



UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS TWENTY-SEVENTH SESSION

**Macau
6 - 12 December 1994**

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I. ORGANIZATION OF THE SESSION

1. The twenty-seventh session of the Typhoon Committee was held at Macau from 6 to 12 December 1994. The session was co-sponsored by the Economic and Social Commission for Asia and Pacific (ESCAP) and the World Meteorological Organization (WMO), and was hosted by the Government of Macau.

Attendance

2. The session was attended by 58 participants and observers. They represented 10 (out of 12) Members of the Typhoon Committee, namely, Cambodia, China, Hong Kong, Japan, Macau, Malaysia, Philippines, the Republic of Korea, Thailand and Viet Nam.

3. One observer each from Brunei Darussalam, Germany and the United States of America (USA) and International Civil Aviation Organization (ICAO) attended the session. Two observers from WMO Commission for Atmospheric Sciences (CAS) and one observer from the Department of Humanitarian Affairs (DHA) / International Decade for Natural Disaster Reduction (IDNDR) Secretariat also attended. The list of participants is attached as Appendix I.

Opening of the session (Agenda item 1)

4. Mr. Fortunato M. Dejoras, Chairman of the Typhoon Committee, declared the meeting open. Mr. A. Costa Malheiro, Director of the Macau Meteorological and Geophysical Services extended a very warm welcome to all the participants at the session. He stated that coordination and cooperation among the Members of the Committee was always necessary for maintaining reliable forecasting and warning systems, and requested that effective support of ESCAP, WMO and United Nations Development Programme (UNDP) be continued. He also stated that since its joining the Committee two years ago, Macau has already achieved significant progress in its forecasting and warning system, and will continue to support the work of the Committee. He concluded that in order to maintain continuing progress it was necessary to receive international assistance on both regional and national basis. He ended by wishing everyone a successful session and an enjoyable stay in Macau.

5. The representative of ESCAP delivered the Statement of the United Nations Economic and Social Commission for Asia and the Pacific. He expressed appreciation to the Government of Macau for hosting the session, and for the continuous support provided to the Typhoon Committee since its joining two years ago. The Committee was informed that the Commission at its fiftieth session in 1994 had noted with appreciation the considerable progress achieved in the implementation of the activities of the Typhoon Committee. The Committee was also informed that the ESCAP Committee on Environment and Sustainable Development at its second session in 1994 had urged members to incorporate action plans for national disaster reduction in disaster-prone areas in

their overall national development plans. The ESCAP Committee had also recommended preparation of hazard maps and application of appropriate land-use planning and management measures for natural disaster mitigation and increased land productivity. The representative of ESCAP thanked those Members that had been supporting the activities of the Typhoon Committee, as well as the WMO, 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 extrabudgetary 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 Macau for hosting the session and for the excellent arrangements made. He extended a warm welcome to all participants. He mentioned that within the framework of the WMO's Tropical Cyclone Programme, whose objectives were the prevention of loss of life and reduction of damage to property, this forum would review the past actions and achievements, to formulate new strategies to further enhance the work of the Committee. He informed the meeting that the Twelfth WMO Congress in 1995 might adopt the section on the Tropical Cyclone Programme of the Fourth WMO Long-Term Plan for the decade 1996-2005.

7. The representative of WMO assured the meeting that WMO would continue to support the Typhoon Committee in its humanitarian goals. He wished the participants a successful session.

8. Mr. Zou Jingmeng, the President of WMO and the Administrator of China Meteorological Administration, expressing his appreciation to Macau for organizing this session, noted that the membership of the Typhoon Committee had grown from 7 to 12 members and the Committee had become one of the most active organizations in the ESCAP Region. He praised the activities of the Committee in promoting and coordinating efforts for minimizing typhoon damage in the region, and in particular referred to successful implementation of Typhoon Operational Experiment (TOPEX) and Special Experiment Concerning Typhoon Recurvature and Unusual Movement (SPECTRUM) projects which have made great contributions to improved typhoon forecasts and warnings and significantly reduced damages. Mr. Zou briefly reviewed the typhoons that affected his country during the past year and informed the Committee that owing to accurate forecasting, warning and evacuation actions, their damage to life and to property was reduced to minimum. Mr. Zou stated that there was a need for further efforts on prediction of typhoon movements and on research and exchange of such information on

typhoon and flood forecasting. He also drew the attention of the Committee to the need for support of all Members and informed the session that WMO would as usual provide support to the activities of the Typhoon Committee within the available resources. He concluded by wishing the twenty-seventh session success in its work.

9. The key-note speaker, Eng. José Manuel Machado, the Secretary of Transport and Public Works of Macau, stated that economic development and patterns of human settlements in developing countries were increasingly being linked to growing vulnerability to natural hazards and that environmental degradation was another element in exacerbating the impacts of such natural phenomena. He noted that if certain initiatives were undertaken to integrate disaster mitigation into development policy, and if resources were provided for investing in measures for improving the forecasting, warning and response system, it could be quite possible to mitigate the effects of natural hazards in the future. He indicated that his administration would continue to support such activities in Macau and his trust that the Typhoon Committee would continue to provide valuable support in helping the world in natural hazard reduction. He concluded by wishing the twenty-seventh session all the success.

10. The session witnessed the awarding of the ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award for 1994. The 1994 award was given to the Macau Fire Corps.

The award was presented by Dr. Roman L. Kintanar, Chairman of the Typhoon Committee Foundation Inc.. The citation of the award read:

In recognition of its outstanding services since 1883 in the promotion of natural disaster prevention and preparedness through its efficient organization, high level of readiness and training, and commitment to the important task of safeguarding lives and rescuing people in times of emergency.

Election of officers (Agenda item 2)

11. Mr. António Costa Malheiro (Macau) and Mr. Toshiyuki Ono (Japan) were unanimously elected as the Chairman and the Vice-Chairman respectively. Mr. Cheang Boon Khean (Malaysia) was elected as the Chairman of the Drafting Committee.

Adoption of the agenda (Agenda item 3)

12. The session adopted the agenda as shown in Appendix II.

II. REVIEW OF THE FOLLOW-UP TO THE TC-26 REPORT (Agenda item 4)

13. The Committee reviewed in depth the action sheet relevant to the Committee's activities on the report of its twenty-sixth session. It expressed its satisfaction, in general, for the achievements of the follow-up actions taken by the Secretariats.

III. THE COMMITTEE'S ACTIVITIES DURING 1994 (Agenda item 5).

14. The Committee reviewed and evaluated in detail its activities undertaken during 1994 under five components as elaborated below. The Committee was pleased to be informed that Members continued to maintain, with the assistance of the Typhoon Committee Secretariat (TCS), ESCAP and WMO, activities called for by its regional cooperation programme.

a) Meteorological Component (Agenda item 5(a))

15. The Committee noted that textual update of the Typhoon Committee Operational Manual (TOM) - Meteorological Component has been published by WMO in July 1994 (Tropical Cyclone Programme Report No. TCP-23) and had incorporated all amendments made up to that date.

16. The Committee further considered the report of the new rapporteur of the TOM, Mr. Shingo Osano (Japan) who had gathered further proposals for amendments to the TOM in collaboration with the focal points of the Members of the Typhoon Committee. The Committee expressed its appreciation to the excellent work of the rapporteur and for the offer of Japan to continue providing the services of a rapporteur. Likewise, the Committee extended its gratitude to Mr. Haruo Ohnishi who had performed very well in the past as rapporteur of TOM.

17. The Committee also considered, after some deliberation, to introduce a new paragraph 4.5 in Chapter 3 of the TOM as given in Appendix III as proposed by the ICAO. The Committee agreed that the changes provided by the rapporteur and ICAO should be incorporated in the TOM and requested the WMO Secretariat to issue a new edition of the TOM in 1995.

18. The common concern with inadequacy in the upper air observation data was expressed on several occasions. The Committee took cognizance of this vital problem and urged Members to give priority consideration on this matter and strongly requested WMO for assistance.

19. A concern has also been discussed regarding the very high cost of producing such upper air observational data and the possibility of involving private clienteles who have been benefiting much from specialized meteorological services to share part of the cost.

20. A summary of the reports of the individual Members in relation to the meteorological component of its activities during 1994 is given in Appendix IV.

b) Hydrological Component (Agenda item 5 (b))

21. Based on the programme for 1994 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 1994 is included in Appendix V.

Activities of ESCAP

22. ESCAP continued to provide support to Members in their endeavors on flood protection. The Typhoon Committee may wish to note that the publication "Manual and Guidelines for Comprehensive Flood Loss Prevention and Management" continued to be utilized as the basic training material in the roving seminars fielded to other countries in the region. In accordance with the wishes of the Panel on Tropical Cyclones, another project had been prepared and received funding from Japan. And during this reporting period roving missions have already been fielded to Fiji, Samoa and India. In addition to providing advisory services on flood loss prevention and management it is planned to benefit from the experiences of participating countries and to revise the Manual and Guidelines accordingly. The project implementation is still continuing. Other project proposals, on "Training workshops on flood risk analysis and mapping" and "Natural hazard reduction and enhancement of production through effective land-use planning and practices" have been formulated for consideration for donor funding.

Activities of WMO

23. By August 1994, five Members of the Committee (i. e. Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam) had designated flood forecasting systems to be monitored using the "Management Overview of Flood Forecasting Systems" (MOFFS), version 2 (c), 1990. Following regional consultation meetings on the applications of MOFFS held in Malaysia in February 1992 and in Mexico in July 1994, minor modifications to version 2 (c) have been introduced to make MOFFS more user friendly. A final version is expected to become available in English, French and Spanish by the end of 1994. It will be distributed to all WMO Members for their use as a practical tool for monitoring the performance of their flood forecasting systems.

24. Other Members of the Committee are welcome to designate systems for monitoring using MOFFS, and the five who have already done so are encouraged to continue their efforts and to report the results to the WMO Secretariat.

25. Nine Members of the Committee have established a Hydrological Operational Multi-purpose System (HOMS) National Reference Centre (China, Democratic People's Republic of Korea, Hong Kong, Japan, Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam). Six of these Members have contributed some 35 components to HOMS, and all Members have made considerable use of HOMS to obtain the technology they require, requesting some 31 HOMS components in the last two years.

Hydrologists' Meeting

26. Prior to the Typhoon Committee Session the pre-session meeting of the hydrologists took place. The report of the hydrologists' meeting is presented in Appendix VI. The hydrologists formulated a set of recommendations which were adopted by the Committee as reflected under Agenda item 8.

c) Disaster Prevention and Preparedness Component (Agenda item 5 (c))

27. 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 the IDNDR during 1994 is included in Appendix VII.

Activities of ESCAP

28. The ESCAP Secretariat has continued its work on disaster prevention and preparedness. An issue paper on "Flood loss mitigation through land use planning and management" was prepared and presented to the ESCAP Committee on Environment and Sustainable Development at its second session in October 1994.

29. 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 reactivated and consultancy/advisory missions have been held in Myanmar, Nepal and Cambodia.

30. ESCAP was also active in preparations for and organization of the World Conference on Natural Disaster Reduction, held in Yokohama, Japan from 23 to 27 May 1994. The secretariat participated in the Scientific and Technical Committee's preparatory session held in November 1993 in Geneva. ESCAP was a sponsor of the World Conference and presented a paper on "Review of recent natural disasters and disaster reduction activities in Asia".

Activities of WMO

31. The Committee recalled that the WMO Congress at its eleventh session in 1991 had adopted the WMO Plan of Action for IDNDR. It

noted that much of the work of national meteorological and hydrological services was concerned with the reduction and mitigation of natural disasters.

32. The Plan identifies a number of WMO IDNDR projects in the Tropical Cyclone Programme and in the Hydrology and Water Resources Programme that contribute to the realization of the aims of the Decade.

33. The Committee was pleased to note that WMO and the International Council of Scientific Union (ICSU) are co-operating in an IDNDR demonstration project entitled "Tropical Cyclone Disasters" involving research into the mechanisms and motions of tropical cyclone. Among various activities of the project, the development of a small autonomous aircraft, "aerosonde" for tropical cyclone reconnaissance was recommended as a major initiative by the Scientific and Technical Committee (STC) for the IDNDR at its fourth session in New Delhi in 1993.

34. The Committee noted that WMO also actively supports the work of the bodies in the Decade and had been represented at the sessions of the Inter-Agency Working Group. These bodies play a useful role in coordinating the work of the various U.N. agencies involved and in ensuring that their work is relevant to the wider aims of the Decade. WMO has seconded a staff member to work with the IDNDR Secretariat from January to July 1994 in support of the preparations for and follow-up to the World Conference on Natural Disaster Reduction (Yokohama, Japan 23 to 27 May 1994). It was convened by the United Nations in response to a General Assembly resolution adopted in December 1993, but formal invitations were not issued until March 1994. The Committee was informed that some thousands of delegates, representatives and associated personnel attended the Conference, representing 150 countries, 18 agencies and programmes of the U.N. system, 21 other intergovernmental organizations and over 40 non-governmental organizations (NGOs). Nine Permanent Representatives of WMO Members were amongst the delegates.

35. The Committee was pleased to learn that the Secretary-General of WMO attended the Conference and addressed the Plenary early in its deliberations. He also acted as moderator for the presentation of papers to the technical committee which considered warning systems. This committee, which was organized by WMO with the support of United Nations Educational, Scientific and Cultural Organization (UNESCO), was among the best attended of the technical committee sessions and produced a series of valuable recommendations which will be published in the report of the Conference.

36. WMO also contributed to the Exhibition, by mounting a display presenting its activities in relation to disaster mitigation, and participated in the poster session with a presentation covering the special IDNDR projects.

37. The principal outcome of the Conference is to be found in the "Yokohama Strategy for a Safer World" and its accompanying

"Yokohama Message". These were adopted at the final Plenary Session of the Conference. Copies are reproduced verbatim as an Appendix to this document. The Committee's attention was drawn, in particular, to the following passages in the Yokohama Strategy (Appendix VIII) in relation to the topics indicated:

- * Warning systems: Principles 1 and 5; paragraphs 11(c), 11(m), 12(c), 12(d) and 13(p);
- * Information exchange: Paragraphs 9(m), 9(n) and 12(c);
- * Technology transfer: Principle 8; paragraphs 9(o) and 13(h);
- * Resources: Principle 10; paragraph 13(f);
- * Follow-up action: Paragraphs 9(r), 13(k), 13(m), 13(r), 14(e) and 14(g).

38. The Committee also noted the appeal for action contained in the Yokohama Message (Appendix IX), in particular its paragraphs 4, 5, 7(d) and 8.

Other Discussions

39. Recognizing television as a very effective medium for disseminating public information, especially amongst the younger generations, the Committee urged the WMO to consider, through its Public Weather Service Programme of World Weather Watch (WWW), setting up a scheme of collection from Members, videotapes on public awareness and preparedness on meteorological and hydrological disasters which may be adapted for use by other Members.

40. The Committee noted that weather service agencies would rarely have the resources necessary to prepare and distribute hazard awareness materials in a meaningful way to enhance public response. However, by developing partnerships with other agencies, NGOs such as the IFRCs, and the private sector, scarce resources could be augmented with dramatic results. This approach would ensure not only the sharing of expertise and resources but also the delivery of a consistent message to the public.

41. The Committee also noted that ultimate preparedness would require that all organizations charged with response actions work together in an effective manner. Seasonal drills should be conducted to ensure that all response organizations receive the necessary critical information and properly implement their action plans.

(d) Training Component (Agenda item 5 (d))

42. The Committee noted that Members continued to take every opportunity to further improve development of their human resources through the facilities available both inside and

outside the region. 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 1994 is given in Appendix X.

(e) Research Component (Agenda item 5 (e))

45. Research work continued to be an integral part of the three major component 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 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 1993 to September 1994. 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 during 1994 is given in Appendix XI.

Activities of CAS

49. The Chairman of the CAS Working Group of Rapporteurs on Tropical Meteorology Research (WGRTMR), speaking through representations, provided a report on the programme with the aerosonde and discussed aspects of the SPECTRUM/Tropical Cyclone Motion (TCM)-90 research and the revision of the "Global View on Tropical Cyclones" (see Appendix XII).

50. The Committee noted with interest that, following the successful format of the International Workshop on Tropical Cyclones (IWTC) series, WGRTMR is moving to establish 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 1996.

51. The Committee considered with great appreciation the initiatives of CAS with particular reference to the recent IWTC-III, the development of the aerosonde for tropical cyclone reconnaissance, the forecast guide and the updating of the global view on tropical cyclones.

52. The Committee expressed its gratitude to CAS for maintaining active cooperation and support to the activities of the Typhoon Committee. In turn, the Committee endorsed its support to the field experiment of aerosonde in the future.

IV. REVIEW OF THE 1994 TYPHOON SEASON/ANNUAL PUBLICATIONS (Agenda item 6)

REVIEW OF THE 1994 TYPHOON SEASON

53. The Regional Specialized Meteorological Center (RSMC) Tokyo-Typhoon Center provided the session with a summary of the 1994 season (Appendix XIII).

54. The Committee was informed that in July the tropical convection became active over the South China Sea and off east coast of the Philippines. A total of seven tropical cyclones formed in July. All of the tropical cyclones developed over these two waters. The Committee was also informed that the occurrence of tropical cyclones from August to October was 23, eight more than the average.

Annual Publications

55. The Committee expressed its appreciation of the Typhoon Committee Annual Review (TCAR) 93 and the Typhoon Committee (TC) Newsletter. TCAR 93 marked the second 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 Typhoon Committee Trust Fund (TCTF). The Committee decided that the same measures should be taken for TCAR 94.

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 TCAR 93. It also thanked the WMO Secretariat for the prompt printing and distribution.

57. The Committee requested Hong Kong to continue to make available the services of the Chief Editor for the coming year. The delegation of Hong Kong assured the Committee that every effort would be made to meet the request. The Committee agreed that the publication of the TCAR and TC Newsletter should continue.

V. CO-ORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (Agenda item 7)

58. The considerations under this agenda item were based mainly upon the information contained in the twentieth status report on the implementation of the WMO Tropical Cyclone Programme (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 by Chief of the TCP Division on the implementation of the TCP. It noted with satisfaction the achievements and progress made in both the general component and the regional component of the TCP since the twenty-sixth session of the Typhoon Committee.

59. The Committee was pleased to learn that the Sixth Training Course on Tropical Meteorology and Tropical Cyclone Forecasting was implemented by the University of Miami and National Oceanic and Atmospheric Administration (NOAA), USA in close co-operation with WMO from 21 February to 29 April 1994, with candidates from all the tropical cyclone basins. The Committee expressed its gratitude to WMO for the encouragement of many participants in the training course by typhoon forecasters from Typhoon Committee Members.

60. The Committee was informed of a highly successful workshop on storm surges for the Bay of Bengal. It was organized by WMO in co-operation with ESCAP and hosted by the Thai Meteorological Department from 14 to 19 November 1994, with participation of most of the Members of the Panel on Tropical Cyclones as well as some Members of the Typhoon Committee. The financial assistance to the participants from the Committee Members was provided from the Committee's Trust Fund.

VI. REVIEW OF THE PROGRAMME OF WORK FOR 1995 AND BEYOND (Agenda item 8)

Regional Cooperation Programme Implementation Plan (RCPIP)

61. A technical working group was formed to look into the plan and make amendments if necessary. The Committee adopted the revised RCPIP submitted by the group which is contained in Appendix XIV.

Meteorological component

Future activities of the RSMC Tokyo

62. The Committee took note of the future activities of the RSMC Tokyo which are contained in Appendix XV.

SPECTRUM

63. The Committee noted with interest the report of the SPECTRUM Research Coordinating Group (SRCG) prepared by its Chairman. See Appendix XVI.

