two specialized projects are being undertaken:

* Project TC1 : Tropical Cyclone Motion (with ICSU); Rapporteur Professor R. L. Elsberry (USA),

* Project TC2 : Scientific Assessment of Climate Change Effects on Tropical Cyclones (with ICSU); Rapporteur Dr. G. J. Holland (Australia).

b) Monsoon Prediction Research, including aspects of training and technology transfer (Rapporteur, Dr. M. Murakami, Japan):

1. To further develop and implement a long-term monsoon prediction research programme as a continuation of research which started under MONEX and WAMEX for a better understanding of regional aspects of Asian and African monsoon behavior;

2. To improve short-and longer-term monsoon prediction, including the development of coupled numerical models that are influenced by anomalies and changes in the tropical oceans;

3. To increase the research emphasis on the West African monsoon.

The monsoon program has two major components, Project M1 and M2, described below. A significant effort has been devoted to aspects of training as well as research activities and this will be maintained. Following the success of the IWTC series, a new series of quadrennial workshops, the International Workshops on Monsoons (IWM), have been instituted with the first to be held in 1996.

Project M1: Research Initiative in on the Mechanisms of the Asian/Australian Monsoon (with GEWEX and PSA). Steering Committee: Y. Ding (Chairman, China), T. Yasunari (Gewex, Japan), C-Y. Tsay (Pacific Science Association), K. M. Lau (USA), J. McBride (Australia), P. A. Winarso (Indonesia), M. Murakami (Rapporteur on Monsoons, Japan), K. Puri (Chairman, Steering Committee for Project M2).

Project M2: Long-term Asian/African Studies. Steering Committee: K. Puri (Chairman, Australia), Mr. B. K. Cheang (Malaysia), Professor Y-H. Ding (Chairman, Steering Committee for Project M1, China), Professor T. N. Krishnamurti (Chairman, Steering Committee for LAM, USA), Dr. M. Murakami (Rapporteur on Monsoons, Japan), Dr. R. Okoola (Rapporteur on Droughts and Rain Producing Systems, Kenya), Professor R. Pearce (United Kingdom), Dr. D. Singh (India).

Project M3: Factors Determining the Seasonal and Local Migration of the ITCZ.

c) Rain-producing Tropical Disturbances Meteorological Aspects of Tropical Droughts (Rapporteur, Dr. R. Okoola, Kenya):

1. To better understand physical processes with a view to improving forecasts of particular rain-producing systems (e.g., the ITCZ, the South American Convergence Zone, West African disturbances and easterly waves, etc.), sometimes in connection with ENSO events, and diagnostic modeling and forecasting studies;

2. To improve the understanding of meteorological factors leading to tropical droughts, including research assessing the probability of drought conditions, and to apply research results to drought predictions;

3. To ensure that meteorological information is directed to meet economic needs (agriculture, water supply, etc.).

Two specific projects have commenced in this area:

* Project AZ1: Scientific Support for ACMAD.

* Project AZ2: Tropical Rain-bearing systems.

d) Interaction Between Tropical and Mid-latitude Weather Systems (Rapporteur Professor L. Chen, China; Dr. V. Keshavamurti, India):

1. To better understand the influence of mid-latitude disturbances on tropic systems and vice-versa in order to improve forecasting procedures tropical regions that are strongly influenced by such interactions;

2. Particular emphasis is to be given to extratropical transition of tropic cyclones, intrusion of mid-latitude systems into the tropics, and cold-cor systems in the summer monsoon.

Project 34.2 - Effective Transfer of Scientific Knowledge and Operation Application of Tropical Meteorology Research Results and/or Experience

a) Tropical Limited Area Prediction Modeling and Operational use of NW Products for Tropical Forecasting:

1. To assist tropical countries with limited computer power facilities developing a limited area numerical modeling capacity, and to exploit th models for research and prediction purposes;

2. To develop methods including application of personal computers interpret weather from NWP products and to make subjective and objec corrections of forecasts including the use of satellite data.

The application of limited area models in tropical countries has been a m component of the WGTMR, with both a training and a technological transfer function.

activities are organized by a Steering Committee Tropical Limited Area Weather Prediction Modeling: Professor T. N. Krishnamurti (USA, Chairman), Dr. J. Adejokun (Nigeria), Mr. R. K. Datta (India), Mr. K. Kuma (Australia), Dr. L. Sitnikov (Russia).

One specific project is being conducted in this area:

* Project LAM1: Implementation of LAM in Tropical Countries.

b) Exchange of Meteorological Literature (Dr. G. J. Holland):

To assist developing countries in obtaining meteorological literature, for example: by provision of spare, or redundant copies from major libraries, or by widespread, free distribution of special review papers.

Project 34.3 - Coordination with ICSU for the IDNDR

a) Interdisciplinary Approach to Tropical Cyclone Research (Dr. G. J. Holland, WMO; Sir James Lighthill, ICSU):

To encourage a major, interdisciplinary approach to tropical cyclone research, with the objective of improving our knowledge of some of the fundamental physical mechanisms involved in all aspects of tropical cyclones.

b) New methods of Observing Tropical Cyclones (Professor R. L. Elsberry, WMO; Professor K. Emanuel, ICSU):

To investigate new economical methods of observing tropical cyclones, including innovative use of satellite data and alternative approaches to providing in situ observations in critical areas for forecasting.

A Steering Committee on Drone Reconnaissance of Tropical Cyclones with Professor R. L. Elsberry (USA, Chairman), Professor K. Emanuel (ICSU, USA), Dr. G. J. Holland (Australia), Dr. S. Lord (USA), Dr. J. Franklin (USA) has been established to consider the application of autonomous aircraft to observing tropical cyclones. The IDNDR also nominated the Aerosonde as a priority development project.

IV. COORDINATION WITH OTHER PROGRAMMES AND ACTIVITIES

The implementation of some TMRP projects requires close collaboration/ coordination with the following programmes and activities: ICSU in respect of the tropical cyclone activities under the IDNDR; WCRP in respect of monsoon prediction research, interaction problems and semi-arid zone meteorology; WCP and the Agricultural Meteorology Programme in drought prediction/desertification studies and in semi-arid zone meteorology; WMO/TCP in respect of tropical cyclone research and the WWW Programme in respect to those projects involving data collection and archiving; the Education and Training Programme in support of the organization of conferences and workshops with training components; Regional Programmes in respect of relevant Tropical Meteorology Research activities; and IAMAS for joint symposia.

Other relevant WMO bodies partially responsible for the efficient implementation of specific TMRP projects are:

1. CAS Groups of Rapporteurs on (a) Short-Range Weather Prediction Research; (b) Medium and Long-Range Weather Prediction Research; (c) the Rapporteur on the Economic Benefit of Weather Forecasting; (d) the Rapporteur on Climate Aspects, and (d) CAS/JSC Working Group on Numerical Experimentation, to collaborate with the implementation of relevant TMRP projects;

2. CAS Activity centres: To undertake and develop specific research tasks and also to serve as centres for communication on project implementation and the organization of scientific workshops, including visits of scientists;

3. The Commission for Climate: To collaborate on the longer term variability and forecasting of tropical droughts and monsoons.

4. Regional Specialized Meteorological Centres: To collaborate on the implementation of relevant TMRP projects.

APPENDIX XII

SUMMARY OF THE 1995 TYPHOON SEASON

Submitted by the RSMC Tokyo - Typhoon Center

SUMMARY

The Walker circulation in the tropical Pacific, which was weaker than normal from August 1994, intensified rapidly in 1995, associated with low-level easterly anomalies along the equator over the central equatorial Pacific. Both the positive SST anomalies, centered around east of the date line, and negative SST anomalies, over low attitudes in the western North Pacific, diminished gradually. Satellite imagery showed that the convective activity was more active than normal in the vicinity of the International Data Line in the beginning of 1995. In spring 1995, the centre of the active convective area shifted gradually to the west.

These features further magnified in the beginning of summer 1995: low-level easterly anomalies intensified over the western equatorial Pacific. Active convective areas were observed over between the Bay of Bengal and the South China Sea, while the convective activity was weak off east of the Philippines. Positive SST anomalies emerged in low latitudes in the western North Pacific. The area of positive SST spread extensively and covered the whole western North Pacific. Some positive SST anomalies above 0.5 degrees were observed in the area. On the contrary, the SST fell gradually in the eastern and central equatorial Pacific and the region of negative SST anomaly expended in the area. It was the first time since 1989 that negative SST anomalies were observed in the vicinity of the date line in September.

The Walker circulation was still strong in autumn. An SST pattern similar to La Niña persisted in the equatorial Pacific.

The first tropical cyclone in 1995 was born east of 160 degrees in the end of April. The number of tropical cyclones formed by July was fewer than normal. The occurrence of tropical cyclones was normal in August and later. The area where tropical cyclones formed shifted to west of the normal area. In total, twenty-one tropical cyclones occurred by the end of October. The number was smaller than normal by three. Nine of them formed over the waters west of 122 degrees extending from west of the Philippines to the South China Sea. The occurrence of tropical cyclones by October in the region was more than normal by five. It was the highest record since 1951. Whereas, ten tropical cyclones occurred by October over the waters extending from 122 degrees to 150 degrees, from off east of the Philippines to the sea south of Japan. The number of occurrences in the region was smaller than normal by five and it was the fourth smallest record since 1951.

Typhoon Ryan (9514) took a rare track: it formed over the South China Sea in the middle of September. It tracked east-northeastward after taking an erratic track on the waters, and entered into the East China Sea through Bashi Channel. Finally, it made landfall on the western part of Japan.

CHUCK (9501)

The first tropical cyclone in 1955 was observed as a tropical depression over the waters near the Marshall Islands on 28 April. It initially moved towards the north. The following day, the tropical depression began to drift west-southwestward and developed into a tropical storm named Chuck (9501). The minimum pressure of 998 hPa and the maximum sustained wind of 35 knots were estimated near the center. Keeping the tropical storm intensity, Chuck (9501) further drifted southwestward until 30 April. On 1 May, it made a sharp turn to the northwest and degenerated into a tropical depression about 400 km east-southeast of Ponape (91348). Chuck (9501) took a westward track and dissipated on 4 May over the sea about 600 km northwest of Ponape (91348).

DEANNA (9502)

A cloud cluster was organized off east of Mindanao and became a tropical depression on 1 June. It moved northwestward and after traversing the Philippines, it developed into a Tropical Storm Deanna (9502) on 3 June. Deanna (9502) traveled northward off the west coast of Luzon keeping the maximum sustained wind of 40 knots and the center pressure of 998 hPa. It stagnated off northwest of Luzon from 5 to 7 June. On the track toward Taiwan, Deanna (9502) degenerated into a tropical depression on 8 June, it became an extratropical cyclone west of Gaoxiong (59554).

FAYE (9503)

A tropical depression formed over the waters east of the Caroline Islands on 16 July. Initially taking a north-northwest track, it developed into a tropical storm Faye (9503) on 17 July. On 19 July, Faye (9503) acquired the severe tropical storm intensity and kept its intensity for about 3 days. After it passed through the Ryukyu Islands on 21 July, it intensified to a typhoon with a small distinct eye. Faye was the first tropical cyclone that attained the typhoon intensity in 1995. Faye reached the peak intensity between late on 22 July and early on 23 July just before it landed on Korea Peninsula. The minimum central pressure of 950 hPa and the maximum sustained wind of 75 knots were estimated. After crossing the Peninsula, it rapidly weakened into a tropical storm late on 23 July and became a tropical depression over the northern part of the Sea of Japan on 24 July. Faye (9503) dissipated near Hokkaido, the northern part of Japan on 25 July.