64. Japan expressed its support to the activities of the SRCG and proposed to host the 4th Technical Conference on SPECTRUM in November / December 1995. The Committee accepted the offer and thanked the Government of Japan.

65. The Committee supported with appreciation the proposed Comparison of Mesoscale Prediction and Research Experiments (COMPARE) model intercomparison study utilizing SPECTRUM and TCM-90 final analyses presented by the CAS representative.

66. The Committee reiterated that non-participating Members to the 1990 field-experiment of SPECTRUM could nominate representative, one each, to the SRCG.

RSMC DATA SERVING SYSTEM

67. The Committee was very pleased to note that the JMA has carried out the feasibility study on distribution of data and products including the Grid Point Value (GPV) being prepared by RSMC Tokyo - Typhoon Center to Members of the Typhoon Committee via a satellite. The outcome of the feasibility study appears in Appendix XVII as RSMC Data Transmission via Satellite.

68. The Committee was informed by the delegate of Japan that a questionnaire prepared by JMA on the feasibility of establishing of an RSMC data serving system through international public telecommunication networks (e.g. Internet or Integrated Services Digital Network (ISDN)) (see Appendix XVIII) was distributed to Members of the Committee in October 1994. As can be seen from the results of the questionnaire given in Appendix XIX, 8 Members indicated their willingness to utilize the system in the near future.

69. In view of the above, as a provisional measure, JMA may commence to operate the system through Internet and ISDN on experimental basis in April 1995.

70. At the same time, the Committee discussed at length the feasibility of the RSMC Data Transmission via Geostationary Meteorological Satellite (GMS) based on the information given in Appendices XVII, XX, XXI and XXII. Finally the Committee recognized that the above system has not yet been authorized by the Japanese Government due to financial and technical difficulties. Consequently, the Committee was informed by the delegate of Japan that the system of the RSMC Data Transmission via GMS would not be implemented within 4 or 5 years.

71. The Committee received with appreciation the report of Japan that GMS-5 will be launched in 1 February 1995 to replace GMS-4

which for the past many years has been successfully operated and used. GMS-5 carries some improvement over GMS-4, notably, the availability of water vapour channel.

Regional Telecommunication Network

72. The Republic of Korea expressed its desire to reestablish contact with D.P.R. Korea regarding the proposal to have a telecommunication link between Seoul and Pyongyang for the speedy exchange of weather and climate data. It requested the Committee for assistance in this regard.

73. The Committee supported the proposal and requested TCS to take the necessary steps to reestablish contact in the near future.

Hydrological Component

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

- (a) TCS to seek requirements from the Typhoon Committee Members in relation to programme on flood loss prevention and management, and based on which to formulate a medium-term hydrological programme for implementation.
- (b) Typhoon Committee to take necessary actions to solicit the assistance from alternate TC Members in dispatching a hydrologist presently dispatched by the Government of Japan.
- (c) Promote the exchange of experience and transfer of technology through Technical Cooperation among Developing Countries (TCDC) or other means.
- (d) Typhoon Committee to consider providing financial support from the TCTF for activities under the Hydrological Component such as exchange visits, attachment of experts to advanced centres, consultation missions and others.

Perspective Development Plan

75. The Committee deliberated on the working document on the Perspective Development Plan of the Typhoon Committee and decided on more contributing comments and plans from the Members and components other than meteorology. It considered preparing a second draft for discussion in the next session.

Training Component

76. The representative from China reported that Nanjing Institute of Meteorology, as a WMO Regional Meteorological Training Centre (RMTC), will offer an International Weather Course on the Interpretation and Application of Numerical Weather Prediction Products from 9 October to 9 November 1995. All Members of the Typhoon Committee are welcome to participate.

Research Component

77. The Typhoon Committee endorsed its support to the field experiment of the aerosonde in the future and noted once more the close relationship between this program and that of SPECTRUM.

VII. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (Agenda item 9)

78. The Committee was informed of the current overall financial situation including information on the WMO Technical Cooperation. The Committee noted with concern the drastic drop in UNDP project support for meteorological and hydrological projects in developing countries over the past few years.

79. 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.

80. The Typhoon Committee expressed its appreciation to Mr. Gabriel S. Monroy, for the valuable services he rendered to the work of the Committee over the years as the Meteorologist of the Typhoon Committee Secretariat.

81. The Committee also expressed its appreciation to the Government of Japan for having provided the services of a full time hydrologist to TCS.

82. The Committee was informed that ESCAP would continue to undertake activities in support of the Typhoon Committee within the framework of its own programme of work and in line with available resources. In this connection the Committee was pleased to note that ESCAP could provide advisory services on flood protection and drainage through its Regional Adviser on Water Resources 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.

83. 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 extrabudgetary funding support for implementation of activities on natural disaster reduction.

84. The Committee reviewed the financial report on the Trust Fund (see Appendix XXIII). 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 financing of certain activities of the Committee. In view of the fact that no favourable response had so far been received from UNDP, the Committee urged its Members to continue and enhance their contributions to the Trust Fund. The Committee was pleased to note that several Members pledged their contributions to the Fund.

85. The Committee agreed to the use of the Trust Fund for the following purposes until the twenty-eighth session:

- (a) Augmentation of travel funds for TCS staff missions;
- (b) Support for organizing symposia, technical conferences and workshops related to typhoons;
- (c) Support for SPECTRUM Research Coordinating Group (SRCG);
- (d) Publishing the Typhoon Committee Newsletter periodically;
- (e) Support to the TCS, including representation and emergency expenses;
- (f) Printing and distribution cost of documents for the twenty-eighth session not exceeding US\$1600;
- (g) Support to the publication of TCAR 94;
- (h) Support to the attachment of typhoon experts to advanced centres;
- (i) Support to hydrologists of Members for such activities as exchange visits, attachment of experts to advanced centres, consultation missions and others;
- (j) Support to attendance of experts at the 4th Technical Conference on SPECTRUM (Japan, November/December 1995).

86. 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.

87. The Committee recognized the need to approach additional sources of support for its activities. It agreed that efforts to continue to be made by the TCS, WMO and ESCAP to enlarge the number of contributors to the Trust Fund, 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 Asian Development Bank, Global Environment Facility (GEF) and other institutions.

88. 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.

89. 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 TC region.

90. The Committee was informed on the status of the WMO Voluntary Co-operation Programme (VCP). The Committee noted with appreciation the contribution of China in providing training, familiarization visits and study tours through this programme. The TCS members were encouraged to update their requests for VCP assistance to WMO.

VIII. AGENDA FOR THE TWENTY-EIGHTH SESSION. (Agenda item 10)

91. The Committee requested TCS, in cooperation with ESCAP and WMO, to prepare the provisional agenda for the twenty-eighth session.

92. The Committee also considered structuring of its annual sessions, and decided to continue with the present arrangement where the session is preceded with the meeting of the hydrologists.

93. The Committee also decided that, starting with the twenty-eighth session, the report of the session be produced in two parts; the main report including appendices on organization and decisions of the session and the action plan for the future activities of the Committee, and the second volume containing informative type of appendices to be produced within the next two months following the Committee Session.

IX. DATE AND PLACE OF THE TWENTY-EIGHTH SESSION (Agenda item 11)

94. The representative of Malaysia extended an official invitation to the Committee to hold its twenty-eighth session at Kuala Lumpur to be hosted by the Government of Malaysia from 5 to 11 December 1995. The meeting of the hydrologists will take place on 4 December 1995. The Committee in accepting the kind invitation, expressed its thanks and deep appreciation to the Government of Malaysia.

X. SCIENTIFIC LECTURES (Agenda item 12)

95. The following scientific lectures were presented.

(a) A New Model for Typhoon Track Prediction (MTTP) at NMC China

by Mr. Qiu Guoqing (China)

(b) Proposed COMPARE Model Intercomparison Study Utilizing Tropical Cyclone Motion (TCM-90) Final Analyses

by Prof. R. L. Elsberry (U.S.A.)

(c) Typhoon Best Track Analysis

by Mr. Edwin S. T. Lai (Hong Kong)

(d) Introduction to SABO work in Japan

by Mr. M. Okamoto (Japan)

(e) Recent Research at Naval Postgraduate School related to Tropical Cyclone Prediction

by Prof. R. L. Elsberry (U.S.A.)

(f) Research Project on Tibetan Plateau Field Experiment

by Prof. Chen Lianshou (China)

96. The Committee expressed its thanks to the lecturers.

XI. ADOPTION OF THE REPORT (Agenda item 13)

97. The Committee adopted its report on 12 December 1994.

APPENDIX I

LIST OF PARTICIPANTS

MEMBERS OF THE TYPHOON COMMITTEE

CAMBODIA

Representative: Mr. Ly Chana, Deputy Director, Department of Agricultural Hydraulics and Hydro-Meteorology, Ministry of Agriculture Forestry and Fisheries, Phnom Penh

Alternate: Mr. Andrew Duncan, Meteorological Advisor, Department of Agricultural Hydraulics and Hydro-Meteorology, Ministry of Agriculture, Forestry and Fisheries, Phnom Penh

CHINA

Representative: Mr. Zou Jingmeng, Administrator, China Meteorological Administration (CMA), Beijing

Alternates: Mr. Ma Henian, Deputy Administrator, China Meteorological Administration (CMA) Beijing

Mr. Wang Caifang, Director, International Cooperation Department, CMA, Beijing

Mr. Chen Lianshou, Director, Academy of Meteorological Sciences, CMA, Beijing

Ms. Lu Jialian, Deputy Director, Department of Operational Development and Weather, CMA, Beijing

Mr. Qiu Guoqing, Deputy Director, National Meteorological Center, CMA, Beijing

Mr. Wang Jide, Deputy Director, Technical Commission of Water Resources Information Center, Ministry of Water Resources, Beijing

Ms. Meng Zhimin, Chief, Division of International Cooperation Department, Ministry of Water Resources, Beijing

Mr. Deng Kenan, Division Chief, Pearl River Water Conservancy Committee, Ministry of Water Resources, Beijing

HONG KONG

Representative:

Mr. P. Sham, Director, Royal Observatory, Kowloon

Alternate:

Mrs. Elaine Koo, Assistant Director, Royal Observatory, Kowloon

Mr. S. T. Lai, Senior Scientific Officer, Royal Observatory, Kowloon

JAPAN

Representative:

Mr. Toshiyuki Ono, Director-General, Forecast Department, Japan Meteorological Agency, Tokyo

Alternates:

Mr. Masao Okamoto, Director, Disaster Prevention Investigation Section and Director, Section of IDNDR, River Bureau, Ministry of Construction, Tokyo

Mr. Kaichiro Nitta, Deputy Director, planning and Coordination Division & IDNDR Promotion Office, Disaster Prevention Bureau, National Land Agency, Tokyo

MACAU

Representative:

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

Alternates:

Mr. Oscar Antonio Gomes da Silva, Secretary-General, Security Coordination Office

Mr. Antonio Viseu, Chief, Meteorology Division, Macau Meteorological and Geophysical Service

Mr. Fernando Crestejo, Chief, Weather Forecast Section Macau Meteorological and Geophysical Service

Mr. Jose Antonio Machado Alves de Matos, Operations Officer, Civil Protection Operations Centre

Mr. Leong Kai Hong, Senior Officer, Macau Meteorological and Geophysical Service

Mr. Wong Chi Hun, Meteorologist, Macau Meteorological and Geophysical Service

MALAYSIA

Representative:

Mr. Cheang Boon Khean, Director-General, Malaysian Meteorological Service, Kuala Lumpur

Alternates:

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

Mr. Chong Sun Fatt, Senior Hydrology Engineer, Department of Irrigation and Drainage, Kuala Lumpur

Mr. Haji Mazlan Bin Mohd. Nor, Assistant Director, National Security Council, Prime Minister's Department, Kuala Lumpur

PHILIPPINES

Representative:

Mr. Fortunato M. Dejoras, Administrator, Office of Civil Defense, Quezon City

Mr. Roman L. Kintanar, Permanent Representative of Philippines with WMO, Quezon City

REPUBLIC OF KOREA

Representative:

Mr. Jong-Hon Bong, Administrator, Korea Meteorological Administration, Seoul

Alternates:

Mr. Heung-Soo Cheong, Director-General, Disaster Prevention Bureau, Ministry of Home Affairs, Seoul

Mr. Yung-Il Park, Director, River Management Division, Water Resources Bureau, Ministry of Construction, Seoul

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

THAILAND

Representative:

Mr. Smith Tumsaroach, Director-General, Meteorological Department, Ministry of Transport and Communication, Bangkok

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Mr. Somsak Klanpoch, Director, Drainage System Development Division, Department of Drainage and Sewerage, Bangkok Metropolitan Administration, Ministry of Interior, Bangkok

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VIETNAM

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Mr. Trinh Van Thu, Deputy Director General of Hydrometeorological Service, Hanoi, Vietnam

Mr. Nguyen Cong Thanh, Acting Director of Hydrometeorological Forecasting Department, Hydrometeorological Service, Hanoi, Vietnam

Ms. Bui Thi Bich, Engineer, Central Committee for Flood and Storm Control, Hanoi, Vietnam

OTHER STATES

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Department of Humanitarian Affairs (DHA)/International Decade for Natural Disaster Reduction (IDNDR) Secretariat

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LOCAL SECRETARIAT

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Chief of Organization
Committee

Mr. Lei Kin Cheon

Secretariat

Ms. Iao Sok Fan

Secretariat

Mrs. Pun Weng U Cordova

Secretariat

Mr. Chio Fok Choi

Secretariat

Mr. João Sousa

Secretariat

Ms. Sandra Bartolo

Secretariat

Mr. Alfredo A. T. da Silva

Coordinator

Ms. Assunta Leung

Coordinator

Mr. Tomás Mendes António

Coordinator

Mr. Vong Kai Vai

Coordinator

Mr. Petter Siu Chung

Coordinator

Mr. Lau Chi Vo

Coordinator

APPENDIX II

AGENDA

1. Opening of the session.
2. Election of officers.
3. Adoption of the agenda.
4. Review of the follow-up to the TC-26 report
5. The Committee's activities during 1994:
 - a) Meteorological component;
 - b) Hydrological component;
 - c) Disaster prevention and preparedness component;
 - d) Training component;
 - e) Research component.
6. Review of the 1994 typhoon season/annual publications.
7. Coordination with other activities of the WMO Tropical Cyclone Programme.
8. Programme for 1995 and beyond.
9. Support required for the Committee's programme.
10. Agenda for the twenty-eighth session.
11. Date and place of the twenty-eighth session.
12. Scientific lectures.
13. Adoption of the report.

APPENDIX III

DRAFT TEXT FOR THE TYPHOON COMMITTEE OPERATIONAL MANUAL: METEOROLOGICAL COMPONENT (WMO/TD/No.196, Report No. TCP-23)

4.5 Warning for aviation

In accordance with the International Civil Aviation Organization (ICAO) Air Navigation Plans (ANPs) for the Asia (ASIA) and Pacific (PAC) Regions, warnings on tropical cyclones for international air navigation are issued as SIGMET messages*, including an OUTLOOK, by designated meteorological watch offices (MWOs), each of which provides information for one or more specified flight information regions (FIRs) or upper information regions (UIRs). The boundaries of the FIRs/UIRs are defined in ICAO ANPs for the ASIA and PAC Regions.

SIGMET information is provided in accordance with WMO-No. 49 - Technical Regulations, Volume II (Meteorological Services for International Air Navigation).

The Tropical Cyclone Advisory Centre in Tokyo disseminates advisory information on positions of the centres of the tropical cyclones to MWOs as appropriate for use in the preparation of OUTLOOKs appended to SIGMETs for tropical cyclones.

* From 1 January 1996, SIGMETs for tropical cyclones will only be issued for those tropical cyclones having a 10-minute mean surface wind speed of 63 Km/h (34 Kt) or more.

APPENDIX IV

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

In CAMBODIA, since mid-1992 the Lutheran World Service (LWS) Meteorological Program has supported the rehabilitation of the observational network. The relocation of the primary meteorological stations back to the airports and staff training at the provincial level has mostly been achieved.

Currently, including the National Meteorological Centre, 10 stations have been partially rehabilitated and refurbished. Two primary and one secondary stations have yet to be touched. These are stations at the coastal province of Koh Kong, northeastern province of Rattanakiri, and Tonle Sap province of Kampong Thom respectively. The construction of these three stations would see adequate meteorological coverage of Cambodia.

During 1994, LWS has also assisted with the establishment and equipping of a Meteorological Briefing Office (MBO) at the Pochentong International Airport. New computerized satellite receiving and communications equipment and software have also been installed at the MBO to aid in forecast preparation.

List of meteorological activities in Kingdom of Cambodia during 1994:

- Relocation and partial rehabilitation of the primary provincial stations of Battambang, Stung Treng and Siem Reap.
- Relocation and rehabilitation of Pochentong observation site back to the International Airport.
- Establishment and equipping of a weather Service office (Meteorological Briefing Office) at Pochentong International Airport.
- Establishment of a library and resource center at the NMC.
- Installation of a PC operated (Rural-Sat) Satellite receiving System (GMS/NOAA) at the MBO.
- Installation of a 100 KVA transformer to connect the NMC to the national power grid.
- Installation of a PC operated HF radio weather facsimile and radio teletype receiving System.
- Installation of three telephone lines: 2 fax/phones at the NMC and 1 fax/phone at Pochentong International Airport.

- Installation of 1 Agro-Meteorological station within the project area of JICA's Master plan, in the suburbs of Phnom Penh.

In CHINA, the meeting of the Expert Group on Typhoon and Oceanographic Meteorology was held in Shenyang, Liaoning Province from 25 to 27, December, 1993. 33 experts participated in the meeting. Real time typhoon operational forecasts, technological problems and some progress of SPECTRUM - 90 research program were discussed at the meeting.

Meteorological services in the fishing season (winter) from November 1, 1992 to the end of January, 1993, were provided by the Shanghai Regional Meteorological Center, The Zhejiang Provincial Meteorological Bureau and the Zhoushan Oceanographic Fishing Forecasting Center. Successful strong wind warnings were made 24 - 48 hours in advance by these weather centers with the error of one grade in Beaufort scale.

The Ninth Session of the National Tropical Cyclone Workshop was held in Nanjing from June 1 to 4, 1994. Research results of China's Key projects related to typhoon and SPECTRUM - 90 were exchanged among more than 90 experts on tropical cyclones at the meeting.

The Second Session of Rainstorm and Strong Convective Conference was held in Nanjing from June 8 to 10, 1994. 60 experts in this field participated in the conference. The presentations consisted of large scale heavy rain (including Meiyu), torrential rain produced by tropical cyclones and local rainstorms caused by meso - scale strong convective systems. Meanwhile, forecasting methods of rainfall were also exchanged.

In order to improve the meteorological telecommunication and operational weather forecast, the meeting on communication network and operational forecasts of management was held at Beijing from October 22 to 28. 60 people participated in it, among them were experts and management officials from meteorological departments at various levels of 30 provinces, cities and autonomous regions. Subjects of discussion at the meeting were as follows: (1) the overall programming, planning and management should be improved, (2) a new generation of process for operational weather forecast should be developed, (3) technical standards to weather analysis and forecasts should be compiled and regulations of working program be worked out, (4) the assessment schemes or methods for the weather forecasting should be optimized and the operational subjective assessment of forecasting quality should be conducted.

Progresses have been made in the tropical cyclone warning system. Modern operational systems have been established at the provincial observatories along China's coastal line in recent ten years. For example, operational marine meteorological forecasting systems have been developed at 16 major marine meteorological observatories along the coastal line of China. From 1980 to 1994, there were no major accidents or casualties due to forecast's failures.

In 1994, scientific and operational experiments on typhoons such as the five offshore typhoon 9405 (Tim), 9412 (Caitlin), 9413 (Doug), 9414 (Ellie), 9416 (Fred) were conducted with a scientific aim to conduct experiment on the severe rainstorm caused by the landing typhoons and the sudden change of the intensity and motion of the offshore typhoons (including tropical cyclones).

Following the comparison experiment on land - sea gale over Huanghai and Bohai seas in the 1970s, a recent such type of experiment on land - sea gale over East China Sea was conducted and through which a lot of data have been obtained.

Ocean route techniques have been developed by China's Global Meteorological Ocean Route Service Co. which has provided such weather services to the ocean - going ships. It is estimated that such benefited ships would reach to 170. Such service have reduced cargo damages, shortened navigational time, saved energy and navigational safety ensured.

In 1993 altogether 19 tropical cyclones' (9302 - 9320) motion forecasting and positioning were assessed accurately. In general, the accuracy of track forecasts in 1993 was lower distinctively than that in the previous years. The 24 hour mean error of official forecasts is about 200Km, while that of 48 hour is up to 414.5Km.

Beijing to Seoul telecommunication circuit has been running since July 9, 1994. This circuit uses international satellite circuit (four lines). The device is Racal - milgo Omnimode96 V.29 modem. Communication speed is 9600bps. We share two channels. Channel A is 4800bps for fax transmission. Channel B is 4800bps for data transmission. All the data from Beijing to Seoul is about 1.9MB. Information from Seoul to Beijing is about 0.3MB.

Another supercomputer system main frame Cray C92/1 - 128 and Cray EL98/4 was installed in this summer in NMC just after installation and operation of domestic made supercomputer Galaxy - II last year. Based on these computer facilities, a NWP model for typhoon track prediction and a new limited area model for precipitation prediction will be put into operation next year and a global model with resolution of T106 will be employed for operation in 1996.

In HONG KONG, the Royal Observatory took delivery of a new Doppler weather radar during the year. It was commissioned on 11 November at a ceremony officiated by Hong Kong's Secretary for Economic Services Mr. G. K. C. Siu, the Director of Guangdong Meteorological Bureau Mr. Xie Guo Tao, the Director of Servicos Meteorologicos e Geofisicos Macau Dr. Antonio P. F. da Costa Malheiro, the Director of the Royal Observatory Hong Kong Mr. P. Sham and Assistant Director of the Royal Observatory Mr. Robert Lau.

The Royal Observatory also took delivery of two new UNIX-based RISC workstations during the year to replace the machines in use.

In addition, work is at hand to procure a ground station for the reception of satellite imageries from the GMS-V satellite which would be launched by Japan in 1995.

Professional meteorologists from the Royal Observatory continued to present weather programmes for all three local television stations.

Work commenced on the construction and refurbishment of a television studio at the Royal Observatory Headquarters in order to give its weather presenters a professional studio environment from which to deliver weather briefings to members of the media.

Stickers and posters were distributed freely to schools, libraries, Government departments in mid-1994 to give publicity to the Royal Observatory's Dial-a-Weather automatic telephone answering service which now receives an average of approximately 39 000 enquiries per day.

A new television announcement on the Rainstorm Warning System which improved upon the previous announcement by the inclusion of animated graphics and information on the precautionary actions to take was produced with the help of the Information Services Department and aired.

In JAPAN, the GMS-4 has been fully operated at 140°E above equator during 1994. In addition to obtaining Earth imagery, it is relaying meteorological data from DCPs. By the end of 1994, the number of DCPs installed or to be installed in the area of Typhoon Committee Members except Japan will increase from 26 to 36. The GMS-5, the successor to the GMS-4, will be launched on 1 February 1995.

Two radars at Miyakojima (47927) and at Ishigakijima (47918) were integrated into a new radar equipped with the Radar Echo Digitizing and Disseminating System (REDIS) at a new site on Ishigakijima/Omotodake (47920) on 1 March 1994. The new radar contributes to expanding the area of typhoon detection over the Ryukyu Islands. Consequently, all the 19 meteorological radars operated by the Japan Meteorological Agency (JMA) have been equipped with REDIS and the data from the JMA's radars began to be digitized.

In the summer of 1995, the radar at Sapporo (47412) will be renewed and will be moved to a new site on Kenashiyama in order to expand its coverage.

The automated upper-air observation system, which had been successively introduced since 1986, was installed at Wakkanai (47401), Kagoshima (47827), Chichijima (47971) and Minamitorishima (47991). Consequently, all the 18 upper-air observation stations have been automated. The automated upper-air observation system automatically collects observational data from the signal and reports the data to the JMA Headquarters.

The new-type of rawindsonde (RS2-91), which has been introduced since October 1992, will be installed in Fukuoka (47807) in February 1995, as the 16th station that employed RS2-91. The remaining two stations, i.e. Ishigakijima (47918) and Minamidaitojima (47945) will also employ it by 1997.

JMA has been operating the ultrasonic ocean waves gauges at eleven sites of Japanese coast. In 1994, the new-type wave observation system was installed at the two sites, Matsumae (47430) and Fukue (47817). Thus, all of the eleven sites have been equipped with the new system which enables it to automatically report observation data to the Headquarters of JMA on an hourly basis.

An asymmetric bogus method developed by JMA was incorporated into the global and regional (Asia) objective analyses in August 1994 because it was confirmed that the developed method can improve typhoon track forecasts not only in Asia Spectral Model (ASM) but also in the Global Spectral Model (GSM). This method is expected to reduce errors in the forecast central positions of typhoon by ASM for the 48-hour forecast by tens of kilometers on average.

Since 1 June 1994, the "estimated precipitation" based on observations of 19 meteorological radars and about 1,300 rain gauges at AMEDAS (Automated Meteorological Data Acquisition System) has been operationally used for issuing forecasts and warnings to compensate rather sparse rain gauge data.

Since 1988, JMA has issued a very-short-range forecast of precipitation for 3 hours at the resolution of 5 Km for the area where digitized radar echo data are available. On 15 March 1994, the meteorological radar at Ishigakijima started to be digitized and then the very-short-range forecasts began to be issued for throughout Japan based on the "estimated precipitation".

Since 1950, JMA and the Ministry of Construction, which is in charge of the management of 109 major rivers in Japan, have issued flood forecasts for the rivers specified taking into account the availability of technologies necessary for forecasting precipitation in the river basin, water level and discharge. In 1950 when the flood forecasts began there were 15 specified river systems. The number of the specified rivers increased year after year until it became 45 systems on 24 March 1994, when two river systems were newly specified.

On 1 February 1994, JMA started transmitting, through the meteorological radio facsimile (JMH), forecast and analysis charts for stream lines at 850 hPa and 200 hPa over the western Pacific which are prepared by RSMC Tokyo-Typhoon Center.

The telecommunication protocol of the MTN circuit between Tokyo and Beijing was changed on 20 December 1993. The telecommunication protocol, X.25 LEVEL 3, was adopted to enable exchange of binary data between Tokyo and Beijing.

JMA had been issuing "Coastal Wave 24-hour Forecast Chart (FWJP)" and "Coastal Wave Analysis Chart (AWJP)" for the waters adjacent to Japan as well as "Ocean Wave 24-hour Forecast Chart (FWPN)" and "Ocean Wave Analysis Chart (AWPN)" for the western North Pacific once a day through the broadcasting service of the meteorological radio facsimile (JMH). Since February 1994, the products of FWJP and AWJP have been prepared twice a day when a typhoon approaches Japan to improve ocean wave information service.

JMA recruited the meteorological observation vessels, Ryofu Maru, Keifu Maru and Chofu Maru in the western tropical Pacific five times in total in 1993 for the monitoring of season-to-season and year-to-year variations of oceanographical structure of the tropical waters. Furthermore, Keifu Maru was dispatched to south of Japan in August through September 1994 to make observations of surface and upper atmosphere as well as sub-surface ocean temperature in the typhoon prone waters.

In MACAU, the International Airport of Macau will enter into the phase of test flight in the middle of next year. According to the agreement between Macau Meteorological Services and the Macau Airport Company, the meteorological technical support and the forecasters and the observers will be provided by our services. Consequently, the training of the qualified forecasters and observers is one of the objectives for this year. For the first time in our services and through the cooperation with the Meteorology Administration of P.R. of China, the forecaster course (WMO Class II) was provided here in Macau.

Moreover, four meteorological specialists from Nanjing Meteorological Institute, Guangdong Meteorological Bureau were invited to give lectures about the subjects of advanced Meteorological, namely, numerical modelling, statistical method, remoting sensing and cloud physics.

Faced with the need of an integrated information system to handle the meteorological information through the telecommunication circuit linked with the Guangzhou Meteorological Bureau, and from the Automatic Weather Stations and to disseminate the processed information to the public, the proposal of acquiring a mini-computer was approved by the Macau Government. The computer system will be installed at the end of this year.

In order to complete the observation system, a preliminary study of the acquisition of a Doppler Radar was carried out this year by a Radar specialist from Portugal. The site of the future radar will be located near the Airport. It is expected that the Radar will enter into operation before the Test Flight stage of the airport. The radar will be linked directly to the mini-computer through a direct optical fiber line. Another study about the acquisition of the High Resolution Satellite Receiver is being carried out.

The plan of forming an observation network which observes the weather conditions in the Pearl River Delta is implemented. This network links the selected Automated Weather Stations of the Macau Meteorological Services, Guangdong Meteorological Bureau and the HongKong Royal Observatory located in the delta region. The network will transmit the meteorological information every 15 minutes to each center. With this network the observation of the significant weather condition in the Pearl River Delta will be improved.

In MALAYSIA, the Malaysian Meteorological Service (MMS) is in the process of installing an Automatic Applied Meteorological Observation System (AAMUS) which is based on a network of 38 meteorological stations distributed throughout the Federal Territory of Kuala Lumpur and Selangor State. Meteorological data will be polled via telephones at regular interval by the Central Control Unit (CCU) located at the MMS Headquarters. Meteorological information will be displayed graphically for the benefit of forecasters monitoring meso-scale weather phenomena over the urbanized Klang Valley region. Relevant meteorological data will also be relayed to the Drainage and Irrigation Department for serving as inputs to their hydrological forecast models.

The project will be carried out in two phases. Phase I will be carried out in 1994 and involves the installation of the CCU and 17 stations. Phase II will cover the installation of the remaining stations in 1995.

The Malaysian Meteorological Service has recently concluded a tender exercise for the procurement of a radar integration system. The system will link up the weather radars at Butterworth, Subang and Kluang to a Data Collection Center that will be established at the MMS Headquarters in Petaling Jaya. With the system in operation by the beginning of 1995, radar data collection, integration and distribution will be automated. This will enable forecasters at the various forecast offices to receive frequent radar updates. The system is an enhanced version of the RAPIC system that is currently in operation in Australia. It will have three-dimensional capability to enable storms to be visualised in a realistic manner. Two more radars will be integrated into the network in the near future.

With the view of taking full advantage of the development in information technology so as to improve its weather forecasting services, MMS has embarked on a tele-computerization networking project since 1992 to upgrade its meteorological data telecommunication infrastructure. The project consists of upgrading its point-to-point teleprinter type national meteorological telecommunication network into a computer-to-computer data line type of network and automation of the forecasting services. This consists of equipping its 34 main meteorological observation stations (metar, synop, pilot and upper air) with PCs, the 6 regional forecast offices with PC-based LAN, the physical integration of its national meteorological data

telecommunication center with the international meteorological data communication center into a single center and equipping this center with a LAN with the Concurrent 7150 workstation serving as its central server. The system is based on the UNIX platform and it uses the Rapid Information Management software of Lockheed, U.S.A. as its communication, data management and processing software. Plotting of

In THE PHILIPPINES, the Japan assisted Meteorological Telecommunication System Development Project (MTSDP) which aims to upgrade the existing telecommunication facilities of PAGASA is in the final phase of equipment installation and is expected to be completed by the end. A one-year Operation and Maintenance Guidance Contract commenced on August 1994, while the Maintenance Agreement was being negotiated.

The "Enhancement of Meteorological Delivery System to the Countryside", a French assisted PAGASA project which involves the acquisition of modern meteorological observation and communication equipment, is about 75% completed with the installation and development of the required equipment. At present, twenty-six field Synoptic stations and three Agromet stations have received and are using the new basic meteorological instruments with 21 back-up generators. Two Integrated Meteorological Observation Systems (IRMOS) have been installed and are operational at the Ninoy Aquino International Airport (NAIA) and at the Subic International Airport. Moreover, four GMS-WEFAX satellite receiving stations and 23 Single Side Band radios have already been put up.

Regarding radars, PAGASA has acquired 2 new radars under the MTSDP which were installed and are presently being tested in Virac, Catanduanes and Guian, Samar. Four other radars are operational in Daet, Tanay, Baler and Mactan. All six upper-air stations in the country are operational, except that of Davao where the hydrogen generator is defective.

The year that passed (1993) was an excitingly busy year for meteorologist in the Philippines due to the record breaking occurrence of thirty two (32) tropical cyclones which affected the country.

In THE REPUBLIC OF KOREA, the Korea Meteorological Administration (KMA) has added 72 more Automatic Weather Station (AWS) this year. Now the total number of AWS become 400 and their average space is about 20Km. This year's installation has emphasized a dense network over the metropolitan area of Seoul and a timely meteorological service for industry/tourism. With this year's installation, the six-year project of establishing nationwide AWS network since 1989 has been completed.

The DAPU collects observations and transmits the data to meteorological telecommunication network for nationwide observation. The normal operation for data acquisition is one hour interval, however, data for single station or some region can be collected at any instant by manual operation.

A telecommunication link between Seoul and Beijing has officially been opened on July 11, 1994. The communication speed is 9600bps and half of it is designated for A/N data transmission and the other is for FAX data. The data is transmitted via communication satellite, the Intelsat-6. With the opening of new GTS line, the KMA now has two GTS link between Seoul and Tokyo and between Seoul and Beijing. Both of them are 9600bps.

The KMA signed with Fujitsu Ltd. in Japan to install its supercomputer, VPX-220/10, in KMA on October 14, 1994 as replacement of current mainframe, Cyber-932. At this moment, KMA is using a supercomputer, Cray C90/16512, which is in the System Engineering Research Institute (SERI) for numerical weather prediction. The Cyber-932 at the KMA has been used for front-end of Cray. The Fujitsu supercomputer will entirely be used for numerical weather prediction and researches in KMA.

The peak performance of the new system is 1.25 Gflops, the memory is 1024 Mbytes, and hard disk is 42 Gbytes. It will have been installed by February, 1995, and will start routine operation on March 23, at the world Meteorological Day.

KMA starts routine operation of Korea Typhoon Model (KTM) in June of 1994. The KTM is an adapted version of operational typhoon model at the JMA, the TYM. The source code has been modified to fit KMA's computing environments and the pre and post processes are developed in KMA in 1992. It has been tested in 1993 typhoon season in KMA, and become operational in this year. This year's performance for 8 approaching typhoons near Korean Peninsula is as follow:

Forecast Time	Number of Case	Mean Error (Km)	Standard Deviation (Km)
+ 12 Hour	64	91	66
+ 24 Hour	59	169	91
+ 36 Hour	52	261	141
+ 48 Hour	44	360	180
+ 60 Hour	37	469	254

A boundary layer model for sea surface winds estimation was developed at the KMA, utilizing the lowest layer wind prediction of the operational regional NWP model (Fareast Limited Area Model: F-LAM). The winds predicted at the height of $\sigma=0.995$ of F-LAM has been converted to 10m winds by the Rossby similarity theory. It has become operation since February 1994 twice a day with 3 hour interval up to 48 hour prediction. The verification shows that the RMSE of 24, 36, 48 hour prediction are 2.9m/s, 3.3m/s, 3.5m/s, respectively.

An objective guidance for probability of precipitation (PoP) has been developed by utilizing the model outputs of F-LAM by Perfect Prog Method (PPM). The PPM equations were developed by

multiple linear regression analysis for the 18 regions and for warm and cold seasons. The predictors are selected among 135 possible variables of F-LAM outputs such as depth of wet layer, winds, vorticity, advection of specific humidity, etc. The forward/backward screening technique has been applied to select 5 to 10 most contributing predictors at each region, each season. Independent verification shows that skill score is almost equivalent to the forecaster's skill.

IN THAILAND, these following weather radars have been already installed and operated:

- Ubon Ratchathani (North-eastern) Doppler C-Band (May 1993),
- Sakon Nakhon (North-eastern) Doppler C-Band (July 1993),
- Chiang Rai (Northern) Doppler C-Band (November 1994),
- Khon Kaen (North-eastern) Doppler S-Band (August 1993),
- Surat Thai (Southern) Doppler S-Band (June 1993).

Next year, 1995, S-and X-Band Doppler weather radars will be installed at Hua Hin and the Meteorological Department respectively.

By the year 1995, four X-Band Doppler weather radars for Narathiwat, Trang, Ranong, Mae Hong Son and also a mobile X-Band Doppler weather radar at the Head Office would be purchased.

By the year 1997, data from 14 weather radar stations are planned to be linked via the telecommunications satellite "THAICOM" to the centre of radar network located at the Head Office, and vice versa.

Four new very high resolution NOAA-AVHRR and GMS-SVISSR satellite receiving systems (GSC-METPRO) were purchased and hereunder is their current status.

- One was established at Chiang Mai - Regional Meteorological Centre (RMC) in April 1993 and later other two sets at Songkhla and Phuket-RMCs were installed in July 1993.

- By June 1994 at Ubon Ratchathani-RMC, the latest one was established and operating satisfactorily.

The National Data Centre (NDC) was established since August 1993 at the main office to retrieve all data from NOAA and GMS satellites which are routinely received at the four RMCs as mentioned earlier. A linkage work station is also available at Aeronautical Meteorology Division, Bangkok International Airport. This system has been completely connected to the four RMCs in June 1994 to exchange the satellite products and GTS data.

The existing satellite receiving system (GSC-METPAK) at the head office is being planned to be upgraded in its hardware, software as well as the capability on retrieving data and products of the NDC by the year 1996.

Three sets of AWOS for Ubon Ratchathani, Ubon Thani and Lampang were purchased to be installed by the end of 1994.

Two sets of AWOSs for Sakon Nakhon and Nan are planned to be installed by the year 1995.

WSAS at Chiang Mai International Airport is now in operation.

A set of WSAS is being purchased for Hat Yai International Airport and will be completely installed by mid December 1994.

Two sets of Ozone Spectrophotometer will be set up at the Head Quarters and Songkhla by 1996.

Two sets of Automatic Radiotheolite System are scheduled to be purchased by 1997.

A project on newly installing message switching system is expected to be implemented by April 1995. The accomplishment of this project will enable us to upgrade speed of the various circuits such as Bangkok-Tokyo, Bangkok-Hanoi, Bangkok-Jeddah, Bangkok-Rangoon, etc., as well as to establish the new Bangkok-Beijing GTS medium speed circuit.

Two GTS point circuit of low speed telegraph linked between RTH Bangkok-NMC Vientiane and RTH Bangkok-NMC Phnom Penh will be newly established. The implementation is under the consideration of both Lao PDR and Cambodia.

A project on newly installing National Meteorological Telecommunication Network via domestic communication satellite "THAICOM" is expected to be implemented by December 1994. The accomplishment of this project will enable Thailand Meteorological Department (TMD) to gain more efficiency in collecting data from meteorological stations.

A set of 10 KW-HF transmitter of radio broadcasts has already been installed at Regional Telecommunication Hub-Bangkok and come into operation since September 1994.

In VIET NAM the Expansion of the local area network of microcomputers was established at the National Hydrometeorological Forecasting Center to meet more operational requirements of data collection, processing and forecasting services.