GARY (9504)

A tropical depression formed off northwest of Luzon, the Philippines, on 28 July. It initially moved erratically, interacting with another tropical cyclone off east of Luzon. Late on 29 July, it intensified into a tropical storm Gary (9504) on its westward track. Gary (9504) made a abrupt turn to the north on 30 July and acquired the severe tropical storm intensity. It reached its peak intensity with the maximum sustained wind of 55 knots and the sea-level pressure of 980 hPa late on 30 to early on 31 July before landing on the southern part of China. Gary (9504) continued to track northward over the central part of China. After staying there for about two days, Gary (9504) dissipated finally over the middle reaches of the Yangtze River on 3 August.

HELEN (9505)

Helen (9505) formed off east of the Philippines on 7 August. After moving northwest for about 18 hours, it gradually turned to the west. On 9 August it intensified to a Tropical Storm Helen (9505) off north of Luzon. It moved west or west-southwest along the northern coast of Luzon for about 2 days. Helen (9505) entered the South China Sea on 10 August, and grew to a severe tropical storm on 11 August. The minimum sea level-pressure and the maximum sustained wind near the center were estimated to be 985 hPa and 50 knots, respectively. Helen (9505) turned its westward track to the north and proceeded further. It made landfall on the southern part of China on 12 August and weakened into a tropical storm. Further it degenerated to a tropical depression late on 12 August over the continent. As it ploughed further inland, Helen (9505) dissipated on 13 August.

IRVING (9506)

Over the South China Sea, a tropical depression formed on 17 August and moved to the north. Within 24 hours, it strengthened to a tropical storm Irving (9506) and took a north-northwest track. Irving (9506) reached its peak intensity with the maximum sustained wind of 45 knots and the sea-level pressure of 990 hPa on 18 August when it passed along the east coast of Hainan Island. It made landing soon later on China. Irving (9506) dissipated near Qinzhou (9506), the southern part of China, on 20 August.

JANIS (9507)

Janis (9507) formed over the waters about 600 km west of Okinotorishima Island (20°N, 136°E) late on 20 August. Drifting to the northwest, it became a tropical storm late on 21 August. Janis (9507) continued to track northwestward until 25 August when it reached about 200 km south of Shanghai. It traveled to the north along the eastern coast of China on 25 August. Janis (9507) did not gain the severe tropical storm intensity. On 26 August, it transformed into an extratropical cyclone over the Yellow Sea. It recurved and accelerated to the east-northeast after the transformation. After it traversed Korea Peninsula, the Sea of Japan, the cyclone passed through the northern part of Japan on 27 August. It finally dissipated off east of Japan on 29 August.

KENT (9508)

A tropical depression formed off east of the Philippines on 24 August. The tropical depression took a northwesterly track and it strengthened to a Tropical Storm Kent (9508) on 26 August. Kent (9508) gradually decelerated on 27 August. It achieved the severe tropical storm status over the water on 28 August and began to move northwestward. It developed into a typhoon off east of Luzon on 29 August. Its peak intensity was observed on 30 August with the minimum pressure of approximately 945 hPa and the maximum sustained wind of 85 knots near the center. Kent (9508) traveled northwestward after passing through the Luzon Strait and made landfall over the southern part of China early on 31 August. Rapid degeneration took place. Kent (9508) degenerated rapidly after the landfall and was downgraded into a severe tropical storm late on 31 August, into a tropical storm 6 hours later, into a tropical depression further 6 hours

later. Finally, it dissipated near Liuzhou (59046), in the southern part of China, on 1 September.

LOIS (9509)

Lois (9509) formed over the South China Sea off west of Luzon on 24 August. Initially, it squatted over the area for about 2 days. On 26 August, it began to move west-northwestward slowly and developed to a tropical storm Lois (9509). Lois (9509) further intensified into a severe tropical storm on 27 August heading to Hainan Island. Lois (9509) reached its peak intensity on 28 August with the minimum sea-level pressure and the maximum sustained wind near the center to be 980 hPa and 50 knots, respectively. It degenerated into a tropical storm on 29 August on its west-northwest track. It passed the Gulf of Tongking and made landfall over Vietnam late on 29 August. Lois (9509) rapidly weakened into a tropical depression and dissipated in Vietnam on 30 August.

MARK (9510)

Mark (9510) formed far off east of Japan on 20 August. Mark (9510) developed to a tropical storm late on 30 August, to a severe tropical storm on 31 August, and to a typhoon on 1 September. The peak intensity with the maximum wind of 65 knots was observed on its northeastward track. But it degenerated shortly later. Gradually weakening into a severe tropical cyclone on late 1 September and to a tropical storm on 2 September, Mark (9510) crossed the International Date Line on 2 September and left the area of responsibility of the Center.

NINA (9511)

A cloud system off east of the Philippines became a tropical depression on 2 September. It initially moved to the northwest holding the tropical depression intensity. On 4 September, the tropical depression traversed Luzon and further moved to the west. When it entered the South China Sea late on 4 September, it intensified to a tropical storm Nina (9511). Turning to the northwest from its westward track, Nina (9511) proceeded toward Hainan Island. It made landfall over the southern part of China and passed over Haikou (59758) on 7 September. As it ploughed further inland, Nina (9511) became a tropical depression near Bose (59211) late on 7 September and dissipated on 8 September.

OSCAR (9512)

Oscar (9512) formed over the waters near the Mariana Islands on 12 September. It intensified rapidly and it achieved the typhoon status on 14 September. Initially, Oscar (9512) took a northwestward track. It began to recurve south of Japan and gained its peak intensity on 16 September with the minimum sea-level pressure on 925 hPa and the maximum sustained wind near the center of 100 knots, respectively. Oscar (9512) tracked close to the central part of Honsyu, Japan on 17 September keeping a largest storm area. Oscar (9512) transformed to an extratropical cyclone on its northeastward track east of Hokkaido late on 17 September. It left the area of responsibility of the Center on 19 September.

POLLY (9513)

A tropical depression formed east of Luzon on 14 September. On the next day, it strengthened into a tropical storm Polly (9513) over the waters. After stagnating there for two days, Polly (9513) started to move to the east-northeast and gradually increased the speed. On 17 September it acquired the severe tropical storm intensity near Okinotorishima Island. It attained the typhoon intensity while it turned its track from east-northeastward to northward and slowed down on 18 September. It again recurved to the northeast over the waters southwest of Chichijima (47971) on 19 September. Polly (9513) reached its peak intensity with the maximum sustained wind of 75 knots and the sea-level pressure of 960 hPa on 20 September. Keeping the northeast track, Polly (9513) downgraded to a severe tropical cyclone and transformed into an extratropical cyclone on 21 September. It left the area of responsibility of the Center on 24 September.

RYAN (9514)

Ryan (9514) took a singular track. A tropical depression formed over the South China Sea off west of Luzon on 15 September and proceeded to the East China Sea. The tropical depression began to intensify steadily with an erratic track for four days. It developed into a tropical storm on 16 September and named Ryan (9514). Further it developed into a severe tropical storm on 18 September. Ryan (9514) acquired the typhoon intensity on 19 September over the South China Sea and began to move to the north. Because strong westerly winds unusually prevailed south of 20 N, Ryan (9514) made an abrupt turn to the east-northeast and accelerated on 20 September while it rapidly deepened its central surface pressure. Ryan (9514) reached its peak intensity on 21 September with the minimum pressure of about 940 hPa and the wind the center of 85 knots. After it passed by south of Taiwan on 22 September, it entered the East China Sea on 23 September. It degenerated from a typhoon to a severe tropical cyclone west of Naha (4793) late on 23 September and further moved to the northeast. Ryan (9514) made landfall on Kyusyu, a western part of Japan on 24 September. It weakened rapidly while it traversed the Japan Islands. It degenerated to a tropical storm over the Sea of Japan, and it became an extratropical cyclone over the northern part of Japan on 24 September. Ryan (9514) further tracked east-northeastward and dissipated off southeast of Kamchatka Peninsula on 26 September.

SIBYL (9515)

The fifteenth tropical cyclone in 1995 formed over the water near the Caroline Islands on 27 September. Taking a northwestward track, it developed to a tropical storm Sibyl (9515) off east of Mindanao Island on 28 September. Sibyl (9515) crossed the Philippines from 29 September to 1 October with the surface central pressure of 990 hPa. After it went into the South China Sea, it slightly deepened its surface central pressure. The minimum pressure of 985 hPa and the maximum sustained wind of 50 knots were observed near the center. It crossed the South China Sea from 1 October to 2 October and made landfall on the southern part of China on 3 October. It downgraded to a tropical storm on 3 October. Sibyl (9515) turned its track from the north to the east over the southern part of China and dissipated late on 4 October.

TED (9516)

A tropical depression formed off east of the Philippines on 7 October. The tropical depression intensified slowly and moved to the west-northwest keeping the tropical depression status. It crossed the Philippines on 7 October, and went into the South China Sea early on 8 October. After traveling westward over the South China Sea from 9 to 10 October, it intensified to a tropical storm Ted (9516) south of Hainan Island late on 10 October. Ted (9516) moved to the north over the Gulf of Tongking. It further intensified into a severe tropical storm over the waters on 12 October. It reached the peak intensity on 12 October with the minimum pressure of 990 hPa and the wind of 50 knots near the center. Ted (9516) made landfall on the southern part of China on 13 October, and downgraded to a tropical storm late on 13 October. It further weakened into a tropical depression late on 13 October. Ted dissipated over the southern part of China on 14 October.

VAL (9517)

Val (9517) formed over the waters near the Mariana Islands on 8 October. After it moved to the north-northeast, it gradually turned its track to the northwest on 9 October and continued to track northwestward for about three days. It gained the tropical storm intensity on 11 October. The minimum pressure of 996 hPa and maximum sustained wind near the center of 40 knots were estimated. On 12 October, Val (9517) made an abrupt turn to the south over the waters west of Chichijima. After it took an erratic track for about two days, it began to move southwestward on 14 October. On 15 October, it made an extratropical transition. The cyclone continued to track southwestward and dissipated off east of Luzon on 15 October.

WARD (9518)

A tropical depression formed about 600 km north-northeast of Truk (91334) on 16 October. It reached the tropical storm intensity and was named Ward (9518) on 17 October about 400 km west of Guam (91413) drifting west-northwestward. Ward (9518) steadily intensified and acquired the severe tropical storm intensity at 0000 UTC on 18 October and gained the typhoon intensity 6 hours later. Ward (9518) turned its track from west-northwestward to northward and decelerated. When it was recurving, Ward (9518) reached its peak intensity with the maximum sustained wind of 85 knots and the sea-level central pressure of 940 hPa on 20 October. Ward (9518) degenerated to a severe tropical storm late on 21 October while it turned its track to the northeast. Ward (9518) transformed to an extratropical cyclone on 22 October on its east-northeastward track. It left the area of responsibility of the Center on 24 October.

YVETTE (9519)

A cloud system formed a tropical depression off east of the Philippines late on 22 October. It passed through the Philippines keeping the tropical depression intensity from 23 to early on 24 October. The tropical depression developed into a tropical storm Yvette (9519) over the South China Sea on 25 October. It continued to drift westward over the South China Sea. The minimum pressure of 985 hPa and the maximum sustained wind near the center of 50 knots were estimated. On 26 October, it made landfall on Vietnam.

Yvette (9519) dissipated over Cambodia on 27 October, after it moved on Indochina Peninsula.

ANGELA (9520)

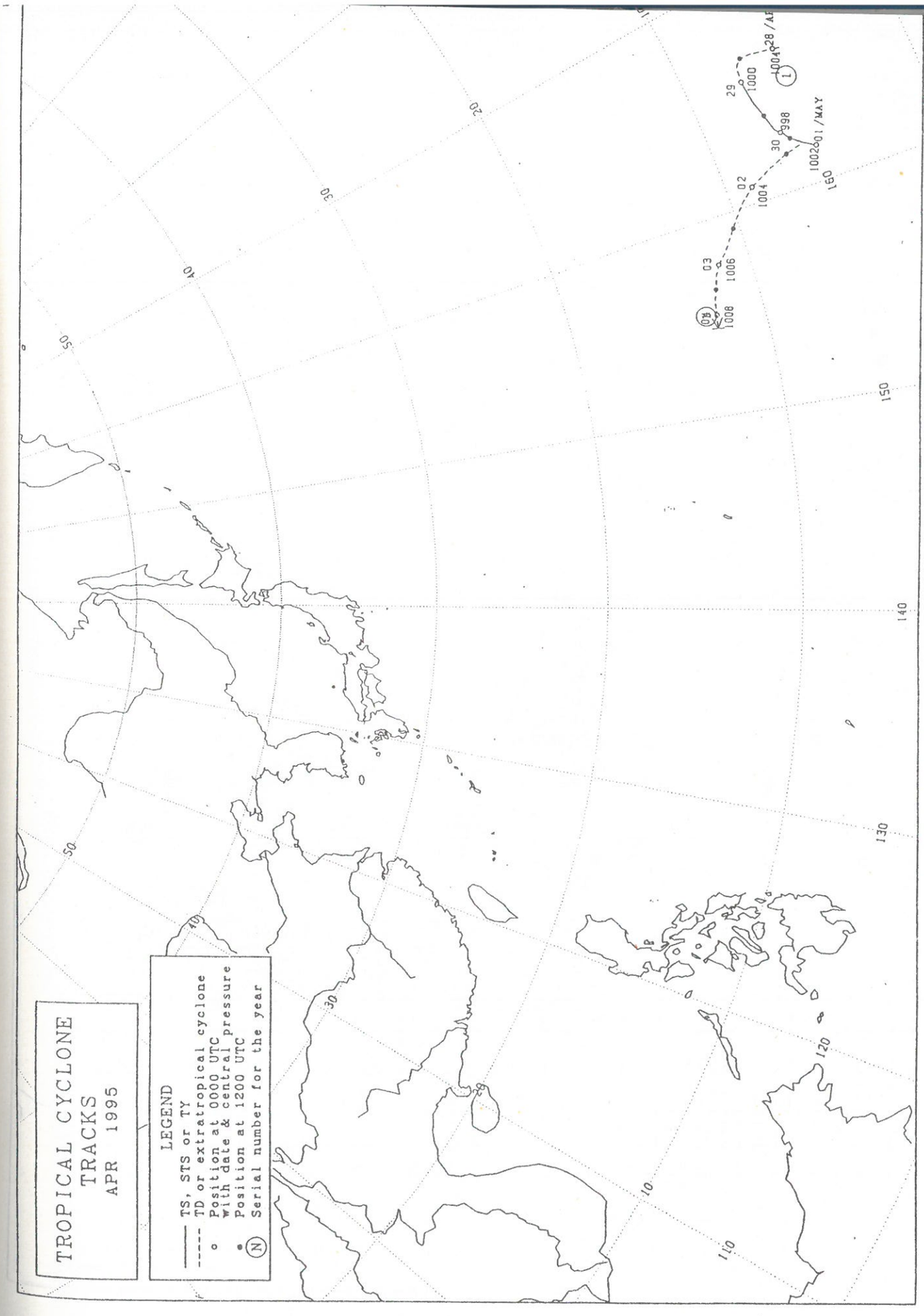
A tropical depression formed about 550 km northwest of Truk (91334) on 25 October. The tropical depression moved west-northwest and developed into a tropical storm Angela (9520) about 150 km southwest of Guam (91212) late on 26 October. Turning its initial track to the west, it gained the severe tropical storm intensity on 28 October. The severe tropical storm traveled for about two days on the westward track. Angela (9520) further intensified to a typhoon late on 30 October. Angela (9520) reached its peak intensity on 2 November when the maximum sustained wind near the center of 115 knots and the minimum pressure of 910 hPa were estimated. It passed through the Philippines with the typhoon intensity on 3 November. After it went into the South China Sea on 4 November, its central surface pressure gradually raised. It weakened into a severe tropical storm on 5 November further taking a westward track. Angela (9520) reached the Gulf of Tongking on 6 November with the tropical storm intensity and dissipated over those waters late on 7 November.

ZACK (9521)

Zack (9521), the last of the six tropical cyclones that formed in October, formed as a tropical depression near the Caroline Islands on 25 October. Zack (9521) took a west-northwestward track. It steadily strengthened and reached the tropical storm intensity at 0000 UTC on 27 October. Zack (9521) further intensified and became a severe tropical storm took place at 1200 UTC on 27 October just before landing on the Philippines. When it went into the South China Sea on 29 October, Zack (9521) achieved the typhoon intensity. It traveled on the South China Sea and reached its peak intensity on 31 October when the maximum sustained wind near the center of 90 knots and the minimum pressure of 950 hPa were estimated. Zack (9521) made landfall on Vietnam on 1 November and weakened rapidly while it ploughed further inland. It dissipated over the inland of Indochina Peninsula on 2 November.

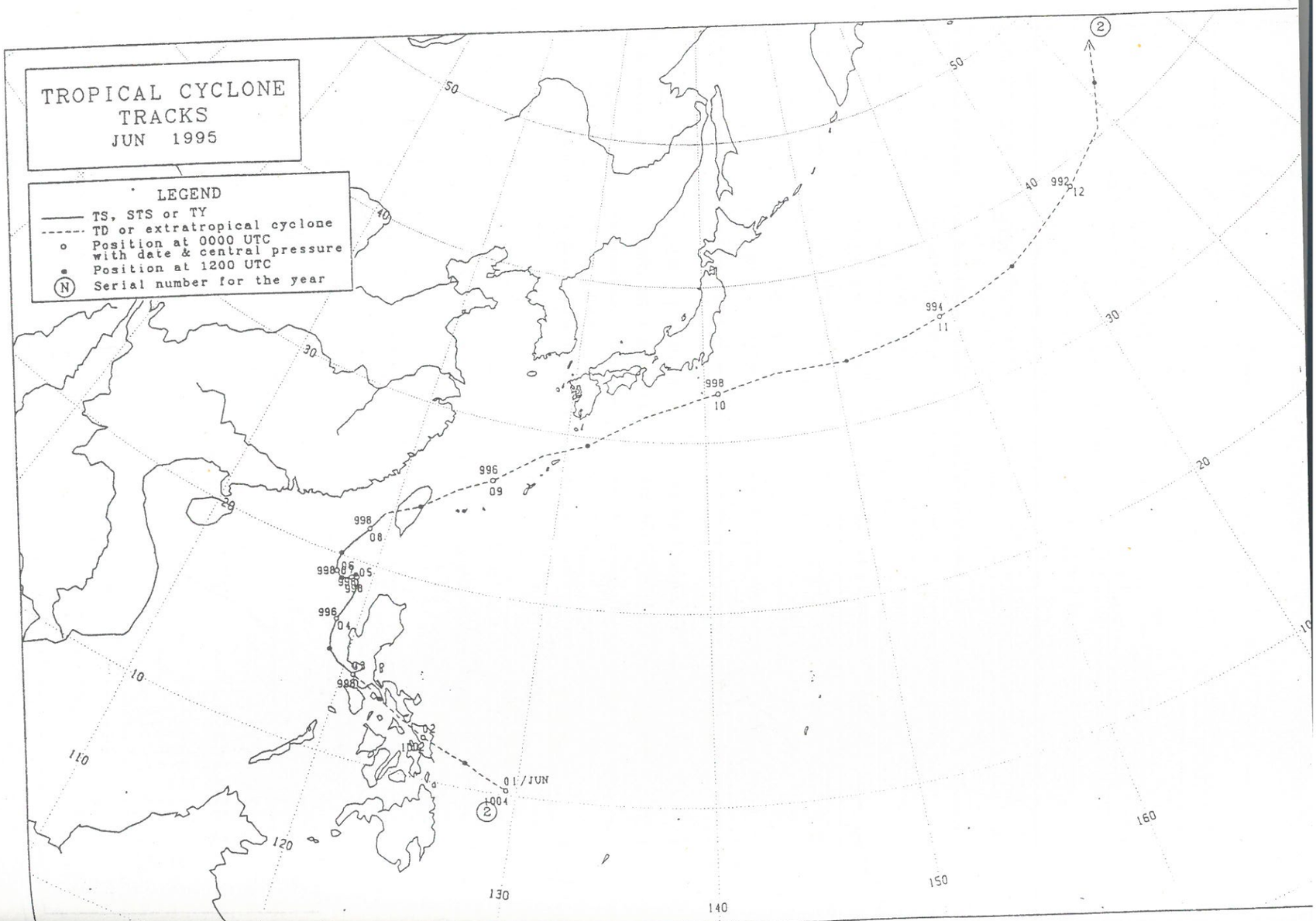
List of tropical cyclones generated in 1995(as of 31 Oct).