The old wind observational instruments installed at the island and coastal stations which were frequently affected by tropical cyclones have been replaced by the new ones.

One upper-air sounding system "DIGICORA" manufactured by Finland Company was purchased and installed at station No. 48900 (HO CHI MINH City Station) replacing the obsolete system being used since early seventies. Another system is planned to be installed at station 48820 (Hanoi City station).

Successful installation and operation of the automatic message switching and data processing systems at the south-regional hydrometeorological center.

Besides the synoptic method used as the main method, two statistical models and one dynamical model continued to be used in computing operational 24-48 hr forecasts of tropical cyclone tracks.

Discussion and preparation for upgrading the meteorological telecommunication links between Hanoi and Beijing and between Hanoi and Bangkok.

APPENDIX V

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

In CAMBODIA, in 1987 the Australian Freedom From Hunger Campaign (AFFHC) began a programme of material and technical support for the rehabilitation of the hydrology stations. By August 1991, with AFFHC assistance, 6 staff gauges along the mainstream of Mekong River had been installed/rehabilitated. Initial discharge measurements were conducted at Stung Treng station which also served as "on-the-job" training for the observers and technicians. The second phase of this programme (1991-1994) was implemented by the Mekong Secretariat to increase the number of river gauging stations to 19. The third and final phase of the programme (up to 1997) will bring the number of stations to 30. At present only manual staff gauges at the river gauging stations are operational and among the 132 rainfall stations which had been installed in the 1980s with Russian assistance only 17 are still taking readings. With JICA assistance 5 river gauge recorders have been installed within the project area of JICA'S Master plan in the suburbs of Phnom Penh. Canadian-Cambodia Development Programme has installed 7 river staff gauges and 6 rainfall stations in Pursat Province.

The Hydrological Section of the Department of Agricultural Hydraulics and Hydro-Meteorology is responsible for taking readings of various different types of gauges at specific points and for making a daily forecast of river water levels for the ensuing 24 hours for broadcast on Cambodian TV and radio.

In CHINA, a national working meeting for hydrological information was held in Qinzhou City of Guangxi Province in March 1994 with 98 participants from the hydrological bureaus of various river basins, hydrology and water resources bureaus of various provinces (municipalities, or autonomous regions) and the National Plan Commission. In the meeting, the participants exchanged the experience in hydrological information and forecasting in the past two years, discussed how to implement the flood control information plan, how to speed up the modernization of hydrological information and forecasting and how to make good service in hydrological information and forecasting, and made a plan for the hydrological information and forecasting in 1994.

In order to probe formation law of flash floods in arid and semiarid regions, the International Symposium on Flash Floods in Arid and Semiarid Regions was held in Xian City, Shanxi Province in September 1994. Flash floods in arid and semiarid regions are characterized by short duration, high strength, small scale and being difficult to forecast and control, which usually result in the loss of lives and damage to property. Therefore, various countries are paying more attention to this kind of floods. In the Symposium, discussions centered on various conditions of flash flood formation and development, including effects

of climate and topography, influence of human beings on environment, temporal and spatial distribution of rainfall, measures of disaster prevention and mitigation; etc..

In HONG KONG, a study on extreme rainfall and design rainstorm profiles was completed and the report was being printed.

A flood forecasting system was under pilot testing in the Indus Basin at the New Territories of Hong Kong by the Drainage Service Department. This Real Time Flow Forecasting System is developed by the Institute of Hydrology in U.S.A. It comprises a hydrological model called Probability Distribution Model which transforms rainfall into runoff and a hydrodynamic model. This system is a modified version of the U.S. National Weather Service DWOPEX/NETWORK.

In JAPAN, the worst droughts on record occurred in 1994 although many areas experienced flooding. The resulting shortage of municipal water affected 15.72 million persons (intermittent supply: 8.16 million, pressure reduction: 7.57 million). The supply of agricultural water was curtailed by 10 to 80% throughout Japan. The combined damage due to the drought and the heat wave on agricultural produce, including vegetables, fruits and rice, is estimated at ¥\$143.70 billion.

Ministry of Construction (MOC) is implementing many international technical cooperation activities, such as joint technical research, dispatch of experts, and technical training. Six conferences/seminars were held under international agreements and with international organizations. Twenty-one experts were dispatched to nine countries/organizations related to Typhoon Committee Members at the present. Twenty-five short term experts concerning rivers were dispatched from 1993 to 1994 to TC Members. One-hundred and twenty nine trainees from overseas were accepted in 1993-1994 including TC Members. Nine development studies were implemented in 1993-1994 in the TC Members.

MOC has installed a warning system for the debris flow and for forecasting pyroclastic flows in Mt. Fugen comprising mirrors, cameras, radar raingauges, telemeter raingauges and seismometers which are being installed to provide a system for issuing warning and when necessary evacuation orders.

With a view to minimizing flood damage by helping people deepen their understanding of the threat of floods and raise the level of their preparedness MOC started to compile Flood Hazard Maps in 1994.

The Flood Hazard Maps are being prepared in three types:

- 1) Evacuation-use type Flood Hazard Map.
- 2) Reference type Flood Hazard Map.
- 3) Educational-use type Flood Hazard Map.

Flood Forecasting and Warning System is improved to include accurate rainfall information by radar rain gauge.

In MACAU, basically the rainfall observation network is completed. It consists of real time data transmitted from the automatic weather stations and the digital rainfall collectors which are collected and processed weekly. The statistical characteristics of the precipitation will be carried out based on this rainfall observation network.

The next plan in the hydrological component is to develop the skills to assimilate the images from the radar in order to improve the forecasting capability for precipitation.

In MALAYSIA presently, 25 river basins have been equipped with telemetric systems for flood monitoring and/or forecasting purposes. 161 VHF radio stations have also been installed to provide additional meteorological and flood information. Plan is underway to establish telemetric systems to about 10 small river basins and dam areas. In addition, major upgrading works to the existing telemetric systems which involved the installation of telephonic telemetry equipment at telemetric outstations are being implemented. With this upgrading, the loss of data especially during the monsoon season is expected to be minimal.

The Tank Model and the Linear Transfer Function Model continued to be used by the Department of Irrigation and Drainage for the real-time forecasting of the Kelantan and Pahang rivers respectively during the 1993/1994 monsoon season with satisfactory results. Development of a flood forecasting model for the Segamat River using Neural Computing technique is nearing completion.

A moderately serious flood was experienced over the east-coast states of Peninsular Malaysia as a result of severe northeast monsoon rain that occurred on 17-25 December 1993. The worst affected state was Kelantan where the water level of the Kelantan River at Guillemard Bridge rose to 20.55 metres from its danger level of 17.70 metres. The capital of Kelantan, Kota Bharu was flooded up to 1.5 metres. This flood event was estimated to have a return period of 18 years and was the worst since the 1988 flood.

In the Flood Information and Retrieval System Paradox data base software continued to be used to store flood information in a microcomputer. This software is useful for updating and retrieving flood information for future use.

In the PHILIPPINES in line with the flood operations of PAGASA, the Flood Forecasting Branch issued 159 flood advisories composed of 121 flood bulletins for the Pampanga, Agno, Bicol and Cagayan river basins; 23 flood bulletins/warnings for the various target areas of Pantabangan, Angat, Binga and Magat dams; and 15 special hydrometeorological information for Metro Manila covering the period from July 1993 to October 1994.

In anticipation of the completion of the Flood Forecasting and Warning System for Dam Operations an intensive Public Information Drive was conducted in the downstream areas of the Pantabangan, Angat, Binga and Magat dams, during the months of April and May 1994. The participants included among others, the local officials, media and the public who were provided information on how flood and dam discharge operations are being carried out, including detailed warning procedures, relief and rehabilitation operations.

Several flooding episodes occurred in the Philippines during the period under review, resulting in the conduct of 10 post flood investigations. Four investigations were conducted in the river basins of Pampanga, Agno, Bicol and Cagayan, while 6 were conducted in La Union (Luzon), Northern Leyte and Central Cebu (Visayas) and General Santos City, Misamis Oriental and Davao (Mindanao). In connection with the Flood Forecasting and Warning System for Dam Operations (FFWSDO) inter-agency activity, the relocation of the Bunga rainfall station was completed in June 1994.

On human resources development, 17 personnel attended local and foreign assisted training courses, programmes, seminars and fellowships in hydrology, remote sensing and natural disaster mitigation.

International linkages were maintained with the provision of the Philippines' HOMS Component JO4.1.06 entitled Micro Computer-Based Flood Forecasting System to Malaysia (Drainage and Irrigation Department) making possible the correspondence and exchange of documents with other member-countries as requested. The Philippines' rapporteur of the Working Group on Hydrology, RA V submitted the final report on "Flash flood and their forecasting to WMO."

In February 1994, PAGASA finalized the memorandum of agreement with the International Center for Disaster Mitigation Engineering in Tokyo in connection with the establishment of a Real-time Flood Forecasting Model for the Agno River Basin.

An On-going research is being conducted on the EC-ASEAN project on Flood Hazard Mapping/Monitoring of the Bicol River Basin. In this connection regular field trips aimed at collecting ground truth data were conducted during the past months.

In the REPUBLIC OF KOREA the Ministry of Construction is in charge of flood forecasting and dam operation for mitigation of flood damages. In the country, five major river basins are equipped with modern flood forecasting systems. There are 316 rainfall and 302 river stage gauge stations operated by the Ministry. Among them, 361 gauging stations (217 rainfall gauge, and 144 river stage) are equipped by telemetry system. The data collected by telemetry system is used for real time flood forecasting and warning.

The 1994 rainfall in the Republic of Korea has been far below the annual average. Consequently the country has been disturbed by a drought and shortage of water which has been the worst in decades, especially in the south-eastern part of Korea where the rainfall was about 63% of the annual average. In that area the water supply hours for municipal and industrial uses have now been shortened and water supply amounts have been limited. Thankfully, several typhoons have affected the Republic of Korea this year and helped to reduce the damage to crops and industrial production from drought by providing the much needed rainfall.

There has not been serious floods during this year which would warrant to issue "the flood warning and dam operation for flood" except for small basins where limited areal concentrated rainfall have been experienced.

The installation of flood forecasting systems in small basins still have some problems to be solved. Presently the lead time is too short and more precision in forecasting is needed. Therefore the Ministry of Construction have plans to install modern flood forecasting systems in two experimental basins. One of them is already under installation.

Some of the river stage stations will be moved to new and more proper locations caused by variation of the river bed sections.

For the rainfall gauging stations, the effect of wind needed to be considered. In order to minimize the distortion of rainfall by wind, several wind shield stations have been installed. After examination of results, the number of such stations will be extended nation-wide.

Research work is continuing for improvement of flood forecasting in connection with the tidal variation at the Younsan river. A similar study is being undertaken in down stream part of Han River for channel routing using a hydraulic model.

In THAILAND the flood forecasting and warning system in the designated Pasak river basin has been monitored on a routine basis.

Two Thai delegates participated in the Asian Disaster Preparedness Centre's Disaster Management Course 17 (DMC-17) held at AIT, Bangkok, Thailand from 6 June to 15 July 1994. Eight Thai delegates participated in a training course on Flood Modelling Programme in Thailand held at AIT, Bangkok, from 1 February to 30 April 1994 and from 1 August to 31 October 1994.

In the next 3-year Development Plan (1994-1996), 5 hydrometeorological stations will be established at the following locations:

- 1) Chawang District, Nakhon Si Thammarat Province

- 2) Phrasaeng District, Surat Thai Province
- 3) Sadao District, Songkhla Province
- 4) Sa Kaeo District, Sa Kaeo Province
- 5) Kamalasai District, Kalasin Province

Thailand has designated Prachinburi river basin as the flood forecasting system to be monitored using MOFFS. The monitored results of the years 1991-1993 have already been reported to WMO.

Thailand, as rapporteur of the Working Group on Hydrology, RA II, has already submitted the final report on "Hydrological Needs in RA II Region" to WMO.

In VIETNAM development of the software system applicable to the local area network of microcomputers for hydrological data collection, processing and timely transmitting hydrological information and forecasts to end-users has been undertaken. Implementation of the project on improvement of rainfall and flood and inundation forecasts for the rivers at the central Vietnam has continued. Statistical hydrological data for design and construction of new hydropower stations, and daily information and forecasts for operation of available hydroelectric plants have been provided, and a new coding regulation for hydrological data and message transmission with use of microcomputers has been prepared.

The "Tank Model", the multivariable regression and unsteady flow equation models proved to be very useful in estimating operational flood forecasts over the rivers in north Vietnam during 1994 flood season.

APPENDIX VI

REPORT OF THE PRE-SESSION MEETING OF HYDROLOGISTS

A. INTRODUCTION

The pre-session meeting on the hydrological component of the Typhoon Committee's Programme was convened by TCS in cooperation with ESCAP and WMO in Macau on 5 December 1994. This was attended by the representatives of the TC Members from China, Japan, Republic of Korea and Malaysia. Mr. Toshio Okazumi (TCS Hydrologist) was elected Chairman while Mr. Chong Sun-Fatt (Malaysia) acted as the Rapporteur of this meeting.

B. EXCHANGE OF EXPERIENCES AMONG TC MEMBERS

The hydrologists discussed and exchanged valuable experiences on topics related to national research activities, development programme of flood forecasting and warning systems as well as the operational aspects of the systems.

C. RECOMMENDATIONS FOR REGIONAL COOPERATION OF TC MEMBERS

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 Secretariat to seek their requirements from the Typhoon Committee Members in relation to programme on flood loss prevention and management, and based on which to formulate a medium-term hydrological programme for implementation.
2. Typhoon Committee to take necessary actions to solicit the assistance from alternate TC Members in dispatching a hydrologist presently dispatched by the Government of Japan.
3. Promote the exchange of experience and transfer of technology through Technical Cooperation among Developing Countries (TCDC) or other means.
4. Typhoon Committee to consider providing financial support from the Typhoon Committee Trust Fund for activities under the Hydrological Component, such as exchange visits, attachment of experts to advanced centres, consultation missions and others.

APPENDIX VII

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

In CAMBODIA, the drought and widespread flooding in 1994 had a disastrous effect on the whole national socio-economic reconstruction effort. It has been reported that nearly 250,000 hectares of rice and 30,000 hectares of other crops were damaged due to floods and about 12,000 hectares of rice due to droughts. The staff of the hydrometeorological services have been exerting all the efforts to provide essential and valuable services despite major constraints, such as: worn out equipment, run down buildings, inadequate technical skills, lack of transport to visit the field stations, and lack of information over the last 25 years about major scientific advances in the fields of meteorology and hydrology.

Cambodia has not yet set up a committee for disaster prevention and preparedness. However due to the severe flooding in August this year a committee was lead by the co-minister of the Council of Ministers. The Department of Agricultural Hydrology and Hydro-Meteorology is an active member of the committee, providing both the hydrological and meteorological data.

Cambodia needs international aid for improvement of its meteorological and hydrological services. In September 1994 ESCAP sent a consultancy mission to Cambodia and organized a seminar on natural disaster prevention and preparedness in Phnom Penh.

CHINA has undertaken the following activities related to IDNDR: the projects on disaster reduction have been improved; the natural disaster monitoring and warning systems have been strengthened so that weather forecasts and weather information on pending hazards could be broadcasted or transmitted to users through various measures; natural disaster risk zoning and preparedness plans were made and consequently a national composite disaster reduction plan would be made based on above mentioned activities; activities on disaster relief were conducted. Annual allocated funds from the central government for urgent relief was equivalent of about one million U.S. dollars.

A national meeting on disaster reduction by large and medium enterprises was held to exchange their experiences in these activities. Countermeasures were also discussed.

An annual consultative meeting on the trend of natural disasters was held by Tianjin Disaster Prevention Association in April 1994. At the meeting, natural disasters in Tianjin in 1993 were reviewed. The meeting put forward the following counter measures: the tracing forecast of approach of a disaster should be improved, and diagnosis of floods, storm surges and other

disasters should be improved even further; research on disasters occurring along the sea shore should be conducted; the medium and short range weather monitoring and forecasting of pending hazards should be improved; disaster reduction countermeasures should be undertaken.

The International Symposium on Tropical Cyclone and Floods in South-east Asia was held in Guangzhou from 22 to 25 November 1993, which was sponsored jointly by Chinese Committee of International Hydrological Project, the Institute of Earth and Environment Sciences of Zhongshan University and 12 other institutions. More than 70 experts from the Republic of Korea, the Philippines, Indonesia, Malaysia, Singapore, Vietnam, Thailand, Cambodia, Myanmar, Bangladesh, the Regional Office for Science and Technology in South-east Asia of UNESCO, the Interim Mekong Committee, ESCAP and some other international organizations participated in the meeting. More than 70 research papers were received of which 36 were presented at the symposium on the following topics: genesis and development of tropical cyclones-diagnosis of their motion and forecast; typhoon disasters analysis and prevention measures; storm surges and their prevention and mitigation measures; analysis and forecasts of typhoons and floods; the cause of floods and their evaluation schemes; flooding risks and their forecasts; the establishment and operation of real-time flooding forecasting and warning; and the effects of typhoons, storm surges and flooding upon economic development.

In HONG KONG on 11 November 1994 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 Serviços Meteorológicos e Geofísicos Macau. The real-time exchange of radar information and the building of additional automatic weather stations are some of the important elements of this agreement.

The hardware for an UNIX-based Integrated Data Display System was delivered and installed. Software for a heavy rain alerting system for forecasters based on real-time radar data is being developed for this system.

A PC-based Rainfall Display System was developed to provide forecasters with real-time display of the rainfall recorded in different parts of the territory, and with visual and audio alarms for the warning of the possibility of flooding and landslides.

Design for a tropical cyclone tracking and warning system was completed and the software is under development.

JAPAN established the Government Headquarters for the IDNDR in May 1989, and has been vigorously undertaking various activities for the Decade as one of its leading proponents.

The Government held series of international conferences and seminars on natural disaster reduction in Japan. For the purpose of promoting the international exchange of experience and information in the field of disaster reduction, e.g., "the IDNDR International Conference 1990 Japan", "the IDNDR Summit Conference on Earthquake and Natural Disaster Countermeasures 1991", "the IDNDR China International Conference 1992" and "the IDNDR Aichi/Nagoya International Conference on Natural Disaster Reduction 1993". Furthermore, 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.

As 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 Government of Japan covered all necessary additional cost it incurred as a host country and in addition contributed 500 thousand U.S. dollars to promote the participation of developing countries in the Conference. Upon the request of the General Assembly resolution 48/188 of 21 December 1993, the aims of the Conference were to:

- a) Review the accomplishments of the Decade at national regional and international levels;
- b) Chart a programme of action for the future;
- c) Exchange information on the implementation of Decade programmes and policies;
- d) Increase awareness of the importance of disaster reduction policies.

The Japanese Government emphasized the following points at the Conference:

- a) Japan will continue to extend various forms of assistance in the field of disaster reduction to support the self-help efforts of developing countries, as a part of its efforts to enhance official development assistance in the field of the environment;
- b) Japan is prepared to make a contribution to regional meeting in order to promote the exchange of views within each region such as Asia;
- c) Japan calls on each country to contribute to the IDNDR Trust Fund and is of the view that the United Nations should pay due consideration to strengthening the IDNDR Secretariat.

The principal outcome of the Conference is to be found in the "Yokohama Strategy for a Safer World" and its accompanying "Yokohama Message", which were adopted at the final Plenary Session of the Conference.

In 1995 and the following years, Japan intends to make further efforts to support developing countries in Asia and the Pacific to implement the action pointed out in the outcome of the World Conference.

The Government of Japan has prepared some information materials for the benefit of other disaster-prone countries, which describes Japan's past experiences of natural disasters and the countermeasures it has taken briefly described in the brochure, "Disaster Countermeasures in Japan" (1994 version).