Tropical Cyclone	Duration of TS intensity or higher (UTC)	Minimum Central Pressure				Maximum Sustained Wind (kt)
		Date/Time (UTC)	Location (°E)	Location (°N)	Pres. (hPa)	
TS 9501 CHUCK	290000 APR - 010000 MAY	290600 APR	7.3	164.5	998	35
TS 9502 DEANNA	030000 APR - 080600 JUN	031200 JUN	15.4	119.0	996	40
TY 9503 FAYE	171200 APR - 241200 JUL	221800 JUL	30.6	127.6	950	75
STS 9504 GARY	291200 JUL - 311800 JUL	301800 JUL	21.1	116.8	980	55
STS 9505 HELEN	090600 AUG - 121800 AUG	110600 AUG	19.9	115.3	985	50
TS 9506 IRVING	171800 AUG - 200000 AUG	181200 AUG	18.9	112.2	990	45
TS 9507 JANIS	211800 AUG - 260000 AUG	241200 AUG	27.7	122.5	990	45
TY 9508 KENT	260600 AUG - 010000 SEP	291800 AUG	19.5	123.4	945	85
STS 9509 LOIS	260600 AUG - 301200 SEP	270600 AUG	17.4	111.9	980	50
TY 9510 MARK	301800 AUG - 021200 SEP	010600 SEP	34.8	160.7	985	65
TS 9511 NINA	041200 SEP - 071200 SEP	061800 SEP	19.7	111.6	992	40
TY 9512 OSCAR	121800 SEP - 171800 SEP	151200 SEP	24.9	137.0	925	100
TY 9513 POLLY	150000 SEP - 211800 SEP	190600 SEP	25.6	138.8	960	75
TY 9514 RYAN	160000 SEP - 240900 SEP	210600 SEP	19.8	117.5	940	85
STS 9515 SIBYL	281200 SEP - 031800 OCT	010600 OCT	16.3	118.4	985	50
STS 9516 TED	101800 OCT - 131200 OCT	120600 OCT	18.5	108.2	990	50
TS 9517 VAL	110000 OCT - 131200 OCT	110600 OCT	26.2	137.8	996	40
TY 9518 WARD	170000 OCT - 221200 OCT	191800 OCT	21.9	134.4	940	85
STS 9519 YVETTE	250000 OCT - 261200 OCT	260000 OCT	13.3	109.9	985	50
TY 9520 ANGELA	261800 OCT - 061200 NOV	011800 NOV	14.4	126.9	910	115
TY 9521 ZACK	270000 OCT - 011800 NOV	310600 OCT	14.8	112.5	950	80



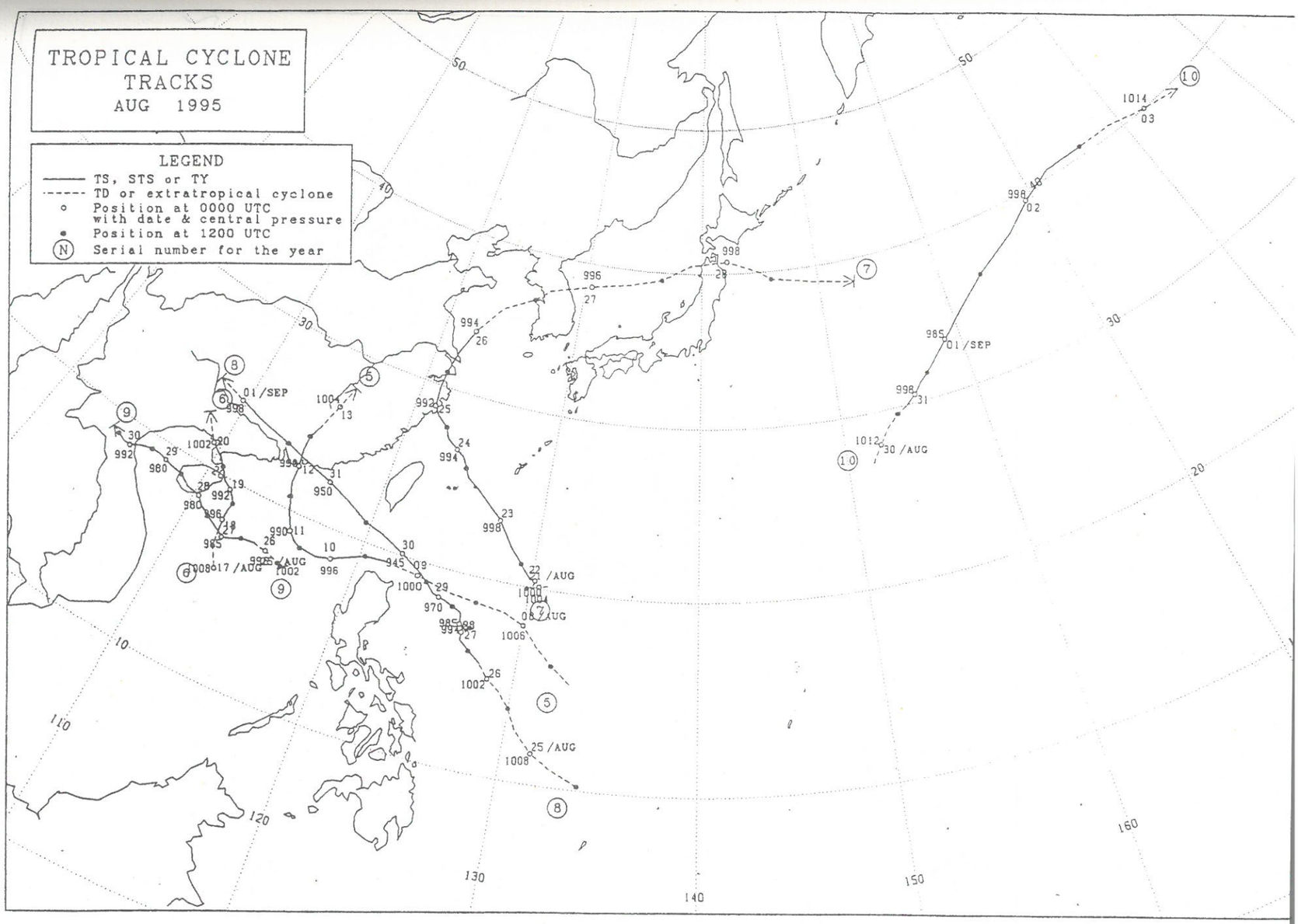
TROPICAL CYCLONE TRACKS
JUN 1995

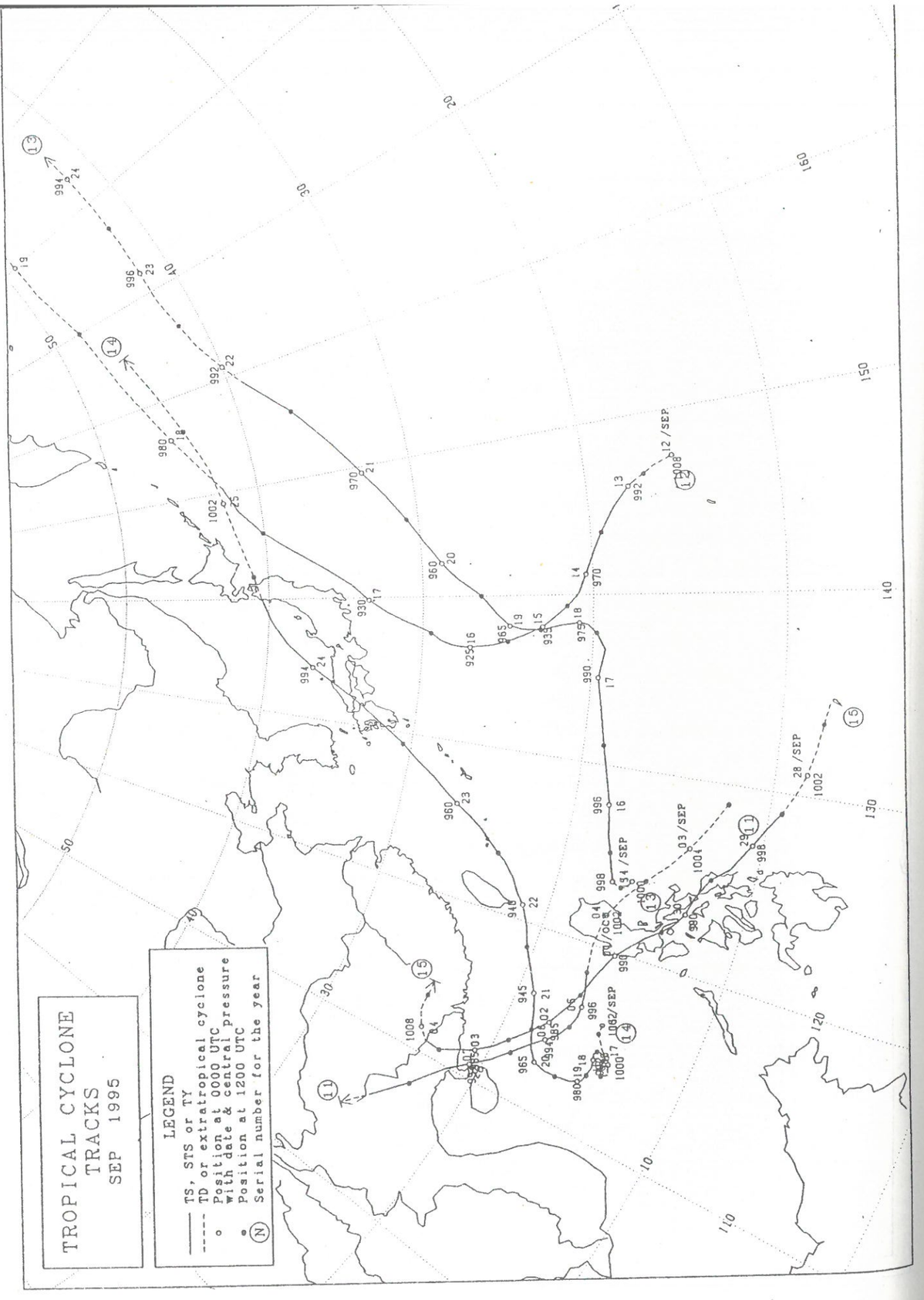
LEGEND
- TS, STS or TY
- TD or extratropical cyclone
- Position at 0000 UTC with date & central pressure
- Position at 1200 UTC
- (N) Serial number for the year



TROPICAL CYCLONE TRACKS
AUG 1995

LEGEND
- TS, STS or TY
- TD or extratropical cyclone
- Position at 0000 UTC with date & central pressure
- Position at 1200 UTC
- (N) Serial number for the year





APPENDIX XIII

REVISED REGIONAL COOPERATION PROGRAMME IMPLEMENTATION PLAN (RCPIP)

(to be updated by the TCS)

1.	TASKS Meteorological Component	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
1.1	***Support to Meteorological Observing Systems and Facilities***							
1.1.1	Establishment of a communication line to RSMC data system via Internet or ISDN for distribution of RSMC Tokyo grid point data	↔	↔	↔	↔	TC Members, WMO and ESCAP	National/External	Introduced during the 26th session and reserved for further discussion.
1.1.2	Expansion of observational programme: *With stress on radiosonde observations*	↔	↔	↔	↔	Members	National/External	Continuous activities
1.1.3	CAS aerosonde field development and testing in the western North Pacific region as a Typhoon Committee Project	↔	↔	↔	↔	WMO (CAS), TC Members and ESCAP	External	Field testing of Aerosonde scheduled for summer 1997
1.1.4	Maintaining services specified in the Operational Manual, including intensified observations (surface, upper-air and radars)	↔	↔	↔	↔	Members	National	Continuous activities
1.1.5	Provision of automated observation facilities and real-time telemetry of meteorological parameters, e.g., winds, rainfall, pressure, etc., by replacing with automatic instruments	↔	↔	↔	↔	Members	National	Continuous activities
1.1.6	Establishment of AMedas, ASDAR, anemometer, tide gauge and water recorder networks	↔	↔	↔	↔	Members	National	Continuous activities
1.1.7	Establishment/upgrading of satellite equipment (GMS/TIROS-N)	↔	↔	↔	↔	Members	National	Continuous activities
1.1.8	Establishment of a WWW data user system for the reception of FAX and GPV data INTERNET or ISDN	↔	↔	↔	↔	Members	National	Continuous activities
1.1.9	Establishment/upgrading of weather radars	↔	↔	↔	↔	Members	National	Continuous activities
1.2	***Support to Meteorological Telecommunication Systems and Facilities***							
1.2.1	Maintaining: • Services and facilities for the real-time exchange of data and products	↔	↔	↔	↔	Members	National	Continuous activities