In MACAU, typhoons or other natural hazards did not cause any loss of lives or damage to property in 1994. Two exercises were planned and executed in order to test the whole Civil Protection Organization and the procedures, the first on 6 May and the second on 6 September.

Training was given to the staff and other personnel concerning their tasks and responsibilities.

In cooperation with the Education Department two training sessions were held on 26 September and 9 November with the aim of giving basic information to the directors and teachers of several schools of Macau, particularly focused on tropical cyclones.

In MALAYSIA, for the year 1993-1994, the Department of Social Welfare located and prepared 3,402 evacuation centres throughout the country which could provide accommodation for 912,676 people. They are situated at strategic positions in flood prone areas.

During the end of 1993 and early 1994 a total number of 29,391 flood victims in the six states of Peninsular Malaysia, namely, Johore, Pahang, Perak, Kelantan, Terengganu and Sabah were evacuated to 323 evacuation centres. Relief aid in the food supplies, mats, blankets and the like were supplied to the victims and the expenditure incurred amounted to RM 591,810.

The Welfare Department maintains close liaison with the Padi and Rice Board to ensure the adequate supply of rice for disaster victims. The Department also has close liaison with the Ministry of Domestic Trade and Consumer Affairs in order to ensure the immediate supply of dry rations and other important items.

The Department has also identified 304 "forward bases" in remote areas where dry food and other essential items can be stored. In the event of any flood victim being stranded in isolated or "cut off" areas, the Royal Malaysian Air Force will be called upon to drop supplies on behalf of the Department.

The Department has a standing arrangement with the Malaysian Red Crescent Society which runs a mobile kitchen service to prepare food provided by the agency in urban areas. In addition the Department also enlists the assistance of the other organizations such as Civil Defence Corp, St. John Ambulance

Brigade, voluntary organisations to man evacuation centres and to provide essential facilities required by victims.

The Department also provides adequate food rations for the families upon their return home from the evacuation centres. A rehabilitation grant is given to those victims whose houses and businesses are destroyed by the disaster.

The preparations stated above are made long before the flood season which usually occurs between November to mid-January each year. The annual project plans are submitted by the respective State Director of Social Welfare in August to enable the Department to collect and prepare a national preparedness plan for submission to the National Security Council which meets to deliberate and coordinate all activities before the flood season begins.

Since receiving the assignment of publishing the ASEAN Disaster Management Information Network (ADMIN) newsletter in August 1993, the Malaysian Meteorological Service has produced 4 issues. This newsletter aims to keep the community in the ASEAN region aware of the latest disaster events in the region - natural or manmade, as well as any new technologies, workshops, books that would help in enhancing disaster management methodologies and skills.

In the PHILIPPINES, the capability-building programme of the National Disaster Coordinating Council (NDCC) received a big boost with the congressional amendment of the General Appropriations Act regarding Calamity Fund utilization. The amended General Appropriations Act now authorizes the utilization of the fund for proactive activities. This development will pave the way for the acquisition of appropriate equipment and materials for disaster preparedness and response activities; upgrade the operating facilities at both the national and regional levels, and train personnel on the different stages of disaster management.

At the end of the year 1993, Calamity Fund releases amounted to nearly 1.6 billion pesos (1 US\$ = 25 pesos) where about 21.5 million pesos went to proactive activities such as the organization and training for disaster preparedness and response and public information drives. A total of 1,987 local Disaster Coordinating Councils (DCCs) were organized, 17,374 people were trained in disaster preparedness and management, and 148 public information campaigns were conducted. The Office of Civil Defense, the operating arm and Secretariat of the NDCC, coordinated all efforts in these areas.

By September 1994 an additional 616 DCCs and 87 Disaster Control Groups (DCGs) were organized, 407 of which were at the barangay (village) level. Meanwhile 35 trainers and 6,345 DCC and DCG members and volunteer-workers underwent training on disaster preparedness and management. About 188 public information campaigns were conducted serving 11,257 participants. During

these seminars, a total of 8,006 posters and related civil defense information materials were distributed.

In line with the directive of the President of the Philippines to incorporate disaster mitigation with economic development, the NDCC members worked with National Economic Development Authority, such that disaster mitigation projects are properly identified and funded under the Medium Term Public Investment Program. As a result, several agencies programmed mitigation projects which are now part of the Executive Department's budget for the Fiscal Year 1994.

For their part, the Department of Social Welfare and Development, the Department of Public Works and Highways and the Department of Science and Technology through their agencies continued their various activities related to disaster prevention and preparedness.

The National Irrigation Authority (NIA) is completing the construction of small dams, embankments, spillways and outlet structures. The construction of 9 additional small water impounding dams with the main objective of mitigating flood damage while at the same time promoting the efficient development and utilization of land and water resources and accelerating economic development in less developed regions are being undertaken.

In the **REPUBLIC OF KOREA**, the central and local governments support various disaster prevention programmes: weather and flood forecasting, construction and improvement of river embankments and implementation of many educational programmes for residents. In spite of such efforts, the loss of human lives and property damage has increased significantly in recent years. According to the statistics of the last ten years: 275 people died, about U.S.\$508 million of property damage occurred and U.S. \$525 million was spent for disaster relief and restoration work every year.

Until June 1993, whenever heavy rains or typhoons occurred, heavy damage and loss of life was looked upon as a natural result.

The prevailing attitude was one of laissez-faire rather than prevention. On June 2, 1993, a wind storm, which was very similar to a severe tropical storm, hit Korea. As a result, 32 people died and U.S. \$290,000 worth of property damage occurred due to the lack of disaster prevention and preparedness.

Since June 1993 the Korean Government has executed a new disaster prevention policy called **PREARRANGED SHELTERING PLAN** for the optimum disaster prevention and preparedness. From the latter half of 1993 to the present there has been a remarkable decrease in loss of human lives and property damage.

The basic objective of this disaster prevention policy has been to apply the following slogan " though there is a disaster, there is no loss of human lives" to all kinds of disasters.

In order to prepare for future disasters such as storms, typhoons, heavy rain, etc., and to implement measures in advance, the cause of past loss of human lives had to be analyzed.

Prearranged sheltering plan is executed in advance according to information compiled from special weather reports. The inconvenience to residents is minimized by speedy and correct weather news systems which inform the residents of the current situation.

If loss of human lives occurs in public facilities as a result of negligence, the authorized person is to be held responsible. The public is made aware of the importance of disaster preparedness. A comprehensive public awareness plan was prepared and carried out for the rainy season including various mass media coverage such as: 1,658 times and 417 kinds through the mass media; 55,742 times in special media and government information.

The new disaster prevention programme is based on respect for human life, and has broken away from the previous attitude. As a result of this program the damages resulting from typhoon Robyn (9307) in August 1993 were minimized. The success was a result of an early meteorological forecasting system, optimum disaster prevention services, and voluntary response of the people.

There is a need to establish and operate measures for disasters such as typhoon, heavy rain, storm, tidal wave, earthquake, etc. and to strengthen training and education to establish the Prearranged Sheltering Plan completely.

In **THAILAND**, widespread drought was experienced in the early part of 1994, affecting 65 provinces and 655 districts. In order to relieve the situation, over 1.5 billion litres of water was provided to the victims in all 4 regions, 1,579 water-carrying vehicles and 819 water pumps were sent to help the victims and considerable amount of cash was also provided by the National Civil Defence Committee.

The situation quickly changed as from August to September 1994. The northern and northeast regions of Thailand were hit by the seasonal monsoon trough bringing in heavy to very heavy rains. The runoff of major rivers in the north, east and west has been high since August, with many rivers overflowing their banks and some areas being repeatedly inundated. Some dams were affected due to reservoir overflow and erosion at the outlet. However, most of the flood damages have already been rectified by the Royal Irrigation Department. The Department had been prepared for heavy rains and flood overflow. Its regional offices were instructed to investigate, maintain and repair dikes to assure their sturdiness in the wake of high water flow. It had

also discharged water from reservoirs and areas to make room for expected overflow and rainfall. Other preparations included river dredging and hyacinth weed eradication to enhance drainage and provision of water pumping during the floods. During the flooding period the Department also kept the people informed of the situation.

The Civil Defense Secretariat of Thailand undertook various disaster reduction activities including preparation of plan for 1994 for prevention and relief, testing the civil defense by holding exercises in eight provinces, providing vehicles and materials for disaster prevention and relief and conducting training courses for director and staff as well as volunteer level personnel.

In VIETNAM, the annual decree of the Prime Minister on activities related to typhoon, flood and other natural disastrous phenomena prevention and preparedness has been promulgated since May 1994 at the beginning of typhoon and flood seasons in Vietnam.

The first joint meeting of the National Committee for typhoon and flood prevention and preparedness and the National Committee for IDNDR was also held in May 1994, for discussion and adopting assessment of 1993 activities and the plan of 1994 activities. The Committees have completed the list of their participating members and distributed concrete responsibilities for each member. It was noticed by Committee that the disastrous natural phenomena occurring in Vietnam has become more and more variable and more intensive. So that it was considered very important to keep closer cooperation between concerned ministries, organizations, taking in time appropriate measures for prevention, preparedness and relief.

In 1994 there were 6 tropical cyclones which affected Vietnam. During the rainy season (from May to November) throughout the country rainfall was much more than the average. Flash floods occurred in north-western part of north Vietnam and in southern part of Central Vietnam. The phenomena caused serious damages.

The most serious damage was resulted from the flood and inundation over the vast areas of Mekong River delta: 286 persons dead; 543,527 houses, 1,346 schools and 285 medical stations destroyed; 34,768 ha of rice field submerged, etc. The material damage was estimated about 1,300 billion Vietnamese Dong or about 118 million USD. The Government of Vietnam carried-out special missions for emergent relief and rescue. In response to the request of Vietnamese Government a number of countries and international organizations have given valuable assistance to people in the flooded areas.

The celebration of International day on natural disaster reduction with the theme "Vulnerable Communities at risk" was held by the National Committee for IDNDR on 12 Oct. 1994.

YOKOHAMA STRATEGY FOR A SAFER WORLD: Guidelines for Natural Disaster Reduction, Preparedness and Mitigation, containing the appeal, the principles, the strategy and the plan of action - as adopted by the World Conference on Natural Disaster Reduction on 27 May 1994

The World Conference on Natural Disaster Reduction,

Having met at Yokohama from 23 to 27 May 1994,

Recognizing the rapidly rising world-wide toll on human and economic losses due to natural disasters,

Recalling the decision of the General Assembly in its resolution 44/236 of 22 December 1989 to launch a far-reaching global undertaking for the 1990s to save human lives and reduce the impact of natural disasters,

Recalling also the forward-looking decision of the General Assembly in its resolution 46/182 of 19 December 1991 to adopt an integrated approach for disaster management in all its aspects and to initiate a process towards a global culture of prevention,

Recognizing that sustainable economic growth and sustainable development cannot be achieved in many countries without adequate measures to reduce disaster losses, and that there are close linkages between disaster losses and environmental degradation, as emphasized in Agenda 21, 1/

Reaffirming the Rio Declaration, 2/ in particular Principle 18, which stresses the need for the international community to assist States afflicted by natural disasters and other emergencies that are likely to produce sudden harmful effects in the environment of those States,

Reaffirming also the role assigned by the Secretary-General of the United Nations to the Emergency Relief Co-ordinator, Under-Secretary for Humanitarian Affairs, through the IDNDR secretariat, in promoting and directing activities of the IDNDR in conformity with General Assembly resolution 46/182,

Emphasizing the need for the United Nations system to pay special attention to the least developed and land-locked countries and small island developing States, and recalling in this regard that the outcomes of the first Global Conference on the Sustainable Development of Small Island Developing States and the Programme of Action for the Least Developed Countries for the 1990s call for giving priority attention to small island developing States and least developed countries in the activities of the Decade,

1/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8), resolution 1, annex II.

2/ Ibid., annex I.

Responding to the request of the General Assembly in its resolution 48/188 of 23 December 1993 to:

- (a) Review the accomplishments of the Decade at national, regional and international levels;
- (b) Chart a programme of action for the future;
- (c) Exchange information on the implementation of Decade programmes and policies;
- (d) Increase awareness of the importance of disaster reduction policies;

1. Appeals to the world, at the time of reaching the mid-point of the International Decade for Natural Disaster Reduction and in the light of increasing human losses and damage caused by disasters and acting in a new spirit of partnership to build a safer world, based on common interest, sovereign equality and shared responsibility to save human lives, protect human and natural resources, the ecosystem and cultural heritage, to reaffirm its commitment to pursuing, through national, regional and international efforts, the transformation of the International Framework of Action for the Decade into a decisive intersectoral Plan of Action;

2. Invites all countries to defend individuals from physical injuries and traumas, protect property and contribute to ensuring progress and stability, generally recognizing that each country bears the primary responsibility for protecting its own people, infrastructure and other national assets from the impact of natural disasters, and accepting at the same time that, in the context of increasing global interdependence, concerted international cooperation and an enabling international environment are vital for the success of these national efforts;

3. Adopts the following Principles, Strategy and Plan of Action.

I. PRINCIPLES

1. Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures.
2. Disaster prevention and preparedness are of primary importance in reducing the need for disaster relief.
3. Disaster prevention and preparedness should be considered integral aspects of development policy and planning at national, regional, bilateral, multilateral and international levels.
4. The development and strengthening of capacities to prevent, reduce and mitigate disasters is a top priority area to be addressed during the Decade so as to provide a strong basis for follow-up activities to the Decade.
5. Early warnings of impending disasters and their effective dissemination using telecommunications, including broadcast services, are key factors to successful disaster prevention and preparedness.
6. Preventive measures are most effective when they involve participation at all levels, from the local community through the national government to the regional and international level.
7. Vulnerability can be reduced by the application of proper design and patterns of development focused on target groups, by appropriate education and training of the whole community.

8. The international community accepts the need to share the necessary technology to prevent, reduce and mitigate disaster; this should be made freely available and in a timely manner as an integral part of technical cooperation.

9. Environmental protection as a component of sustainable development consistent with poverty alleviation is imperative in the prevention and mitigation of natural disasters.

10. Each country bears the primary responsibility for protecting its people, infrastructure, and other national assets from the impact of natural disasters. The international community should demonstrate strong political determination required to mobilize adequate and make efficient use of existing resources, including financial, scientific and technological means, in the field of natural disaster reduction, bearing in mind the needs of the developing countries, particularly the least developed countries.

A. Basis for the Strategy

1. Natural disasters continue to strike and increase in magnitude, complexity, frequency and economic impact. Whilst the natural phenomena causing disasters are in most cases beyond human control, vulnerability is generally a result of human activity. Therefore, society must recognize and strengthen traditional methods and explore new ways to live with such risk, and take urgent actions to prevent as well as to reduce the effects of such disasters. The capacities to do so are available.
2. In this context the least developed countries, small island developing States and land-locked countries are the most vulnerable countries, as they are the least equipped to mitigate disasters. Developing countries affected by desertification, drought and other types of natural disasters are also equally vulnerable and insufficiently equipped to mitigate natural disasters.
3. In all countries the poor and socially disadvantaged groups suffer most from natural disasters and are least equipped to cope with them. In fact disasters contribute to social, economic, cultural and political disruption in urban and rural contexts, each in its specific way. Large-scale urban concentrations are particularly fragile because of their complexity and the accumulation of population and infrastructures in limited areas.
4. Some patterns of consumption, production and development have the potential for increasing the vulnerability to natural disasters, particularly of the poor and socially disadvantaged groups. However, sustainable development can contribute to reduction of this vulnerability, if planned and managed in a way to ameliorate the social and economic conditions of the affected groups and communities.
5. Vulnerable developing countries should be enabled to revive, apply and share traditional methods to reduce the impact of natural disasters, supplemented and reinforced by access to modern scientific and technical knowledge. The existing knowledge and know-how should be studied and efforts should be made to ameliorate, develop and better apply them today.
6. Global social stability has become more fragile and reduction of natural disasters would contribute to reducing this fragility. In the effort towards effective disaster management, the full continuum from relief through rehabilitation, reconstruction and development to prevention must be the concept guiding actions towards the reduction of human and physical losses which remains the ultimate objective.
7. Notwithstanding the full continuum, disaster prevention is better than disaster response and achieving the goals, objectives and targets of the Decade as adopted by the relevant resolutions of the General Assembly would result in greatly reducing disaster losses. This requires maximum

participation at community level which can mobilize considerable potential and traditional expertise in the application of the preventive measures.

B. Assessment of the status of disaster reduction midway into the Decade

8. Approaching the mid-point of the International Decade for Natural Disaster Reduction, the World Conference has identified, on the basis of national reports and technical discussions, the following main accomplishments and failures:

(a) Awareness of the potential benefits of disaster reduction is still limited to specialized circles and has not yet been successfully communicated to all sectors of society, in particular policy makers and the general public. This is due to a lack of attention for the issue, insufficient commitment and resources for promotional activities at all levels;

(b) At the same time, however, activities during the first years of the Decade in training, technical applications and research at local, national and international levels and in regional cooperation, have had positive results in some regions in reducing disaster losses;

(c) Equally, the creation of the organizational framework called for by the General Assembly, which includes National Decade Committees and Focal Points and, at the international level, the Special High-Level Council, the Scientific and Technical Committee and the Decade secretariat, has laid the basis for intensified preventive and preparedness efforts in the second half of the Decade;

(d) These new efforts in the field of disaster reduction have not systematically been part of multilateral and bilateral development policies;

(e) Education and training programmes and facilities for people professionally involved and the public at large have not been sufficiently developed with a focus on ways and means to reduce disasters. Also the potential of the information media, industry, scientific community and the private sector at large has not been sufficiently mobilized;

(f) It must be noted that not all entities of the United Nations system have contributed to the Decade's implementation to the extent possible and desired by the General Assembly in adopting its resolution 44/236. In recent years emphasis has again been placed primarily on disaster response both within the United Nations and beyond. This has slowed down the momentum of the Decade's initial phase, based on the consensus of the importance of action before disasters strike;

(g) A number of positive results have been achieved during the first five years of the Decade, although unevenly and not in the concerted and systematic way as envisaged by the General Assembly. Only if these achievements are recognized, consolidated and accelerated, will the Decade be able to reach its goals and objectives and contribute to the development of a global culture of prevention. In particular the existing tools which can yield improvements in disaster response, as part of a comprehensive approach towards disaster management, are not always utilized to the full extent of their potential;

(h) There is a strong need to strengthen the resilience and self-confidence of local communities to cope with natural disasters through recognition and propagation of their traditional knowledge, practices and values as part of development activities;

(i) Experience has demonstrated that, although not a part of the mandate of the Decade, the concept of the disaster reduction should be enlarged to cover natural and other disaster situations including environmental and technological disasters (Na-Techs) and their interrelationship

which can have a significant impact on social, economic, cultural and environmental systems, in particular in developing countries.

C. Strategy for the Year 2000 and beyond

9. The World Conference, based on adoption of the Principles and the assessment of the progress accomplished during the first half of the Decade, has formulated a Strategy for Disaster Reduction centred on the objective of saving human lives and protecting property. The Strategy calls for an accelerated implementation of a Plan of Action to be developed from the following points:

(a) Development of a global culture of prevention as an essential component of an integrated approach to disaster reduction;

(b) Adoption of a policy of self-reliance in each vulnerable country and community comprising capacity-building as well as allocation and efficient use of resources;

(c) Education and training in disaster prevention, preparedness and mitigation;

(d) Development and strengthening of human resources and material capabilities and capacity of research and development institutions for disaster reduction and mitigation;

(e) Identification and networking of existing centres of excellence so as to enhance disaster prevention, reduction and mitigation activities;

(f) Improvement of awareness in vulnerable communities, through a more active and constructive role of the media in respect of disaster reduction;

(g) Involvement and active participation of the people in disaster reduction, prevention and preparedness, leading to improved risk management;

(h) In the second half of the Decade, emphasis should be given to programmes that promote community-based approaches to vulnerability reduction;

(i) Improved risk assessment, broader monitoring and communication of forecasts and warnings;

(j) Adoption of integrated policies for prevention of, preparedness for, and response to, natural disasters and other disaster situations including environmental and technological hazards;

(k) Improved coordination and cooperation among ongoing national, regional and international disaster research activities, at universities, regional and subregional organizations and other technical and scientific institutions, having in mind that links between causes and effects, inherent to all types of disaster, should be investigated through interdisciplinary research;

(l) Effective national legislation and administrative action, higher priority at the political decision-making level;

(m) Placing higher priority on the compilation and exchange of information on natural disaster reduction, especially at regional and subregional levels, through the strengthening of existing mechanisms and improved use of communication techniques;

(n) Promotion of regional and subregional cooperation between countries exposed to the same natural hazards through exchange of information, joint disaster reduction activities and

other formal or informal means including the establishment or strengthening of regional and subregional centres;

(o) Making available the existing technology for broader application to disaster reduction;

(p) Integration of the private sector in disaster reduction efforts through promotion of business opportunities;

(q) Promotion of the involvement of non-governmental organizations in natural hazard management; in particular those dealing with environmental and related issues and including indigenous non-governmental organizations;

(r) Strengthening the capacity of the United Nations system to assist in the reduction of losses from natural and related technological disasters, including coordination and evaluation of activities through the Decade and other mechanisms.

II. PLAN OF ACTION

A. Recommendations for action

10. Based on the Principles and the Strategy and taking into account information provided to the Conference in the national summary reports presented by a large number of countries and in the scientific and technical presentations, the Conference adopts a Plan of Action for the future, comprising the following specific actions to be implemented at the community and national levels, the subregional and regional levels, and the international level, through bilateral arrangements and international cooperation.

1. Activities at the community and national levels

11. During the remaining part of the Decade all countries are called upon to:

(a) Express the political commitment to reduce their vulnerability, through declaration, legislation, policy decisions and action at the highest level, which would require the progressive implementation of disaster assessment and reduction plans at the national and community levels;

(b) Encourage continued mobilization of domestic resources for disaster reduction activities;

(c) Develop a risk assessment programme and emergency plans focusing efforts on disaster preparedness, response and mitigation, and design projects for subregional, regional and international cooperation, as appropriate;

(d) Develop documented comprehensive national disaster management plans with emphasis on disaster reduction;

(e) As appropriate, establish and/or strengthen National Committees for the Decade or clearly identified bodies charged with the promotion and coordination of disaster reduction actions;

(f) Take measures to upgrade the resistance of important infrastructure and lifelines;

(g) Give due consideration to the role of local authorities in the enforcement of safety standards and rules and strengthen the institutional capacities for natural disaster management at all levels;

(h) Consider making use of NGO support for improved disaster reduction at the local level;

(i) Incorporate disaster reduction prevention or mitigation in socio-economic development planning based on the assessment of the risk;

(j) Consider the possibility of incorporating in their developmental plans the conducting of Environmental Impact Assessments with a view to disaster reduction;

(k) Clearly identify specific disaster prevention needs which could use the knowledge or expertise that may be available from other countries or from the United Nations system, for instance, through training programmes designed to enhance human resources;

(l) Endeavour to document all disasters;

(m) Incorporate cost-effective technologies in reduction programmes, including forecasting and warning systems;

(n) Establish and implement educational and information programmes aimed at generating general public awareness, with special emphasis on policy makers and major groups, in order to ensure support for, and effectiveness of, disaster reduction programmes;

(o) Enrol the media as a contributing sector in awareness raising, education and opinion building in order to increase recognition of the potential of disaster reduction to save human lives and protect property;

(p) Set targets which specify how many distinct disaster scenarios can reasonably be given systematic attention by the end of the Decade;

(q) Stimulate genuine community involvement and empowerment of women and other socially disadvantaged groups at all stages of disaster management programmes in order to facilitate capacity building, which is an essential precondition for reducing vulnerability of communities to natural disasters;

(r) Aim at the application of traditional knowledge, practices and values of local communities for disaster reduction, thereby recognizing these traditional coping mechanisms as a valuable contribution to the empowerment of local communities and the enabling of their spontaneous cooperation in all disaster reduction programmes.

2. Activities at the regional and subregional levels

12. Considering the many common aspects of disaster vulnerability among countries of a same region or subregion, cooperation among them should be strengthened by implementing the following actions:

(a) Establishing or strengthening of subregional or regional centres for disaster reduction and prevention which, in cooperation with international organizations and with a view to enhancing national capabilities, would perform one or more of the following functions:

- (i) Collecting and disseminating documentation and information to improve public awareness of natural disasters and the potential to reduce their impact;
- (ii) Formulating education and training programmes and technical information exchanges aimed at human resource development;
- (iii) Supporting and strengthening natural disaster reduction mechanisms;

(b) Given the importance of vulnerability of developing countries, particularly least developed countries, technical, material and financial resources should be made available in support of concerned subregional or regional centres to strengthen regional and national capacities to reduce natural disasters;

(c) Improving the communications on natural disasters among the countries of the region in the context of preparedness and early warning systems;

(d) Establishing and/or strengthening early warning mechanisms for disaster reduction;

(e) Commemorating the International Day for Natural Disaster Reduction;

(f) Establishing mutual assistance agreements and joint projects for disaster reduction within and between regions;

(g) Reviewing periodically in regional political forums the progress made on disaster reduction;

(h) Request and enable regional organizations to play an effective role in the implementation of relevant regional plans and programmes on natural disaster reduction;

(i) The international community should give highest priority and special support to activities and programmes relating to natural disaster reduction at subregional or regional level in order to promote cooperation between countries exposed to the same risks;

(j) As decided by the General Assembly, special attention should be given to the least developed countries in support of their activities in the field of natural disaster reduction;

(k) Regional arrangements should be carried out in close coordination with and should supplement the national programmes for disaster reduction;

(l) The international community should assist the developing countries in establishing measures to integrate disaster prevention and reduction within the existing machinery and strategies at the national, subregional and regional levels for poverty eradication in order to achieve sustainable development.

3. Activities at the international level, in particular through bilateral arrangements and multilateral cooperation

13. In the context of global interdependence and in the spirit of international cooperation, all activities to reduce disasters, in particular those laid down by the International Decade for Natural Disaster Reduction should be encouraged and supported in the following ways:

(a) It is recommended that extrabudgetary resources be provided for implementation of the Decade and, therefore, that voluntary contributions from Governments, international

organizations and other sources, including the private sector, be strongly encouraged. To this end, the Secretary-General is urged to ensure an effective and efficient administration of the Trust Fund for the Decade, established as requested in General Assembly resolution 44/236;

(b) It is recommended that donor countries should increase the priority on disaster prevention, mitigation and preparedness in their assistance programmes and budgets, either on bilateral or multilateral basis, including increasing contributions to and through the Decade Trust Fund, in order to support fully the implementation of the Yokohama Strategy and Plan of Action, particularly in developing countries;

(c) Disaster prevention and mitigation should become an integrated component of development projects financed by multilateral financial institutions, including the regional development banks;

(d) Integration of natural disaster reduction into development assistance programmes, through effective means, including as suggested in subparagraph 13 (b) above;

(e) Ensuring the cooperation in the area of research and science and technology development related to natural disaster reduction in order to enhance the capacities of the developing countries to reduce their vulnerability in this respect;

(f) The Trust Fund for the Decade should give priority in financing the establishment and strengthening of the early warning systems of the disaster prone developing countries particularly of the least developed, land-locked and small island developing States;

(g) Ensuring that from the formulation phase development projects be designed in a way to contribute to reducing, and not increasing, vulnerability to disasters;

(h) Improving the exchange of information on disaster reduction policies and technologies;

(i) Encouraging and supporting ongoing efforts aimed at developing appropriate indicators of vulnerability (indices);

(j) Reaffirmation of the roles of the Special High-Level Council and the Scientific and Technical Committee in promoting Decade activities, in particular the awareness of the benefits of disaster reduction;

(k) Enhancing the activities of, and cooperation between, organizations and programmes of the United Nations system, intergovernmental organizations, non-governmental organizations and the private sector related to disaster reduction, including more efficient use of existing resources;

(l) Supporting efforts of Governments at the national and regional levels in the implementation of the priority areas of the Programme of Action for the Least Developed Countries for the 1990s, and the Programme of Action for the Sustainable Development of Small Island Developing States, related to the management of natural and environmental disasters through measures referred to in paragraph 13 (b) above;

(m) Providing wider support for the existing mechanism for disaster management and reduction of the United Nations system, in order to expand its capacity to give advice and practical assistance, as required, to countries facing natural disasters and other disaster situations including environmental and technological hazards;

(n) Providing adequate support for Decade activities, including those of the secretariat of the Decade, in particular with a view to ensuring the timely implementation of the Yokohama Strategy and Plan of Action. In this regard it is time to consider proposals on ways and means to ensure functional security and continuity of the secretariat of the Decade, to the extent possible through the United Nations regular budget;

(o) Recognition of the need for adequate coordination of international disaster reduction activities and strengthening of the mechanisms established for this purpose. International coordination should relate, in particular, to the formulation of development projects which provide assistance for disaster reduction and their evaluation;

(p) Establishment or improvement, as a priority, of national, regional and international warning systems and more effective dissemination of warnings;

(q) Effective coordination of international disaster management, in particular by the United Nations system, is paramount for an integrated approach to disaster reduction and should, therefore, be strengthened;

(r) Holding of a review conference on natural disaster reduction at the end of the Decade in order to map a strategy for continued disaster reduction activities into the twenty-first century.

B. Proposals to the Conference

- to be included in an annex to the report of the Conference.

III. FOLLOW-UP ACTION

14. With the aim of ensuring the early and successful implementation of the Yokohama Strategy and Plan of Action, the Conference decides to:

(a) Transmit the report of the World Conference containing the Yokohama Strategy and Plan of Action for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation, through the Economic and Social Council, to the General Assembly at its forty-ninth session;

(b) Request the General Assembly to consider adopting a resolution endorsing the Yokohama Strategy and making an appeal to all countries to continue working towards the objective of a safer world for the twenty-first century;

(c) Transmit the outcome of the World Conference to the mid-term global review conference on the implementation of the Programme of Action for least developed countries, to be held in 1995, as decided by the General Assembly in its resolution 48/171, and to the Commission on Sustainable Development in the initial review of the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, undertaken by the Commission in 1994, in accordance with the Commission's Multi-Year Programme of Work;

(d) Reaffirm the crucial importance of a substantial reduction in the loss of lives and in the physical damage caused by disasters by the year 2000 and of continuing the disaster reduction process beyond the end of this century, as appropriate;

(e) Request the Secretary-General to ensure that the outcome of the Conference be given as wide as possible dissemination, including transmission of the Yokohama Strategy to relevant international and regional organizations, multilateral financial institutions and the regional development banks;

(f) Request also the secretariat of the Decade to communicate the outcome of the Conference to national committees and focal points for the Decade, relevant non-governmental organizations, scientific and technical associations and the private sector, and to facilitate the review of the implementation of the Yokohama Strategy and Plan of Action and further planning by these institutions at the regional level before the year 2000;

(g) Request the Secretary-General to submit an annual report to the General Assembly, based on information provided by Governments, regional and international organizations, including the multilateral financial institutions and the regional development banks, the United Nations system and the non-governmental organization community, on progress made in the implementation of the Yokohama Strategy;

(h) Recommend the inclusion of a sub-item entitled "Implementation of the outcome of the World Conference on Natural Disaster Reduction" in the provisional agenda of the Assembly under the item entitled "Environment and sustainable development";

(i) Request the United Nations, through the secretariat of the Decade, to provide Governments, upon request, with technical assistance in the preparation and development of disaster management plans and programmes.

YOKOHAMA MESSAGE
 - as adopted by the World Conference on Natural Disaster
 Reduction on 27 May 1994

We, the States Members of the United Nations and other States, having met at the World Conference on Natural Disaster Reduction, in the city of Yokohama, Japan, from 23 May to 27 May 1994, in partnership with non-governmental organizations, and with the participation of international organizations, the scientific community, business, industry and the media, deliberating within the framework of the International Decade for Natural Disaster Reduction, expressing our deep concern for the continuing human suffering and disruption of development caused by natural disasters, and inspired by the Yokohama Strategy and Plan of Action for a Safer World,

Affirm that:

1. The impact of natural disasters in terms of human and economic losses has risen in recent years, and society in general has become more vulnerable to natural disasters. Those usually most affected by natural and other disasters are the poor and socially disadvantaged groups in developing countries as they are least equipped to cope with them.

2. Disaster prevention, mitigation, preparedness and relief are four elements which contribute to and gain from the implementation of sustainable development policies. These elements, along with environmental protection and sustainable development, are closely interrelated. Therefore, nations should incorporate them in their development plans and ensure efficient follow-up measures at the community, national, subregional, regional and international levels.

3. Disaster prevention, mitigation and preparedness are better than disaster response in achieving the goals and objectives of the Decade. Disaster response alone is not sufficient, as it yields only temporary results at a very high cost. We have followed this limited approach for too long. This has been further demonstrated by the recent focus on response to complex emergencies which, although compelling, should not divert from pursuing a comprehensive approach. Prevention contributes to lasting improvement in safety and is essential to integrated disaster management.

4. The world is increasingly interdependent. All countries shall act in a new spirit of partnership to build a safer world based on common interests and shared responsibility to save human lives, since natural disasters do not respect borders. Regional and international cooperation will significantly enhance our ability to achieve real progress in mitigating disasters through the transfer of technology and the sharing of information and joint disaster prevention and mitigation activities. Bilateral and multilateral assistance and financial resources should be mobilized to support these efforts.

5. The information, knowledge and some of the technology necessary to reduce the effects of natural disasters can be available in many cases at low cost and should be applied. Appropriate technology and data, with the corresponding training, should be made available to all freely and in a timely manner, particularly to developing countries.

6. Community involvement and their active participation should be encouraged in order to gain greater insight into the individual and collective perception of development and risk, and to have a clear understanding of the cultural and organizational characteristics of each society as well as of its behaviour and interactions with the physical and natural environment. This knowledge is of the utmost importance to determine those things which favour and hinder prevention and mitigation or encourage or limit the preservation of the environment for the development of future generations, and in order to find effective and efficient means to reduce the impact of disasters.

7. The adopted Yokohama Strategy and related Plan of Action for the rest of the Decade and beyond:

- (a) Will note that each country has the sovereign responsibility to protect its citizens from natural disasters;
- (b) Will give priority attention to the developing countries, in particular the least developed, land-locked countries and the small island developing States;
- (c) Will develop and strengthen national capacities and capabilities and, where appropriate, national legislation for natural and other disaster prevention, mitigation and preparedness, including the mobilization of non-governmental organizations and participation of local communities;

(d) Will promote and strengthen subregional, regional and international cooperation in activities to prevent, reduce and mitigate natural and other disasters, with particular emphasis on:

- (i) Human and institutional capacity-building and strengthening;
- (ii) Technology sharing, the collection, the dissemination and the utilization of information;
- (iii) Mobilization of resources.

8. The framework of action of the International Decade for Natural Disaster Reduction provides all vulnerable countries, in particular the developing countries, with the opportunity to achieve a safer world by the end of this century and beyond. In this regard, the international community and the United Nations system in particular must provide adequate support to the International Decade for Natural Disaster Reduction, and its mechanisms, especially the secretariat of the Decade to enable them to carry out their mandate.

9. The Yokohama Conference is at a crossroad in human progress. In one direction lie the meagre results of an extraordinary opportunity given to the United Nations and its Member States. In the other direction, the United Nations and the world community can change the course of events by reducing the suffering from natural disasters. Action is urgently needed.

10. Nations should view the Yokohama Strategy for a Safer World as a call to action, individually and in concert with other nations, to implement policies and goals reaffirmed in Yokohama, and to use the International Decade for Natural Disaster Reduction as a catalyst for change.

APPENDIX X

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

In CHINA, the seminar on Operational Weather Forecasting System was held at Lushan, Jiangxi Province from Oct. 18 to 21, 1994. More than 40 trainees devoted to training courses such as the real-time data transmission techniques, the routine data processing and handling, overlapped images techniques, computer window techniques, data base and retrieval. At present in China, operational forecasting systems are being transferred to weather forecasting centers at local and county levels.

A training seminar on "China's disaster reduction plan" organized by China National Committee for the IDNDR was held in Beijing from Oct. 27 to 28. 45 people took part in it. The objective of the seminar is to work out China's Disaster Program and its priority items. Two experts from UNDP attended the seminar and gave some guiding opinions in it.

The Sixth National Numerical Weather Prediction Conference organized by the Committee of Numerical Prediction of China Meteorological Society was held in Nanjing Institute of Meteorology from Oct. 18 to 21, 1994. 60 experts on numerical weather prediction participated.

International Training Course on Satellite Meteorology was held in Nanjing Institute of Meteorology from Aug. 29 to Sept. 25, 1994 by Regional Meteorological Training Center (RMTC)/WMO. 33 trainees from 18 Asian and African countries took part in it. Satellite observational principles, data processing and the analyzing techniques and forecasting method of tropical weather and intense convective systems were presented during the training course. Moreover, application of radar data was also introduced in the course.

In HONG KONG, several local training courses covering the operation of new equipment, observational practices, meteorology and forecasting were run by the Royal Observatory. A total of around 114 participant/times of class I, Class II and Class III meteorologists attended these courses. Two of these trainees were meteorologists from Servicos Meteorologicos e Geofisicos Macau.

Four officers from the Royal Observatory attended courses in meteorology at the Meteorological College in U.K. while one attended a course on the "Use and Interpretation of ECMWF products" at ECMWF. Two officers attended courses on the MM5 model at NCAR. In addition, a senior meteorologist undertook a consultancy study on analysis and forecast of tropical cyclones at ECMWF.

In JAPAN, JMA has been making continuous efforts to expand technical cooperation. Training events were offered to Members of the Typhoon Committee on the subjects of NWP and telecommunications as shown in table 1. Expert services were provided in the fields given in table 2.