1. TASKS — Meteorological Component	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
• Monitoring of data exchange	↔	↔	↔	↔	RTHs Bangkok, Beijing and Tokyo	Members concerned	Continuous activities
	↔	↔	↔	↔	RTH Bangkok, Vientiane-Hanoi Bangkok-Vientiane-Ho Chi Minh	Members concerned	Continuous activities
1.2.2 Improvement of facilities and their operation as necessary for the rapid and reliable collection and distribution of the required observational and processed information	↔	↔	↔	↔	Members	National	Continuous activities
1.2.2.1 Establishment of regional telecommunication links							
• Bangkok - Cambodia					Thailand and Cambodia	National and external assistance	
• Bangkok - Vientiane					Thailand and Lao DPR	External assistance	
• Seoul - Pyongyang					ROK and DPRK	National	Depending on bilateral discussion
1.2.2.2 Improvement of data completeness and quality, including use of real-time and non real-time monitoring results for this purpose	↔	↔	↔	↔	Members	National	Continuous activity
1.2.2.3 Review of existing arrangements for dissemination of typhoon warnings with a view of introducing improvements where necessary	↔	↔	↔	↔	Members	National	Continuous activity
1.2.2.4 Improvement of national data collection and retransmission to associated RTHs	↔	↔	↔	↔	Members	National/External	Continuous activity
• Upgrading of telecommunication circuit linking Hanoi and Bangkok from 75 bauds to 100 or 200 bauds					Vietnam	National and external assistance	
• Establishment of telecommunication circuit between Hanoi and Beijing with speed of 2400 bauds					Vietnam	National and external assistance	Speed is under negotiation

1. TASKS — Meteorological Component	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
1.3 *Requirements Specifically for Tropical Cyclone Forecasting and Warning*							
1.3.1 Continuing provision and dissemination of processed information, advisories and other products needed by TC Members for their forecasting and warning systems, archival of information on typhoon data in accordance with the TC Typhoon Operational Manual	↔	↔	↔	↔	RSMC Tokyo	Japan	Continuous activity
1.3.2 Exchange of forecasts including products of different objective methods in accordance with the TC Typhoon Operational Manual	↔	↔	↔	↔	Members	National	Continuous activity
1.3.3 Enhancement of cooperation in typhoon monitoring, forecasting and warning	↔	↔	↔	↔	Members	National	Continuous activity
1.3.4 Establishment of a regional computer network					Members	National and external assistance	
1.3.5 Installation of a computer processing system in view of integrating satellite, radar and rainfall data so as to provide spatial distribution of rainfall amount over a large region					Member	National and external assistance	TCDC, technical consultancy and assistance from external sources would be required
1.3.6 Setting up of electronic equipment maintenance and repair workshops	↔	↔	↔	↔	Members	National and external assistance including TCDC	Continuous activities
1.3.7 Promotion of development at the interface between the meteorological warning services and the users of warnings for increasing the impact and effectiveness of these services	↔	↔	↔	↔	Members	National and external assistance in conjunction with IDNDR	Continuous activities

TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
2. Hydrological Component							
2.1 *Flood Forecasting and Warning*							
2.1.1 Installation and operation networks of observing stations required for flood forecasting systems	↔	↔	↔	↔	Members	National	Continuous activity
2.1.2 Establishment and operation of flood forecasting and warning system	↔	↔	↔	↔	Members	National	Continuous activity
2.1.3 Establishment of flood forecasting and warning systems for dam operations	↔	↔	↔	↔	Interested Members	National and external assistance	
2.1.4 Establishment of flood forecasting and warning systems for inundation from storm surges	↔	↔	↔	↔	Members concerned	Members concerned and external assistance including TCDC	Includes interaction of river floods and storm surges
2.1.5 Monitoring of/and reporting on performance of existing flood forecasting systems	↔	↔	↔	↔	Members	National and external assistance including TCDC and with support of TCS and WMO	Coordinated by WMO, using MOFFS
2.1.6 Further improvement of existing flood forecasting and warning systems, making use, where appropriate, of the results of TOPEX	↔	↔	↔	↔	Members	Members concerned and external assistance including TCDC	Includes catchment modeling
2.1.7 Implementation of recommendations of mission by experts to provide technical guidance on items 2.1.1 to 2.1.6	↔	↔	↔	↔	Members	External assistance, Missions to be organized by WMO and ESCAP	Using, where appropriate, technology available through HOMS
2.1.8 Exchange of technical visits among flood forecasters	↔	↔	↔	↔	Members	National and external assistance	Coordinated by WMO
2.1.9 Development and application of guidance on hydrological technology models for tropical cyclone regions	↔	↔	↔	↔	Members	External assistance with WMO	On the basis of OHP (HOMS)
2.1.10 Development and use of improved techniques for Quantitative Precipitation Forecast (QPF) taking advantage of data provided by satellite and radar	↔	↔	↔	↔	Members	National and external assistance	WMO to assist in development and promulgation of improved techniques

TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
2. Hydrological Component							
2.2 *Comprehensive Flood Loss Prevention and Management*							
2.2.1 Establishment of pilot area for comprehensive flood loss prevention and management	↔	↔	↔	↔	Members	Bilateral or multilateral support if available	Detailed programme will be established by respective Members
2.2.2 Investigation and survey including:					Members	National	ESCAP and WMO to assist in organizing investigations and surveys
• Determination of flood-prone areas subject to heavy damages	↔	↔	↔	↔			
• Determination of magnitude and corresponding frequency of floods in each flood-prone area	↔	↔	↔	↔			
• Assessment of potential flood damage in each area for various flood magnitudes	↔	↔	↔	↔			
• Preparation of flood risk maps	↔	↔	↔	↔			
2.2.3 Application of the manual and guidelines for/and dissemination of techniques for comprehensive flood loss prevention and management	↔	↔	↔	↔	Members	National and external assistance	With assistance of ESCAP and WMO
2.2.4 Implementation of selected aspects of comprehensive flood loss prevention and management	↔	↔	↔	↔	Members	National and external assistance	With assistance of ESCAP and WMO
2.2.5 Mission of experts to provide technical guidance to Members on items 2.2.1 to 2.2.4 above	↔	↔	↔	↔	Members	UNDP, TCDC and bilateral, multi-lateral support if available	With assistance of ESCAP and WMO
2.2.6 Preparation and application of a manual and guidelines for integrated river system development and management with reference to comprehensive flood loss prevention and management	↔	↔	↔	↔	Members	National and external assistance	With assistance of ESCAP and WMO
2.2.7 Preparation of guidelines for the formulation of a comprehensive master plan for urban flood loss prevention and mitigation	↔	↔	↔	↔	Members	National and external assistance	With assistance of ESCAP and WMO
2.2.8 Storm surge prediction and risk analysis	↔	↔	↔	↔	Members	National and external assistance	With assistance of ESCAP and WMO

TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
2. Hydrological Component							
2.2.9 Improvement of dam water release operation system	↔	↔	↔	↔	Members	National and external assistance	With assistance of TCS, ESCAP and WMO

TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
3. Disaster Prevention and Preparedness Component							
3.1 *Public Awareness*							
3.1.1 Improvement of public awareness on typhoon and flood threat and preparedness coupled with studies of human response to warnings	↔	↔	↔	↔	Members	National and external assistance in conjunction with IDNDR	With advice and assistance of DHA/IFRC/WMO and other agencies concerned
3.1.2 Production of materials (audio-visual aids, pamphlets and booklets) related to public information and education	↔	↔	↔	↔	Members	National and external assistance	Work under the WMO TCP projects 12 and 14 is also revenant
3.2 *Disaster Management*							
3.2.1 Establishment/upgrading of national disaster prevention and preparedness plans	↔	↔	↔	↔	Members	Bilateral or multilateral support if available	With advice, and if possible, support from ESCAP
3.2.2 Strengthening national coordination and cooperation between departments and agencies involved in DPP activities	↔	↔	↔	↔	Members	National	
3.2.3 Improvement in the timely dissemination of warnings of typhoons, floods and storm surges with particular attention to remote areas	↔	↔	↔	↔	Members	National	
3.2.4 Improvement of communication systems for warning dissemination and relief operations	↔	↔	↔	↔	Members	Bilateral or multilateral support if available	
3.2.5 Improvement of damage assessment and reporting	↔	↔	↔	↔	Members	Multilateral support if available	With advice from ESCAP roving mission
3.2.6 Development and exchange of information and guidance materials on structural and non-structural measures for mitigation of disasters	↔	↔	↔	↔	Members	External assistance	With guidance from international agencies, such as, DHA, IFRC, ESCAP and WMO
3.2.7 Conducting case studies of response to major disasters	↔	↔	↔	↔	Members	External Assistance	With advice from DHA, IFRC, and WMO
3.2.8 Compilation of annual information on loss of life and damage caused by typhoons, floods and storm surges including damage to houses, public facilities, agricultural products, and so on	↔	↔	↔	↔	Members	External Assistance	With advice from DHA in co-operation with ESCAP

TASKS 3. Disaster Prevention and Preparedness Component	TIME SCALE 96 | 97 | 98 | 99	BY WHOM	RESOURCES	REMARKS
3.2.9 Where appropriate, implementing the recommendations of joint missions and seminars to evaluate DPP procedures and to provide advice on local problems	↔ ↔ ↔ ↔	Members	Bilateral or multilateral support if available	
3.2.10[1] Production of material related to public information and education on the Typhoon Committee activities, particularly storm warning and DPP	↔ ↔ ↔ ↔	Members	External Assistance	With support of ESCAP, WMO and TCS

[1] External assistance in conjunction with IDNDR

TASKS 4. Training Component	TIME SCALE 96 | 97 | 98 | 99	BY WHOM	RESOURCES	REMARKS
4.1 *Meteorology*				
4.1.1 Training on engineering application of tropical cyclone climatological data	↔ ↔ ↔ ↔	Members	External assistance	Conferences, seminars and overseas training programmes, including roving missions and arrangements
4.1.2 Training on applications of radar and satellite data in tropical cyclone tracking, forecasting and very short-range precipitation forecasts	↔ ↔ ↔ ↔	Members	External assistance	
4.1.3 Training in calibration, maintenance and repair of electronic meteorological instrumentation	↔ ↔ ↔ ↔	Members	National and external assistance	Coordinated by WMO
4.1.4 Training on utilization of software for integrating satellite/radar/rainfall data	↔ ↔ ↔ ↔	Members	Short-term fellowships with external support	Coordinated by WMO
4.1.5 Training of quantitative precipitation forecast (QPF) models	↔ ↔ ↔ ↔	Members	Short-term fellowships with external support	Coordinated by WMO
4.1.6 Training of personnel through fellowships on tropical cyclone forecasting	↔ ↔ ↔ ↔	Members	UNDP, WMO and other international organizations concerned	Coordinated by WMO
4.1.7 Other courses and seminars organized WMO and Members	↔ ↔ ↔ ↔	Members	UNDP, WMO and other international organizations concerned	Coordinated by WMO
4.1.8 Group training courses in meteorology	↔ ↔ ↔ ↔	Members	JICA	Japan International Cooperation Agency
4.1.9 Exchange of forecaster(s) between tropical cyclone forecasting and warning centers	↔ ↔ ↔ ↔	Members	External assistance	Through TCDC arrangement
4.1.10 Training on observing technology	↔ ↔ ↔ ↔	Members	External support	Seminars
4.1.11 Exchange of meteorological experts between Members other than 4.1.9 above	↔ ↔ ↔ ↔	Members	Bilateral or TCDC arrangements	

4. Training Component — TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
4.1.12 Training on storm surge and wave prediction	↔	↔	↔	↔	Members	Short-term fellowships with external support	
4.1.13 Training in message-switching, wave forecasting, numerical weather prediction and cloud physics, through attachments	↔	↔	↔	↔	Members	External assistance	TCDC arrangements
4.1.14 Training personnel through fellowships on maintenance of electronic meteorological and hydrological equipment	↔	↔	↔	↔	Members	External assistance	
4.2 *Hydrology*							
4.2.1 Training on repair and maintenance of electronic equipment used in flood forecasting and warning	↔	↔	↔	↔	Members	WMO, UNDP and other sources	Roving seminars to be organized by WMO
4.2.2 Training on advanced techniques for flood forecasting and warning associated storms, including hardware and software	↔	↔	↔	↔	Members	WMO, UNDP and other sources	Courses and seminars to be organized by WMO
4.2.3 Training in hydrology with emphasis on flood forecasting	↔	↔	↔	↔	Members	WMO, UNDP and other sources	Courses and seminars to be organized by WMO
4.2.4 Training on personnel through fellowships on flood loss prevention	↔	↔	↔	↔	Members	WMO, UNDP and other sources	Courses and seminars to be organized by WMO
4.2.5 Training on appropriate topics relating to flood loss prevention and management	↔	↔	↔	↔	Members	ESCAP, UNDP and other sources	Seminar to be organized by ESCAP
4.2.6 Group training courses on river engineering	↔	↔	↔	↔	Japan	Japan International Cooperation Agency (JICA)	At the request of TC
4.2.7 Exchange of flood forecasting experts	↔	↔	↔	↔	Members	WMO, UNDP and other sources	TCDC requirements
4.3 *Disaster Prevention and Preparedness*							
4.3.1 Training of disaster managers and volunteer leaders	↔	↔	↔	↔	Members	National and external assistance	With advice from international agencies

4. Training Component — TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
4.3.2 Test exercises	↔	↔	↔	↔	Members	National and external assistance	With advice from international agencies
4.3.3 Training in DPP	↔	↔	↔	↔	Members	External assistance	Regional seminars organized by TCS with help of DHA, IFRC, ESCAP and WMO
4.3.4 Exchange of information on the socio-economic impact of disaster	↔	↔	↔	↔	Members	DHA, IFRC	Seminars organized by DHA, IFRC and WMO
4.3.5 Training on disaster vulnerability and risk assessment	↔	↔	↔	↔	Members	DHA, IFRC	Courses and seminars organized by DHA, IFRC and ESCAP
4.3.6 Group training courses on technology for disaster prevention	↔	↔	↔	↔	Japan	JICA	At the request of TC
4.3.7 Exchange of DPP personnel	↔	↔	↔	↔	DHA, IFRC, TCS and ESCAP	DHA, IFRC, ESCAP and other sources	TCDC arrangement organized by DHA, IFRC, TCS and ESCAP

5. Research Component — TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
5.1 *Meteorology*							
5.1.1 General studies on:							
5.1.1.1 Interaction between typhoons and the environmental circulation	↔	↔	↔	↔	Members or regionally coordinated programme	National	
5.1.1.2 Typhoon climatology in relation with anomalies in regional circulation	↔	↔	↔	↔	Members or regionally coordinated programme	National	
5.1.1.3 Forecasting storm surge and heavy rainfall	↔	↔	↔	↔	Members or regionally coordinated programme	National	
5.1.1.4 Tropical cyclone related rainfall and intensity rates aimed at detection of possible relationship to global climate change							
5.1.2 Utilization of TOPEX, SPECTRUM, TCM-90 and TYPHOON-90 data set in tropical cyclone numerical and physical modeling, with the aim of improving existing methods of predicting formation, development and steering	↔	↔	↔	↔	Members or regionally coordinated programme	National	Need for short-term attachment of experts to advanced centers in the typhoon region
5.1.2.1 Establishment and operation of a tropical cyclone data bank for the northwestern Pacific and East Asia with software exchanges between Members	↔	↔	↔	↔	RSMC Tokyo	Japan	According to the procedure described in TOM
5.1.2.2 Development of an operational NWP model for typhoon movement and development	↔	↔	↔	↔	Members or regionally coordinated programme	National	
5.1.2.3 Irregular tropical cyclone behavior, such as, sudden turning of tracks, sudden increase/decrease of intensity, rainfall and storm surge	↔	↔	↔	↔	Members or regionally coordinated programme	National	
5.1.2.4 Air-sea interactions associated with the occurrence of typhoons, with emphasis on wave and storm surge generation	↔	↔	↔	↔	Members or regionally coordinated programme	National	
5.1.2.5 Study on typhoon-related wind climatology					Members	National	

5. Research Component — TASKS	TIME SCALE 96	97	98	99	BY WHOM	RESOURCES	REMARKS
5.1.2.6 Study on climatology of precipitation extremes	↔	↔	↔	↔	Members	National	Counts on discussion
5.1.2.7 Encourage participation in the works of the CAS working group	↔	↔	↔	↔	Member	National	
5.1.2.8 Encourage members to provide the CAS Committee on Climate Change Aspects of Tropical Cyclones relevant data sets for their consideration	↔	↔	↔	↔	Members	National	
5.2 *Hydrology*							
5.2.1 Application of meteorological inputs to flood forecasting	↔	↔	↔	↔	National or regionally coordinated programmes	National	In cooperation with ESCAP
5.2.2 Study of effects of deforestation, urbanization and changing land use on the hydrology of the catchment and on the intensity of floods	↔	↔	↔	↔	Members	National	In cooperation with ESCAP
5.3 *Disaster Prevention and Preparedness*							
5.3.1 Studies on the socio-economic impact of typhoon and flood disasters	↔	↔	↔	↔	Members	National	With advice and possible support of DHA, IFRC, ESCAP and WMO
5.3.2 Vulnerability and risk assessment of disaster-prone areas	↔	↔	↔	↔	Members	National	With advice and possible support of DHA, IFRC, ESCAP and WMO
5.3.3 Socio-economic implication of availability and quality of typhoon and flood forecasts and warnings	↔	↔	↔	↔	Members	National	With advice and possible support of DHA, IFRC, ESCAP and WMO
5.3.4 Disaster impact modelling	↔	↔	↔	↔	Members	National	With advice and possible support of DHA, IFRC, ESCAP and WMO

APPENDIX XIV

CURRENT ACTIVITIES AND FUTURE PLANS OF THE RSMC TOKYO-TYPHOON CENTER

1. Major activities of the RSMC Tokyo - Typhoon Centre in 1995 (after the twenty-seventh session of the Typhoon Committee)

1.1 *Improvement of meteorological data provision services*

A data server (the RSMC Data Serving System) was introduced to the RSMC Tokyo - Typhoon Centre in April 1995, and the Centre initiated the dissemination of meteorological data to Members of the Typhoon Committee with the System. These data include global observational data and grid point values (GPVs) of the analysis and forecast that were produced with the JMA Global Spectral Model.

1.2 *Numbers of the products disseminated from RSMC*

Products disseminated by the RSMC Tokyo - Typhoon Centre to the Members of the Typhoon Committee from 1 January through 31 October 1995 are shown in Table 1.

1.3 *Skill of tropical cyclone forecasts*

The skill of tropical cyclone forecasts was evaluated for the period from 1 January through 31 October 1995. The results are presented in Figures 1 and 2, and summarized in Tables 2 and 3. Annual mean forecast errors of the tropical cyclone position in 24- and 48-hour forecasts from 1982 through 1995 are shown in Figure 3.

1.4 *Publication*

The Centre published the "Annual Report on Activities of the RSMC Tokyo - Typhoon Centre 1994" in October 1995, and "Technical Review No. 1" in March 1995.

1.5 *Monitoring of observational data availability*

Regular monitoring of the exchange of observation data associated with typhoons was carried out by the Centre during the following two periods:

Period 1 : from 00 UTC, 20 July 1995 to 00 UTC, 24 July 1995
Period 2 : from 00 UTC, 29 September 1995 to 12 UTC, 3 October 1995

The results will be forwarded to the Members of the Typhoon Committee in December 1995.

1.6 *Exchange of information with Members*

The Chief Forecaster of the Centre visited Meteorological Services in Seoul, Shanghai and Hanoi in March and April 1995 to discuss with officials in charge analysis and forecast techniques of tropical cyclones.

2. Future plans of the activities of the RSMC Tokyo - Typhoon Centre

2.1 *Replacement of computer system*

Replacement of the Computer System for Meteorological Services (COSMETS) of JMA with a new system is planned in March 1996. When the new system is put into operation, it is expected that the improved global model which produces streamline charts and typhoon track forecasts will ameliorate the quality of products to be disseminated to Members. The improvement includes the higher resolution of the model.

The outline of the global model and the typhoon model is shown in Tables 4 and 5. It is planned that the global model and the typhoon model will be operated at the initial time of 00 and 12 UTC, and at 06 and 18 UTC, respectively.

2.2 *Improvement of typhoon analysis system*

It is planned that the Centre will introduce a man-machine interactive system to assist the analysis and the forecast of typhoons to ensure the expeditious and reliable operation. The new system is being built to be completed by the summer of 1996.

2.3 *Improvement of products on tropical cyclones*

At present, the guidance for forecasts with the typhoon model is disseminated on GTS. When the new COSMETS comes into operation, the guidance for forecasts over the whole globe with the global model are to be additionally distributed via GTS.

At present, 48-hour typhoon track forecasts are made just for the area west of 150°E. The area where the track forecast are carried out, will be expanded into the entire area of responsibility of the RSMC Tokyo as of March 1996. (The area of responsibility of RSMC Tokyo covers the western North Pacific, north of the equator from 100°E to 180 degree in longitude).

In the summer of 1996, 72-hour typhoon track forecasts will be experimentally made and simultaneously evaluated. If the forecast accuracy fully satisfies operational requirements, the operational service on a routine basis would be initiated in the summer of 1997.

The implementation plan from 1995 to 1998 is attached to this report.

Table 1 Monthly and annual numbers of issuance of the Center's products in 1995 (as of 31 October 1995)

PRODUCT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
TCNA20	0	0	0	8	0	20	30	72	109	95	334
TCNA21	0	0	0	11	6	41	45	82	130	123	438
WTPQ20-25	0	0	0	13	6	47	53	97	134	132	482
WTPQ30-35	0	0	0	4	2	16	22	43	61	62	210
FXPQ20, 21	0	0	0	5	2	20	19	43	57	60	206
FXPQ30-35	0	0	0	10	4	40	45	84	125	122	430
AXPQ20	0	0	0	0	1	0	1	3	5	5	15
AUXT85 AUXT20	62	56	62	60	62	60	62	62	60	62	608
FUXT852 FUXT854	62	56	62	60	62	60	62	62	62	62	608
FUXT202 FUXT204	62	56	62	60	62	60	60	60	60	62	608

Notes:

- via the GTS -

·SAREP reports	TCNA20, 21 RJTD
·Tropical cyclone advisory	WTPQ20-25 RJTD
·Prognostic reasoning	WTPQ30-35 RJTD
·Guidance for forecast by typhoon model	FXPQ20, 21 RJTD
·Tropical cyclone advisory information	FXPQ30-35 RJTD
·Best track information	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 positional errors in the 24-hour forecast for individual tropical cyclones in 1995 (as of 31 October 1995). EO/EP indicates the ratio of actual forecast errors (EO) to those of persistency (EP).