Table 1

Training implemented at JMA related to activities on the Typhoon committee since its twenty-sixth session

Subject	Member(s) from	Number of participants	Duration
Intercomparison of meteorological instruments	Thailand and Hong Kong	3	2 weeks from 28 February 1994
4-Dimensional Data Assimilation	Republic of Korea	1	4 months from 27 June 1994
Meteorology (Group training)	Thailand	1	4 months from 25 August 1994
Global Environment Analysis Using Satellite Data	Republic of Korea	1	5 months from 7 November 1994

Table 2

Expert service to the Typhoon Committee Member from JMA since its twenty-sixth session

Subject	Member(s) in service	Number of experts	Duration
Transplant of a global spectral model (GSM)	Republic of Korea	1	4 weeks from 9 March 1994
Development of a numerical prediction model at ASEAN Meteorological Centre	ASEAN	1	4 weeks from 7 March 1994
Analysis of Meteorological Satellite Data	Philippines	2	2 weeks from 28 November 1994

In MACAU, numbers of SMG staffs have been trained in the following meteorological course:

Course	Number of participants
Class III Met. Officer	8
Class II Met. Officer	5
Short course on Met. Observing Practice	7

Overseas training/Seminar/Workshop attended by SMG personnel in 1994:

Subject	Venue	Duration	No. of Participants
Regional Training Seminar on Data Management for RA II and RA V	Singapore	5DEC - 9DEC	1
9th Seminar on Hazardous Weather	Hong Kong	10NOV - 11NOV	9
4th International Conference on Atmospheric Science and Applications to Air Quality	Seoul	30MAY - 2JUN	1

In MALAYSIA, training provided by the Malaysian Meteorological Service to overseas meteorological personnel in 1994:

Date	Course	Duration	Country	No. of participants
14 - 19 November 1994	Basic Meteorological Instrument and Observation Practices	6 days	Brunei Darussalam	4
5 - 23 December 1994	Basic Meteorological Instrument and Climatology Course	19 days	Brunei Darussalam	2
19 - 14 December 1994	Operational Course in Agrometeorology	6 days	Brunei Darussalam	2

Overseas Training/Seminar/Workshop attended by SMG personnel in 1994:

Subject	Venue	Duration	No. of participants
Weather Forecasting	Nanjing, China	29.08.94 - 26.09.94	1
WMO RAIL/RAV Training Workshop on Background Atmospheric Composition Monitoring and Operation of GAM stations	Beijing, China	12.09.94 - 16.09.94	4
Sixth Annual BMRC Modelling Workshop	Melbourne, Australia	05.10.94 - 07.10.94	1
Regional Workshop on National Inventories of Anthropogenic Emissions and Removals of Greenhouse Gases for Asia-Pacific	Chieng Mai, Thailand	03.07.94 - 07.10.94	1
Wordshop on short-term climate forecasts and their applications for social and economic benefit and sustainable development	Bali, Indonesia	07.11.94 - 09.11.94	1
WMO RAIL/RAV Training Seminar on Data Management	Singapore	05.12.94 - 09.12.94	1

In the PHILIPPINES, International Trainings and Seminars Attended - 40

Field/Course	No. of Participants	Place
Tropical Cyclone	2	China/USA
Disaster Management	4	Philps./Japan
Flood Forecasting	1	Israel
Satellite Met. & Remote Sensing	2	Australia
Other Meteorology Fields	26	Australia, France, India, Israel, Italy Japan, Korea, Malaysia Indonesia, Australia
Marine Weather Forecasting	2	Thailand
ERS-1 Seminar/Workshop	1	Malaysia
EC-ASEAN ERS-1 training	2	

Local Trainings conducted by PAGASA

Course	Duration	No. of Participants
Basic course on Radar Met.	18 Oct. - 08 Dec. 1993	18
Met. Obs. Training Course	Oct.'93 - Aug.'94	49
Met. Training Course	Nov.'93 - Oct.'94	36
Tropical Cyclone Forecasting	14 March - 20 May '94	22
Natural Disaster Met. Course	20 June - 5 Aug. '94	26
OJT on Weather Related Disaster (Myanmar Fellows)	19 Sept - 14 Oct '94	2
Familiarization in Forecasting (Indonesian Fellow)	Sept. 19 - 30 1994	1

International Workshops Conducted in the Philippines

WMO Regional Seminar on the Interpretation of Climate Data and Productions for Climatological Forecasting, 22 - 26

November 1993 - 21 participants.

Southeast ASEAN Regional Workshop on Scientific Development and Research Applications of Greenhouse Gas Inventories, 11 - 15 April 1994, Subic, Zambales.

VCP Scholars at the university of the philippines taking up Post Graduate Courses on Meteorology

- 1 - Pakistan
- 2 - Sri Lanka
- 3 - Yemen
- 4 - Vietnam
- 12 - Philippines

In the REPUBLIC OF KOREA, numbers of KMA staff have trained overseas in 1994 with various financial resources. Among them training related to the activities on the Typhoon Committee are listed as follow:

Period (day/month)	Country (Organization)	Contents	Financial Source
17/1 - 21/1	Japan (JMA)	International Meeting on Numerical Prediction of Tropical Cyclone	Japan
21/2 - 29/4	USA	Training Course on Tropical Meteorology and Tropical Cyclone Forecasting	WMO
19/6 - 20/10	Japan (JMA)	4-Dimensional Data Assimilation	KMA
29/8 - 29/9	China	Satellite Meteorology	WMO
4/11 - 12/4/95	Japan (JMA)	Global Environment Anaysis using Satellite Data	KMA
13/11 - 19/11	Japan (JMA)	International Seminar on the Utilization of the Extended Information from the GMS	Japan
13/11 - 20/11	Thailand	Workshop on Storm Surges for the Bay of Bengal	WMO

One expert from JMA has visited KMA for one month period, from March 9 to April 5, 1994. Mr. Kenichi Kuma, the expert on global spectral modeling, gave several seminars and technical discussion/advise to KMA staff on the topics of numerical weather prediction, especially for the JMA Global Spectral Model.

In THAILAND, the tabular summary of training courses for 1994 is as follows:

No. of Participants	Title	Host	Duration
1	Forecasting and Monitoring Activities	Norway	3 - 14 Jan. 94
2	Comparison of Barometer	Japan	27 Feb.-11 Mar.94
2	Hands on Training Scheme (HOTS)	UK	10-23 Apr.94
2	Workshop on Acid Rain Network in South, East and Southeast Asia (ARNSESEA)	Malaysia	17-19 May.94
1	17th Disaster Management Course	AIT	6 Jun.-15 Jul.94
1	Workshop "Precipitation Processes of Monsoon Rain in Thailand"	Japan	2-4 Aug.94
1	Training Course on Meteorology II for 1994	Japan	18 Aug.-22 Dec.94
1	Weather Forecasting	China	29 Aug.-26 Sept.94
1	Software Development for Meteorology	Singapore	1 Sept.-31 Oct.94
30	Workshop on Storm Surges	Thailand	14-19 Nov.94

In VIETNAM, the regional workshop on climate change was held in Hanoi, June 1994. The other regional workshop on water resources management also held in Hanoi, November 1994.

Two local training courses on weather and hydrologic forecast and one course on marine meteorological observation and measurement were carried out respectively for local forecasters and observers.

With assistance of France 5 persons implemented their study on hydro-meteorological services.

In 1994, 12 specialists from the Hydrometeorological Service of Vietnam were sent abroad to attend seminars, workshops and short training courses on the following subjects:

- Numerical weather prediction and modelling.
- Climate change and its response policies.
- Use of satellite meteorological data in weather forecasting
- Hydrometeorological instruments and their calibration.
- Agrometeorological services.

List of training courses in Kingdom of Cambodia during 1994:

Course (International only)	Venue	Duration	N° of Participant
Tropical forecasting	Darwin RSMC/RFC (Australia)	01 Jan - 09 April	02
Workshop on Hydro-meteorological	Bangkok (Thailand)	21-23 February	01
Completion a master degree on Hydrology	(Belgium)	2 years	01

APPENDIX XI

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

IN CHINA, the Third Technical Conference on SPECTRUM was held by ESCAP/WMO Typhoon Committee in Shanghai from Oct. 25 to 29, 1993. The experts extensively exchanged their viewpoints on typhoon unusual movements at the conference. Many research results were directed to forecasting typhoon unusual motion.

Many research achievements from national research key project on tropical cyclone theoretical study were obtained in 1994, which include tropical cyclone unusual motion caused by adjustment of large scale circulation, interaction between different motion scale, impact of asymmetric structure within storm, effect from the topography and underlying surface. Other research results are concerning the tropical cyclone intensity change and structure and heavy rainfall induced by landing tropical cyclone along the coastal line.

In 1994, CMA/NMC installed its first Cray supercomputer system - Cray C92/1-128 (Fig.8). Also installed is a Cray EL98/4 system. Major performance indicators of them are:

	number of CPUs	peak performance	memory size	disk capacity
Cray C92/1-128	1	1000Mflops	128MW+128MW SSD	40GB
Cray EL98/4	4	593Mflops	128MW	20GB

A tropical NWP model for typhoon track prediction has been developed at NMC since 1992. The experiment of this model in the summer of 1994 shows that the model has some capabilities for typhoon track forecasting.

A higher resolution limited area model is developed in 1994, which is based on the operational Limited Analysis and Forecast System (LAFS). The adiabatic part of the model is just as that in the operational model. The integrated domain is: 15°N-64°N, 70°E-145°E. The horizontal resolution is 1°X1° in latitude and longitude. Fifteen levels with unequal δ values are used in vertical.

Based on the intensive observational data from SPECTRUM, the impact of different motion scale interaction on typhoon motion is discussed through theoretical analysis, dynamic statistics and numerical simulation. Results show that interaction between tropical cyclone and environmental field is a key factor in typhoon motion when the steering flow is weak.

Impact of underlying surfaces which include SST, island and coastal topography, etc. on typhoon motion is also very significant. Through analyzing the observational data of TYPHOON-

90 field experiment, they found that a typhoon moving westwards near the warm sea area will deviate from steering flow and moves toward the warm sea area. This is consistent with the results of Chinese meteorologists-typhoon has a moving trend towards warm sea area and away from cold one. Other studies show that when some typhoons approach Taiwan, Luzon island and Japan island, induced lows may occur around these islands. A numerical experiment on the impact of Taiwan island topography on typhoon motion shows that island terrain can cause tropical cyclone's right-turning. Furthermore, while a typhoon is approaching a coast from different directions or partly landing, sudden turning of the typhoon's direction may occur to adapt to new equilibration.

Comparative analyses on typhoon track prediction and capability of different kind of numerical prediction models (including typhoon prediction models with different initialization schemes, typhoon bogussing data and cumulus parameterization scheme, etc.). Based on the target typhoons during SPECTRUM, typhoon unusual motion has been studied with different kinds of numerical simulation. It is suggested that the model itself, the quality of initialization, the cumulus parameterization schemes and the resolution degree all have rather important influences on the typhoon track prediction accuracy. Results of the numerical analysis on the target typhoons also show that typhoon unusual track is determined by the interaction among the typhoon asymmetric structure, the basic flow, β effect and the underlying surface conditions.

In the aspect of tropical cyclone structure and intensity change, a multiscale composition theory of tropical cyclone formation and development is put forward. An observational fact-asymmetric structure can affect tropical cyclone track-is found and proved through diagnostic analysis and numerical simulation with the observational data obtained from SPECTRUM programme.

Some studies show that the interaction between westerly trough and tropical cyclone has a significant impact on the intensification of tropical cyclone-caused torrential rain. In the study on the formation mechanism of typhoon-caused heavy rain, it is found that moisture distribution and its variation have an important function on typhoon-caused heavy rain. Besides, it is pointed out that mixed Rossby-gravity elliptical cosine wave of stratified atmosphere may cause local intensive heavy rain. Some improvements are also achieved in the study on operational forecast method of tropical cyclone-caused torrential rain.

In HONG KONG, the Ninth Guangdong-Hong Kong-Macau Seminar on Hazardous Weather was held at the Royal Observatory on 10 and 11 November. The seminar was attended by 25 participants from the Guangdong Meteorological Bureau, Serviços Meteorológicos e Geofísicos Macau and the Royal Observatory. Nine papers were presented, of which two were on tropical cyclones, three on heavy rain and four on the numerical prediction of severe weather. Three of the papers were from the Royal Observatory.

The MM5 mesoscale modelling system was successfully customized to run on an IBM workstation using initial data from the Royal Observatory's operational objective analysis and boundary data from the global model of JMA.

Several other studies on heavy rain and tropical cyclones were also completed within the year.

SPECTRUM related studies were also in progress jointly with the City Polytechnic of Hong Kong.

In JAPAN, a study on the validity of symmetric typhoon bogus data which have been employed so far revealed that in the cases of T9230 (GAY) and T9231 (HUNT) the data were valid in data spare areas but invalid in areas where sufficient observation data are available.

A method for asymmetric typhoon bogus was developed to combine asymmetric components extracted from the first guess field with symmetric bogus field. It was found that this method can reduce, on average, forecast errors including northward bias of the central position of a typhoon.

As a result of a study on the impact of higher resolution of JMA's Global Spectral Model (GSM), the horizontally and vertically high resolution model (T213 L30) forecast the track of T9019 (Flo) more accurately than the only horizontally high resolution model (T213 L21) and the current operational model (T106 L21) for 8 days. It suggests that the difference in accuracy of forecast typhoon tracks between models with different resolution heavily depends on the phase error of the mid-latitude baroclinic wave.

In August 1994, a semi real-time forecast experiment was conducted for T9413 (DOUG), T9414 (ELLIE) and T9416 (FRED). The experiment revealed that introduction of the Arakawa-Schubert scheme improves typhoon track forecasts by JMA's GSM. This scheme will be employed in GSM when it is confirmed that it does not give an adverse impact on extratropical forecasts.

It was found that introduction of satellite wind vector data in the lower atmosphere in the vicinity of a typhoon into forecast and analysis models gives little impact on the forecast and analysis of the typhoon.

In order to study the impact of the observations made during SPECTRUM in August/September 1990, the Meteorological Research Institute (MRI) of JMA is making reanalysis for the above period using JMA's operational GSM. At present, comparison are being made between the forecast with real-time upper air observations from drifting buoys and ships and that without such special observation data. As a result, it was found that the latter was worse in some cases due to poor quality observation data. MRI is planning to study the impact of non real-time data, such as drop sonde and aircraft observations and the special observation data through quality check.

When the typhoons T9421 (KINNA) and T9426 (ORCHID) approached the Kanto Region, upper air observations by using a omega sonde were made at intervals of three hours. Observations with Doppler radars were also made for a continuous heavy rain associated with T9426. Analysis of these data are being made to study the change of the structure and the mechanism of the heavy precipitation of the typhoon in the middle latitude.

When the typhoons T9413 (DOUG) and T9416 (FRED) passed the Sakishima Islands, intensive observations were made with a radar at Ishigakijima (47918) to analyze the three dimensional structure and temporal change of the rain band of a developing typhoon. The analysis is now under way.

A study on the diurnal variation of convective activities over the South China Sea with three hourly GMS infrared data confirmed that the diurnal variation over the ocean is active when the intraseasonal variation of the convective activities is active.

By using a model to forecast storm surge on a real-time basis, simulation and forecast experiment of storm surge by the typhoon T9119 (MIREILLE) were made. It was confirmed that storm surge is simulated and forecast in a good manner provided that appropriate wind and pressure field are given. A newly developed method for estimating the wind field from tide levels revealed that storm surge in a typhoon depends on the detailed wind distribution. It was also found that improvement of the forecast of not only typhoon tracks but also change in structure of a typhoon are important.

In MACAU, studies on hazardous weather and two research works are entitled:

1. Analysis of the trajectory of S.T.S. RUSS
2. Analysis of Severe Rain Storm during 22-29 July, 1994

In MALAYSIA, the Malaysian Meteorological Service will attempt to study the upper tropospheric divergence changes over equatorial Southeast Asia induced by the presence of typhoons in the neighbourhood and to link such change with other results obtained from earlier studies of large-scale effects of typhoons.

In the PHILIPPINES, in congruence with the national trust on disaster impact reduction the PAGASA continued to undertake researches pertaining to various meteorological and hydrological concerns. Among these are:

- . Completed research in December 1993:
- . An analysis of Recurvature and Non-recurvature of Tropical Cyclones affecting the Philippines.
- . A numerical model for Storm Surge Prediction incorporating overland flooding.

- . Forecasting Tropical Cyclone Movement by incorporating Synoptic Situations in PTC method.
- . Tropical Cyclone Rainfall Statistical Analysis for five (5) stations in the Philippines.
- . Tropical Cyclone Intensity and Frequency of occurrence in the Philippines.
- . Tracking Typhoon Gay (TY9230) Using a Barotropic model.
- . Rainfall statistics of the Weather Modifications Experiment (WEMEX).
- . Some on-going studies are:
- . Study on Typhoon Surface Wind Structure.
- . Tropical Cyclone Forecasting Development Scheme.
- . Thunderstorm Hazard mapping in Metro Manila.
- . Flood Risk Mapping of Taguig Metro Manila.
- . Flood Vulnerability study of Laguna Bay Area.

In the REPUBLIC OF KOREA, four researches on typhoon have been reported in 1993-1994 in the Republic of Korea. Two of them are on the typhoon track forecast, the others are for typhoon dynamics. Brief overviews are listed below:

Research using an axisymmetric tropical cyclone numerical simulation model is tested to investigate impacts of different cumulus parameterization and the role of increasing inertial stability on storms during rapid intensification. Results show that the pragmatic approach using both the implicit and the explicit method has an advantage over the explicit method and even the traditional approach of the implicit method combined with simple removal of super saturation.

Dynamics of movement of a non-divergent barotropic vortex is investigated with numerical model. Results show that a background flow plays an important role in the movement of the vortex while nonlinear advection and the pressure work nearly cancel each other.

CLIPER model for northwestern Pacific has been retested. During the period of 1945 to 1988, statistical characteristics of typhoon track is quite different for before and after recurvature. Therefore it is recommended that CLIPER model can be divided into two models for before and after recurvature for better performance.

A Quasi-Lagrangian model is tested to predict typhoon track and associated rainfall. Bogussing is performed to enhance the initial typhoon structure in the ECMWF analysis. Results show

that model produces predictions with comparable accuracy to that of operational models. Coupling of bogussing typhoon with the synoptic field is found to be necessary.

In THAILAND, some objective techniques for tropical cyclone prediction over Thailand and neighbouring 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 displayed by software developed on IBM-PC/AT for purposes of research and operation of weather forecast.

Establishing a working group with the closed coordination of the scientists from various research institutes aiming to develop models of Numerical Weather Prediction.

The existing 5-level limited area model is under study and modification for use over region of Thailand and neighbouring areas.

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

The other tropical cyclones are further studied such as GAY (8929, 1-9 Nov.1989) and ANGELA (9224, 15-31 Oct.1992) on their peculiar movement in the area of the Gulf of Thailand. All concerned data were collected the most that is possible. Significant aspects of the evolution and development of these disturbances and the related large-scale environment during the period of the occurrence are under analysis and investigation. The essential of and requirement for a limited area numerical model for forecasting purposes are on experiment and study as well as the model is under formulation with additional beneficial data utilization of Global Mode 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 (9017) is one of the typhoon which interested us regarding its significant phenomena. In a specific area, the output of disturbance movement will be further deliberated and also studied in comparative with climatological characteristics.

Some Objective Techniques for Investigation of the Thai People's Attitudes towards Meteorological Work.

A comparative Studies of Water Inflow and Storage by Dam: Rainfall Caused by Tropical Cyclones Passing Thailand.

In VIET NAM, research activities are as follows:

Continuation of studying vortex initialization for a numerical model predicting tropical cyclone tracks.

Case study of synoptic situations related to tropical storms causing extremely heavy rains and flash floods.

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

Study of the influence of various heating sources on the results of the mesoscale model predicting meteorological elements over the sea areas.

Evaluation of forecast results of two statistical models and one dynamical model which have been applied into operational prediction of tropical cyclone positions for the period 1983-1992 (ten years).

Application of a numerical model for computing storm surges occurred in the northern and Central Vietnam coastal areas.

(c) 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.

An initial focus of this Priority Mission is the development of the 'autonomous Aerosonde' for operational application and development of a CAS statement on climate change aspects of tropical cyclones.

APPENDIX XII

ACTIVITIES OF THE COMMISSION FOR ATMOSPHERIC SCIENCES (CAS)

The Committee was informed that at the recent CAS-XI, the group's name was changed back to the Working Group on Tropical Meteorology Research, to reflect the extensive nature and importance of its activities.

The WGTMR is strongly committed to close interactions with the operational community, and considers that research and operations can work very well together in a spirit of mutual cooperation. The recent interactions on IWTC-III, the production of the Forecast Guide, the revision of the Global View on Tropical Cyclones, interactions on the SPECTRUM, TCM-90, Typhoon-90 field programmes and associated research provide excellent examples of the benefits that arise from such interaction.