Tropical Cyclone	Errors Mean (km)	Errors S.D. (km)	Number of Forecasts	EO/EP (%)
TS 9501 CHUCK	154	91	4	124
TS 9502 DEANNA	280	101	17	128
TY 9503 FAYE	104	56	24	56
STS 9504 GARY	252	135	5	72
STS 9505 HELEN	166	63	10	61
TS 9506 IRVING	42	101	5	71
TS 9507 JANIS	231	92	12	80
TY 9508 KENT	185	75	16	108
STS 9509 LOIS	92	33	10	98
TY 9510 MARK	267	141	6	58
TS 9511 NINA	272	102	9	114
TY 9512 OSCAR	129	53	16	40
TY 9513 POLLY	261	143	23	79
TY 9514 RYAN	221	99	29	87
STS 9515 SIBYL	129	63	17	80
STS 9516 TED	106	63	7	71
TS 9517 VAL	388	202	4	88
TY 9518 WARD	112	57	18	43
STS 9519 YVETTE	223	4	2	80
TY 9520 ANGELA	151	96	39	90
TY 9521 ZACK	149	81	19	106
Annual Mean(Total)	181	113	292	80

Table 3 Same as Table 2 but in the 48-hour forecast

Tropical Cyclone	Errors Mean (km)	Errors S.D. (km)	Number of Forecasts	EO/EP (%)
TS 9501 CHUCK	-	-	0	-
TS 9502 DEANNA	464	120	13	95
TY 9503 FAYE	237	130	20	49
STS 9504 GARY	-	-	0	-
STS 9505 HELEN	185	137	6	22
TS 9506 IRVING	214	0	1	289
TS 9507 JANIS	372	241	8	59
TY 9508 KENT	341	179	12	69
STS 9509 LOIS	190	94	6	87
TY 9510 MARK	762	119	2	71
TS 9511 NINA	528	223	5	72
TY 9512 OSCAR	180	110	12	25
TY 9513 POLLY	477	285	19	55
TY 9514 RYAN	316	170	25	51
STS 9515 SIBYL	214	47	13	73
STS 9516 TED	221	57	3	73
TS 9517 VAL	-	-	0	-
TY 9518 WARD	221	134	14	28
STS 9519 YVETTE	-	-	0	-
TY 9520 ANGELA	276	185	35	73
TY 9521 ZACK	215	132	15	66
Annual Mean(Total)	302	201	209	56

Table 4 Specifications of the Global Spectral Model (GSM)

	current Global Model (GSM8911-T106L21)	new Global Model (GSM9603-T213L30L)
Integration ahead	72 hours (00 UTC), 192 hours (12 UTC)	84 hours (00 UTC), 192 hours (12 UTC)
Resolution		
Horizontal		
Grid interval	approx. 110 km	approx. 55 km
Number of grid points	320 × 160	640 × 320
Maximum wave number	106 with triangular truncation	213 with triangular truncation
Vertical		
Number of levels	21	30
Coordinate	η (σ - p hybrid)	η (σ - p hybrid)
Top	10 hPa	10 hPa
Initial field		
Analysis	mandatory pressure levels, 1.875° lat/long grid 2 dimensional optimum interpolation + asymmetric typhoon bogus	model η levels model Gaussian grid 3 dimensional optimum interpolation +asymmetric typhoon bogus
Initialization	non-linear normal mode full vertical modes	non-linear normal mode up to the fifth vertical mode with the inclement method
Dynamical process		
	hydrostatic approximation	hydrostatic approximation
Time integration	Eulerian time integration	Eulerian time integration
Discretization		
horizontal	spectral	spectral
vertical	finite-difference	finite-difference
Physical process		
Cumulus convection	Kuo scheme	Arakawa-Schubert scheme
Boundary layer	level-2 closure scheme	level-2 closure scheme
Land surface	Simplified Biospheric (SiB) model	Simplified Biospheric (SiB) model with improvement of initialization of hydrological processes
Radiation	short- and long-wave radiations	short- and long-wave radiations with the improved cloud radiation scheme

Table 5 Specifications of the Typhoon Model (TYM)

	current TYM	new TYM
Resolution		
Horizontal		
grid interval	50 km (at the typhoon center)	40 km (at the typhoon center)
number of grid points	109 × 109	163 × 163
max. wave number	70 × 70	106 × 106
Vertical	8 levels	15 levels
Coordinate		
Map projection	Mercator (when the typhoon center is south of 20 °N at the initial time) Lambert (when the typhoon center is north of 20 °N at the initial time)	Mercator Lambert
Vertical	σ	η (σ - p hybrid)
Prognostic variables	U, V, T_v, q, $ln\ P_s$	U, V, T_v, q, $ln\ P_s$, cloud amount, water content
Domain	approx. 5400 km × 5400 km	approx. 6480 km × 6480 km
Integration ahead	60 hours from 00,12 UTC	78 hours from 06,18 UTC
Initial field		
Analysis	1.875°- resolution Global Objective Analysis (mandatory pressure levels) + asymmetric typhoon bogus	model Gaussian grid (~ 0.5625°) Global Objective Analysis (model η levels) + asymmetric typhoon bogus
Initialization	non-linear normal-mode initialization (NNMI)	NNMI + physical initialization using precipitation field analyzed with radars, surface rain gauges and satellite data
Initialization of typhoon(s)	transplantation of modeled typhoon(s) + adjustment of initial movement velocity	transplantation of modeled typhoon(s)
Boundary conditions		
lateral	predictions with GSM starting at T-12h	predictions with GSM starting at T-6h
upper	no vertical velocity (σ = 0) at the top	no vertical velocity (η = 0) at the top with some sponge layers to avoid reflection of gravity waves
Dynamical process		
	hydrostatic approximation Eulerian time integration	hydrostatic approximation Eulerian time integration
Discretization		
horizontal	double-Fourier spectral	double-Fourier spectral
vertical	finite-difference	finite-difference
Water loading	not included	included
Physical processes		
Cumulus convection	moist convective adjustment	Arakawa-Schubert scheme
Radiation	not included	same as GSM8911
Boundary layer	simple K-theory with bulk method	Level-2 closure for surface fluxes
Surface	analyzed SST/ no heat flux over land	analyzed SST/ heat budget for multi-layer soil temperature prediction

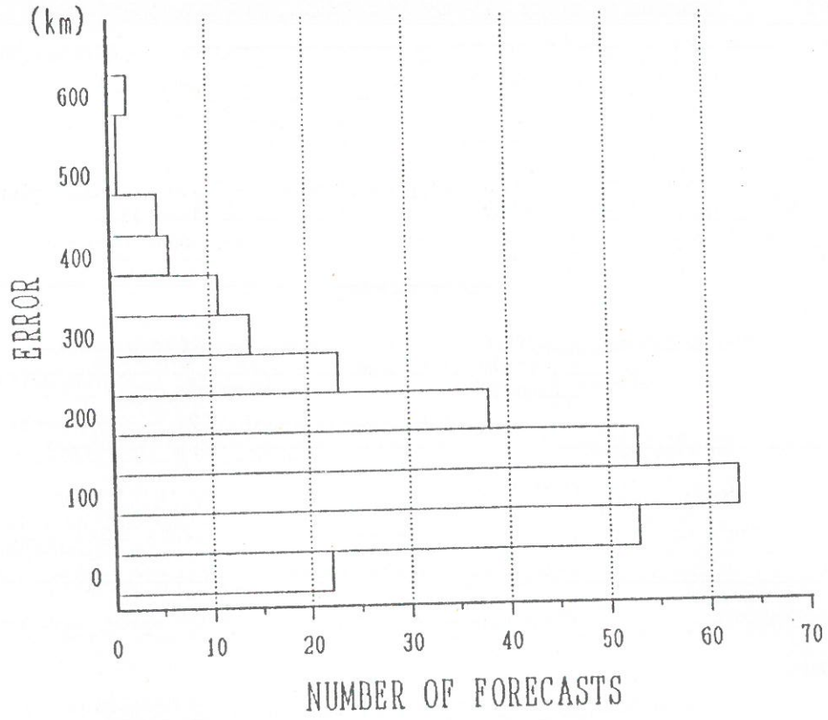


Figure 1 Distribution of positional errors of the 24-hour forecast

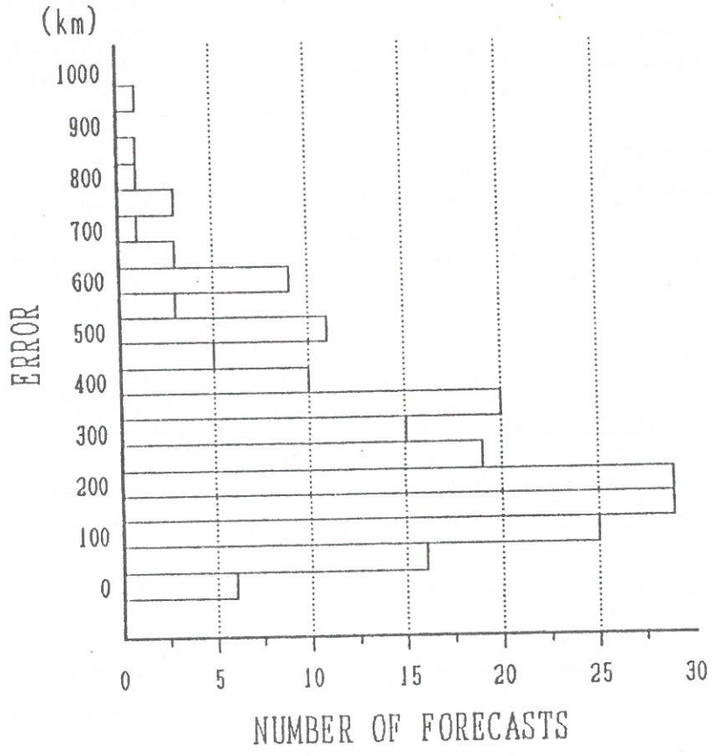


Figure 2 Same as Figure 1, but of the 48-hour forecast

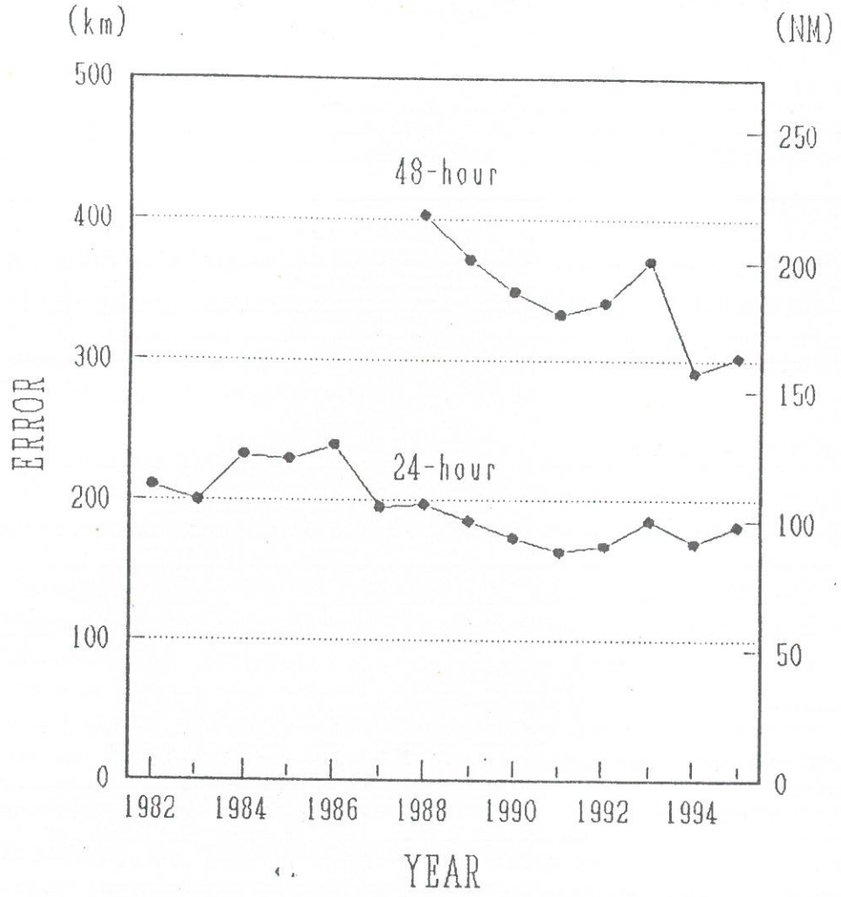


Figure 3 Annual mean of positional errors in the 24- and 48-hour forecast (values for the year 1995 are 10-month means.)

Product	95	96	97	98	Remarks
GMS observation					
GMS S-VISSR	———				28 times/day (full disk)
WEFAX	———	———	———	———	8 times/day (4-sector), (water vapor channel: 2 times/day)
	———	———	———	———	24 times/day (Image H),
	———	———	———	———	20 times/day (Image I/J)
Cloud motion wind	———	———	———	———	4 times/day
Analysis					
SAREP (for tropical cyclone)	———	———	———	———	8 times/day (Dvorak estimation: 4 times/day)
Ocean waves	———	———	———	———	Fax, once/day
Sea surface temperature	———	———	———	———	Fax, 10-day mean and its anomaly
Objective analysis					
conventional	———	———	———	———	Fax
stream line	———	———	———	———	Fax
Forecast					
NWP products					
conventional	———	———	———	———	Fax, GPV (Global Model)
stream line	———	———	———	———	Fax (Global Model)
Ocean waves	———	———	———	———	Fax, once/day
Sea surface temperature	———	———	———	———	Fax, 10-day mean and its anomaly
Advisory					
Tropical Cyclone Advisories	———	———	———	———	4 times/day (up to 48 hrs)
Prognostic Reasoning	———	———	———	———	2 times/day
Output of numerical prediction model	———	———	———	———	4 times/day (up to 60 hrs)
		———	———	———	8 times/day (up to 84 or 78 hrs)
Others					
Best Track	———	———	———	———	
Annual Report	———	———	———	———	
Technical note	———	———	———	———	

Supporting activity	95	96	97	98	Remarks
Data archive	———	———	———	———	
Monitoring of data exchange	———	———	———	———	
Product dissemination	———	———	———	———	via JMH, GTS, ISDN and Internet

APPENDIX XV

RECOMMENDATIONS OF THE FOURTH TECHNICAL CONFERENCE ON SPECTRUM

(a) WMO publishes the articles presented at the Fourth Technical Conference on SPECTRUM (Tsukuba, 27 November - 1 December 1995) in the publication series of the Tropical Cyclone Programme (TCP). The authors are urged to submit their articles in camera-ready form according to the prescribed format of twenty pages or less, including figures and references, to reach the WMO Secretariat by 29 February 1996.

(b) The Typhoon Committee is requested to consider conclusion of activity of the SPECTRUM Research Coordinating Group (SRCG) and organization of another coordinating group for wider research activities related to operational tropical cyclone analyses and forecasting. In organizing such coordinating group (e.g., Coordinating Group for Research Activities concerning Typhoon Analyses and Forecasting) on the basis of SRCG, the "Correspondent for Research Activities in Meteorological Component of the Typhoon Committee" be better to be concurrently integrated with the member of SRCG. The Typhoon Committee is urged to seek financial support for having meeting of new group in a regular interval as every two years, possibly during the Technical Conference recommended in the following item (c).

(c) In principle, the "Regional Technical Conference on Typhoon (tentative title)" of the Typhoon Committee be organized under coordination of newly organized Coordinating Group for Research Activities in a regular interval as every two years. This Technical Conference be organized at the request of the Typhoon Committee under close cooperation with WMO and the Typhoon Committee Secretariat (TCS). The First Technical Conference be held, possibly in 1997. The exact dates and venue should be decided, taking into account the progress of research activities of the Members of the Typhoon Committee.

(d) WMO and the Typhoon Committee are invited to explore the provision of financial support, such as from the WMO fellowship fund and the Typhoon Committee Trust Fund, where needed, to attach typhoon experts of the Typhoon Committee Members to advanced centers at mutually convenient times to carry out studies which could not otherwise be conducted owing to the limitation of computing facilities. etc.

(e) Noting that the input of Commission for Atmospheric Sciences (CAS) of WMO is valuable for the future research activities of the Typhoon Committee, communication between the Typhoon Committee, especially between newly organized Coordinating Group, and representative of CAS should be maintained.

(f) To benefit a large number of personnel of the Members of the Typhoon Committee in learning the latest developments in the basic understanding and/or numerical

prediction of various aspects of typhoons, the Typhoon Committee and WMO are invited to explore a financial support for sending experts on those matters to some Members of the Typhoon Committee for such purposes.

(g) In considering inadequate utilization of SPECTRUM-related datasets in several members, the RSMC Tokyo - Typhoon Center is requested re-delivery of SPECTRUM-related datasets including TCM-90 and TYPHOON-90 data in a proper format and media, where needed.

(h) Although remarkable progress in tropical cyclone track prediction has been demonstrated by several forecast centres at this Conference, the needs for maintaining and upgrading existing observation set and improving the observations in the environment of the tropical cyclones is also evident. The Typhoon Committee is encouraged to explore methods of improving observations from remote sensing platforms such as satellites and wind-profilers or direct measurements such as Aerosonde.

(i) All numerical modelling groups in the Typhoon Committee are encouraged to participate in the project of Comparison Of Mesoscale Prediciton And Research Experiments (COMPARE) undertaken by WMO-CAS/JSC-WGNE that will have initial conditions from the SPECTRUM, TCM-90 and TYPHOON-90 field experiments.

(j) The numerical modelling groups in the Typhoon Committee Members are encouraged to focus on operationalizing the results of SPECTRUM research studies geared towards promoting the capability of tropical cyclone forecasting.

(k) Researchers are encouraged to focus their studies on the precipitation aspect of tropical cyclones and on the interaction between the storm and the environment.

(l) To verify the applicability of numerical products available from a number of advanced global data processing centers, the operational group is encouraged to sue and evaluate these numerical outputs.

(m) Typhoon Committee Members should promote closer interaction between the operational group and the numerical modellers.

APPENDIX XVI

TYPHOON RESEARCH COORDINATING GROUP

Terms of Reference:

1. To further strengthen efforts using SPECTRUM, TCM-90 and Typhoon-90 data with extended aspects on rainfall, strong winds and storm surges as well as NWP comparison studies geared towards operational typhoon forecasting.

2. To identify scientific and technical problems in the operational analysis and forecasting of tropical cyclones, and to suggest key research projects at certain periods for Typhoon Committee consideration.

3. To maintain communication with other related international research communities and to promote research addressing common scientific and technical problems.

4. To coordinate the organization of a "Regional Technical Conference on Typhoon" with WMO and the TCS at the request of the Typhoon Committee so as to keep abreast of scientific and technical findings and of the developments relating to the operational analysis and forecasting of tropical cyclones and related impacts to each Member.

5. To report to the Typhoon Committee Session on the recent developments in research activities associated with operational analysis and forecasting of tropical cyclones.

APPENDIX XVII

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND

Interim Account for the Biennium 1994/1995

As of 31 December 1994

	$	$
Balance of fund as of 1 January 1994		219,323
Advances received	60,000	
Other income	11,037	71,037
Total revenue		290,360
Less: Expenditure		
TCS Coordinator Services	9,000	
Administration Costs - Local	7,848	
Administration Costs - WMO	4,412	
Bank Charges	45	
Publications and Reports	3,693	
W/S Storm Surges Bay of Bengal	5,015	
Technical Working Group KL	260	
Missions	8,074	
Total Expenditure		38,347
Balance at 31 December 1994	$	252,013

Represented by:

Cash at Bank		256,804
Less: Unliquidated obligations		4,791
	$	252,013

Contributions received	1994	1995	Year of Assessment
China	12,000		1994
Hong Kong	12,000		1994
Macau	12,000		1994
Malaysia	12,000		1994
Republic of Korea	12,000		1994
Total	60,000	0	

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND

Interim Account for the Biennium 1994/1995

As of 31 July 1995

	$	$
Balance of fund as of 1 January 1994		219,323
Advances received	108,000	
Other income	19,479	127,479
Total revenue		346,802
Less: Expenditure		
TCS Coordinator Services	9,000	
Administration Costs - Local	20,370	
Administration Costs - WMO	6,875	
Bank Charges	45	
Publications and Reports	10,118	
W/S Storm Surges Bay of Bengal	5,015	
Technical Working Group KL	260	
Missions	8,074	
Total Expenditure		59,757
Balance at 31 July 1995	$	287,045

Represented by:

Cash at Bank	299,590
Less: Unliquidated obligations	12,545
	$ 287,045

Contributions received	1994	1995	Year of Assessment
China	12,000		1994
Hong Kong	12,000		1994
Japan		24,000	1993/94
Macau	12,000		1994
Malaysia	12,000	12,000	1994/95
Republic of Korea	12,000		1994
Thailand		12,000	1994
Total	60,000	48,000	

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND

Interim Account for the Biennium 1994/1995

As of 15 December 1995 (Provisional)

	$	$
Balance of fund as of 1 January 1994		219,323
Advances received	180,000	
Other income	27,603	207,603
Total revenue		426,926
Less: Expenditure		
TCS Coordinator Services	27,000	
Administration Costs - Local	18,396	
Administration Costs - WMO	13,218	
Bank Charges	49	
Publications and Reports	18,609	
W/S Storm Surges Bay of Bengal	4,635	
Technical Working Group KL	259	
Spectrum Technical Coference	16,647	
Missions	16,088	
Total Expenditure		114,901
Balance at 31 July 1995	$	312,025

Represented by:

Cash at Bank	335,445
Less: Unliquidated obligations	23,420
	$ 312,025

Contributions received	1994	1995	Year of Assessment
China	12,000	12,000	1994/95
Hong Kong	12,000	12,000	1994/95
Japan		24,000	1993/94
Macau	12,000	12,000	1994/95
Malaysia	12,000	12,000	1994/95
Republic of Korea	12,000	12,000	1994/95
Thailand		24,000	1994/95
Vietnam		12,000	1995
Total	60,000	120,000	