The WGTMR has been actively seeking closer collaboration with other international research organisations and has established collaboration with the International Council of Scientific Unions (ICSU) and the International Association for Meteorology and Atmospheric Science (IAMAS). This collaboration is taking the form of joint sponsorship of international meeting, such as the IWTC series, the Beijing Symposium on Tropical Cyclones as Natural Disasters (which produced a reference book that was circulated by CAS), and the IAMAS-93 in Yokahama (which has produced a review issue of Meteorology and Atmospheric Physics, to be issued in February 1995). Strong collaboration has occurred with ICSU on development of the Aerosonde for tropical cyclone applications and on production of statement on climate change aspects of tropical cyclones that has been published in the December 1994 issue of BAMS.

The attention of the Committee was brought to two important initiatives that are being undertaken by WGTMR.

The first is that CAS XI nominated Tropical Cyclones as the first CAS Priority Mission with the aim of providing an enhanced effort on the following priority areas.

(a) To promote research efforts in Members, 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;

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

APPENDIX XIII

REVIEW OF THE 1994 TYPHOON SEASON

The Committee was informed that due to the disappearance of the influence of the El Nino phenomena, the atmosphere and ocean conditions returned to normal in the tropics in the first half of this year. Sea surface temperature (SST) was higher than normal over the eastern Indian Ocean and the western Pacific. Four tropical cyclones formed in June. This number of occurrence is normal compared to the long-term average which is 5.0. In July the tropical convection became active over the South China Sea and off the east coast of the Philippines. A total of seven tropical cyclones formed in July. All of the tropical cyclones developed over these two waters. In August, SST got lower than normal over the waters around the Philippines. On the contrary, it rose in the equatorial waters in the vicinity of the International Date Line. It is considered that these might induce the development of tropical cyclones in the eastern part of the Western North Pacific (WNP). The occurrence of tropical cyclones from August to October was 23, eight more than the average. Thirteen of them evolved in the seas east of 150°E. Occurrence of tropical cyclones this year was larger than normal.

Referring to tropical cyclone tracks, one finds that in July and August there were a number of tropical cyclones travelling westward along the periphery of the subtropical High. Most of them took tracks toward China mainland. A few moved to the north, leading to a trough which persisted off far east of Japan. In September the subtropical high broke into two cells, one being over the continent and the other being off far east of Japan. While a trough resulted over Japan, some of the tropical cyclones which formed in the eastern part of the WNP just moved northward. Meanwhile, some tropical cyclones which formed in the western part of the WNP moved straight toward Viet Nam. In October, as the subtropical high was positioned south of Japan, most tropical cyclones took tracks at lower latitudes. Some recurved to the northeast after a short westward movement along the periphery of the subtropical high.

REVISED REGIONAL COOPERATION PROGRAMME IMPLEMENTATION PLAN
(RCPIP)

(to be updated by the TCS)

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1 METEOROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES							
1.1.1 Establishment of a dedicated simplex transmission/retrieval of RSMC Tokyo grid data (GPV) for standardized distribution and local processing of weather charts for various uses, through Internet and ISDN.	=====				TC Members and WHO	National/External	Introduced during the 26th session and amended at the 27th session.
1.1.2 Expansion of observational programme: <i>With stress on radiosonde observations</i>	=====	=====	=====	=====	Members	National/External	Continuous activities. Free equipment of Cambodia observation network needed.
1.1.3 CAS pilot aerosonde project field development and testing in the western North Pacific region to be given support by the Typhoon Committee.		=====	=====	=====	WHO (CAS), TC Members	External	Introduced during the 26th session and engaged for further discussion.
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 Amdas, 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

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1 METEOROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
1.1.8 Establishment of a WWW data user system for the reception of FAX and GPV data via GMS					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:					Members	National	Continuous activities
• services and facilities for the real-time exchange of data and products					RTHs Bangkok, Beijing and Tokyo	Members concerned	Continuous activities
• Monitoring of data exchange					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					Thailand and Cambodia	National and external assistance	
• Bangkok-Cambodia					Thailand and Lao PDR	External assistance	
• Bangkok-Vientiane							

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1 METEOROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
• 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 activities
1.2.2.4 Improvement of national data collection and retransmission to associated RTHs					Members	National/External	Continuous activities
• Upgrading of telecommunication circuit linking Hanoi and Bangkok from 75 bauds to 100 or 200 bauds					Viet Nam	National and external assistance	
• Establishment of telecommunication circuit between Hanoi and Beijing with speed of 2400 bauds					Viet Nam	National and external assistance	Speed is under negotiation
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

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1 METEOROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
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					Members	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

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

2 HYDROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
2.1 FLOOD FORECASTING AND WARNING							
2.1.1 Installation and operation of 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 MOFES
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 modelling
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 and ESCAP

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1 HYDROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
2.1.9 Development and application of guidance on hydrological technology models for tropical cyclone regions	=====	=====	=====	=====	Members	External assistance WHO	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	WHO to assist in development and promulgation of improved techniques
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 & WHO 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 & WHO

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

2 HYDROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
2.2.4 Implementation of selected aspects of comprehensive flood loss prevention and management	=====	=====	=====	=====	Members	National and external assistance	With assistance of ESCAP & WHO
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 & bilateral support if available	With assistance of ESCAP & WHO
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 & WHO
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 & WHO
2.2.8 Application of storm surge prediction and risk analysis	=====	=====	=====	=====	Members	National and external assistance	With assistance of ESCAP & WHO
2.2.9 Improvement of dam water release operation system	=====	=====	=====	=====	Members	National and external assistance	With assistance of TCS, ESCAP and WHO

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

DISASTER PREVENTION AND PREPAREDNESS COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
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/IDNDR Secretariat, 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 relevant
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 operation	=====	=====	=====	=====	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/DHA mission

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

3 DISASTER PREVENTION AND PREPAREDNESS COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
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/IDNDR Secretariat, IFRC, ESCAP and WMO
3.2.7 Conducting case studies of response to major disasters	=====	=====	=====	=====	Members	External assistance	With advice from DHA/IDNDR Secretariat, 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/IDNDR Secretariat in cooperation with ESCAP
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

External assistance in conjunction with IDNDR

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

4 TRAINING COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
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 on 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 by WMO and Members	=====	=====	=====	=====	Members	UNDP, WMO and other international organizations concerned	Coordinated by WMO
4.1.8 Group training courses in meteorology	=====	=====	=====	=====	Japan	Japan International Cooperation Agency (JICA)	JICA
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

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

4 TRAINING COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
4.1.11 Exchange of meteorological experts between Members other than 4.1.9 above	=====	=====	=====	=====	Members	Bilateral or TCDC arrangements	
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

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

4 TRAINING COMPONENT

TASKS	TIME SCALE			BY WHOM	RESOURCES	REMARKS
	95	96	97 98			
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 arrangements
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
4.3.2 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 the help of DHA/IDNDR Secretariat, IFRC, ESCAP and WMO
4.3.4 Exchange of information on the socio-economic impact of disaster	=====	=====	=====	Members	DHA/IDNDR Secretariat, IFRC	Seminars organized by DHA/IDNDR Secretariat, IFRC and WMO
4.3.5 Training on disaster vulnerability and risk assessment	=====	=====	=====	Members	DHA/IDNDR Secretariat, IFRC	Courses and seminars organized by DHA/IDNDR Secretariat, 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/IDNDR Secretariat, IFRC, TCS and ESCAP	DHA/IDNDR Secretariat, IFRC, ESCAP and other sources	TCDC arrangement organized by DHA/IDNDR Secretariat, IFRC, TCS and ESCAP

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

5 RESEARCH COMPONENT

TASKS	TIME SCALE			BY WHOM	RESOURCES	REMARKS
	95	96	97 98			
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 Study to add "Super Typhoon" classification	=====	=====	=====	Members	To be discussed in the 29th session	
5.1.2 Utilization of TOPEX, SPECTRUM, TOPEX-90 and TYPHOON-90 data set in tropical cyclone numerical and physical modelling, 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	

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

RESEARCH COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	95	96	97	98			
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	Counts on discussion
5.1.3 Exchange of climate data & research reports					Members	National	
5.2 HYDROLOGY							
5.2.1 Application of meteorological inputs to flood forecasting					National or regionally coordinated programme	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/IDNDR Secretariat, IPRC, ESCAP, and WHO
5.3.2 Vulnerability and risk assessment of disaster-prone areas					Members	National	With advice and possible support of DHA/IDNDR Secretariat, IPRC, ESCAP, and WHO
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/IDNDR Secretariat, IPRC, ESCAP, and WHO
5.3.4 Disaster impact modelling					Members	National	With advice and possible support of DHA/IDNDR Secretariat, IPRC, ESCAP, and WHO

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

1. Major activities of the RSMC Tokyo - Typhoon Center in 1994 (after the twenty-sixth session of the Typhoon Committee)

1.1 Enhancement of streamline charts through JMH

In addition to the analysis and 24-/48-hour prognostic charts of streamline at 850 hPa with the initial time of 12 UTC, the Center started broadcasting the streamline charts with the initial time of 00 UTC effective 1 February 1994 in order to disseminate them twice a day. The analysis and prognostic charts of streamline at 200 hPa have also been delivered twice a day since the same day.

1.2 Numbers of the products disseminated from RSMC

The RSMC Tokyo - Typhoon Center disseminated the products to the Typhoon Committee Members from 1 January through 31 October 1994, as shown in Table 1.

1.3 Evaluation of tropical cyclone forecasts

For the period from 1 January through 31 October 1994, thirty-four tropical cyclones were observed in the western North Pacific. Results of the evaluation of the tropical cyclone forecasts issued by the RSMC are presented in Figures 1 and 2, and summarized in Tables 2 and 3. Furthermore, annual mean forecast errors of tropical cyclone positions in 24-and-48hour forecast 1982 through 1994 are shown in Figure 3.

1.4 Publication

In October 1994, the Center published the "Annual Report on Activities of the RSMC Tokyo-Typhoon Center 1993".

1.5 Monitoring of data exchange

The regular monitoring of the exchange of observation data associated with typhoons is being carried out by the Center for the following two periods selected from the year from 1 November 1993 through 31 October 1994;

Period 1: from 00 UTC 9 September 1994 to 00 UTC 13 September 1994

Period 2: from 00 UTC 9 October 1994 to 00 UTC 12 October 1994

The results will be forwarded to all the Typhoon Committee Members in December 1994.

2. Future plans for the activities of the RSMC Tokyo - Typhoon Center

Since the establishment of the RSMC Tokyo - Typhoon Center, the Japan Meteorological Agency has continuously made efforts to expand its functions and capabilities to serve as the center for tropical cyclone analysis, tracking and forecast in the East Asia region. The following improvements are planned in the years 1995 - 1996.

2.1 Replacement of computer system

COSMETS (Computer System for Meteorological Services), which is JMA's computer system, is to be replaced with a new system in February or March 1996. Preparations are being made for developing a system to improve the quality of numerical prediction products. When the new system is put into operation, the resolution of the global model will become higher.

2.2 Improvement of analysis system

So far, analysis and forecast of typhoon have been made based on weather charts. The Center is planning to introduce a man-machine interactive system in order to ensure expeditious and reliable operation. The system is designed with a view to being completed by the year 1996.

APPENDIX XVI

REPORT OF THE SPECTRUM RESEARCH COORDINATING GROUP PROGRESSIVE DEVELOPMENTS RELATED TO SPECTRUM IN 1994

1. Major Events in the Field of International Cooperation

1.1 The Third Technical Conference on SPECTRUM was held in Shanghai, China, from 25 to 29 October 1993. It was organized by Chinese Government in co-operation with WMO and the Typhoon Committee Secretariat (TCS). The conference was attended by about fifty experts from the participating members of SPECTRUM. Based on a number of presentations and active discussions, the conference shared the most recent knowledge and findings concerning tropical cyclone (TC) analysis and forecast.

1.2 The Technical Conference made recommendations as shown in Appendix-1. The Twenty-sixth Session of the Typhoon Committee (Quezon City, the Philippines, 2-8 November 1993) approved the recommendations of the Third Technical Conference.

1.3 The papers presented at the Third Technical Conference on SPECTRUM were published by WMO in April 1994 as the Technical Document No.595, one of the publication series of the Tropical Cyclone Program (TCP) of WMO.

1.4 The Third International Workshop on Tropical Cyclone (IWTC-III) was held from 22 November to 1 December 1993 in Huatulco, Santa Cruz, Mexico. Several forecasters and researchers from the participating members of SPECTRUM attended the workshop and contributed to the success of the workshop.

2. Researches Carried out by Participating Members

2.1 On 22 June 1994, the chairman of the SPECTRUM Research Coordinating Group (SRCG) requested the members of SRCG to provide him with information on the SPECTRUM related activities of each participating Member. Five Members reported the SPECTRUM related researches as follows:

2.2 China:

The Ninth Session of National Workshop on Tropical Cyclone was held on 1-4 June 1994 in Nanjing. At the workshop, studies on following topics were presented and discussed.

(1) Mechanism studies

Mechanisms of impact of asymmetric structure of TC on its motion and impact of different physical processes on TC asymmetric structure were investigated. Impact of Taiwan topography on TC motion was also investigated. Some studies showed the formation mechanism of small-scale gyres that can affect TC motion as same as beta gyres.

(2) TC unusual motion predictability

A study on TC motion predictability was made by using historical TC data in the western North Pacific.

(3) Development of numerical prediction model

Based on PSU/NCAR meso-scale model, a triple point nested model was developed. The model has been used to investigate TC motion and precipitation caused by the topography.

(4) Empirical study

The meteorological condition when TC crossed subtropical high was analyzed. The relationship between long wave adjustment and TC motion was investigated. Some TC bogussing techniques were obtained and used successfully in the numerical simulation. The interaction between meso-scale circulation systems and TC vortex was also studied.

2.3 Hong Kong:

SPECTRUM related research topics currently being studied are as follows:

Environmental - TC interaction and its relationship to TC motion.

The asymmetric flow associated with TC motion.

Re-run of ROLAM forecast based on SPECTRUM data.

Observational study of TCs with sheared or cold-cored characteristics.

2.4 Japan:

Present SPECTRUM related research activities in Japan are mainly focused on improvement of numerical TC forecasting models. Studies to prepare more reasonable initial fields based on new observational data and asymmetric bogussing techniques are carried out, the impact of the cumulus parameterization scheme proposed by Arakawa and Schubert on TC forecasting has been tested.

For estimating importance of additional observations during SPECTRUM, sensitivity studies on the additional data such as special upper-air observations made by SPECTRUM related ships have been carried out.

The objective global analysis of JMA (JANAL) referred TC bogus data and did not include non-real-time data such as drop sonde observations, whereas the final analysis of TCM-90 (TANAL) referred all of non-real-time data and no

bogus data. Therefore, comparison of JANAL and TANAL is expected to show the effect of additional data on TC analysis and to give us a clue to make clear the cause of northward bias error that is evident in track forecasts of TCs initiated by JANAL. The comparison study revealed some differences between these two initial fields.

For issuing more accurate forecast of rainfall amount caused by TCs, upgrading of an empirical guidance material for orographic rainfall induced by TC approaching Japanese Islands has been continued.

2.5 Malaysia:

SPECTRUM researches to be conducted by the Malaysian Meteorological Service are as follows:

(1) Large-scale upper divergence in connection with TCs over the South China Sea.

(2) The wide spectrum of the large-scale effects of TCs over the equatorial region in terms of boundary-layer convergence, large-scale pressure drop, wave height, cloud bands rainfall and upper divergence.

2.6 Thailand:

With the valuable assistance from the Chairman of SRCG on utilizing the TCM-90 data tapes, Thailand is now drafting the data available particularly in the areas concerned. Notwithstanding the interest by this moment is focused on the movement of DOT(9017), its phenomena will be further deliberated in comparison with climatological storm tracks.

2.7 For further information, the "Progress Report on Research Studies in Meteorological Component of Typhoon Committee" prepared on 2 November 1994 by the coordinator for research activities under cooperation of correspondents in meteorological component of the Typhoon Committee, Dr. Masashi Nagata, will be useful.

3. Remarks

Four years have passed since the field observational phase of SPECTRUM was successfully conducted from 1 August through 31 September 1990. Although a few participating Members have not yet completely solved problems in reading TCM-90 data tapes, active research activities are maintained in each of the participating Member. In expanding research activities, we should pay a special attention to that the overall objective of SPECTRUM is to improve operational TC forecasting by utilizing SPECTRUM related data sets. The research corresponding to this objective should be firstly promoted, and exchange of information and papers on newly acquired knowledge which improves TC forecast should be expanded among the participating members.

The Fourth Technical Conference on SPECTRUM is proposed to be held late in 1995. The conference will review the fruits of three Technical Conferences on SPECTRUM held in Tokyo (1990), Guangzhou (1991) and Shanghai(1993), and summarize all the researching activities during these years.

Although the papers presented at the Fourth Conference will be published by WMO upon the request of the Typhoon Committee, it is desirable that an overall publication collecting total fruits that stemmed from SPECTRUM related research activities be published by the Typhoon Committee. A special publication of the RSMC Tokyo - Typhoon Centre of JMA or a special issue of the Typhoon Committee Annual Review (TCAR) edited by Hong Kong will be suitable for this publication.

As a follow-up activity of the recommendations made at the Third Technical Conference on SPECTRUM in Shanghai, an attempt to realize attachment of researchers to advanced centre is under coordination between WMO, TCS and hosting country. Continuous effort to seek financial supports is desired in order to extend attachment of researchers and meteorologists to advanced centres.

RSMC Data Transmission via Satellites

	GMS (LRIT)	INTELSAT	JCSAT-3
System Outline	<ul style="list-style-type: none"> Point to Multipoint service Packet type transmission. See Fig. 1~Fig. 3 	<ul style="list-style-type: none"> Point to Multipoint service 	<ul style="list-style-type: none"> Point to Multipoint service Launch Date: August 1995
Technical Characteristic	<ul style="list-style-type: none"> Bit rate: 64Kbps Frequency: S Band(1691MHz) Receive Ant.: 1.2mφ existing WEFAX antenna is usable 	<ul style="list-style-type: none"> Bit rate: 9600bps Frequency: C Band(6GHz) 	<ul style="list-style-type: none"> Bit rate: 9.6kbps~2Mbps Frequency: C Band(6GHz) Receive Ant.: 1.8mφ~2.4mφ(MANILA, SINGAPORE, JAKARTA) 6mφ~8mφ(PAPUA NEW GUINEA, FIJI)
Service Area	<ul style="list-style-type: none"> See Fig. 4 	<ul style="list-style-type: none"> See Fig. 5 	<ul style="list-style-type: none"> See Fig. 6
Cost, etc.	Receiving Side <ul style="list-style-type: none"> Circuit charge is Free Receiving equipment about 50,000US\$. (except GPV processing computer) see Fig. 2 Transmitting Side <ul style="list-style-type: none"> Transmitting System: 2 million US\$~3 million US\$ 	Receiving Side <ul style="list-style-type: none"> Circuit charge is 7,000 US\$/month (Including receive equipment rental fee) Transmitting Side <ul style="list-style-type: none"> Circuit charge is 3 million yen/month 	<ul style="list-style-type: none"> Not applicable. (but circuit charge is needed)
Note	<ul style="list-style-type: none"> Transmission schedule will be limited, because the RSMC data is transmitted during the spare time of the WEFAX This system will be compatible with other Geo-stationary Meteorological Satellites 	<ul style="list-style-type: none"> There are some limitation of service area 	<ul style="list-style-type: none"> International communication system is under negotiation with countries concerned
Evaluation	☆☆ Desirable(for User Side) ☆ Transmittting system is expensive but JMA is planning to use the GMS.	☆ AVAILABLE, but circuit charge is expensive.	☆ AVAILABLE

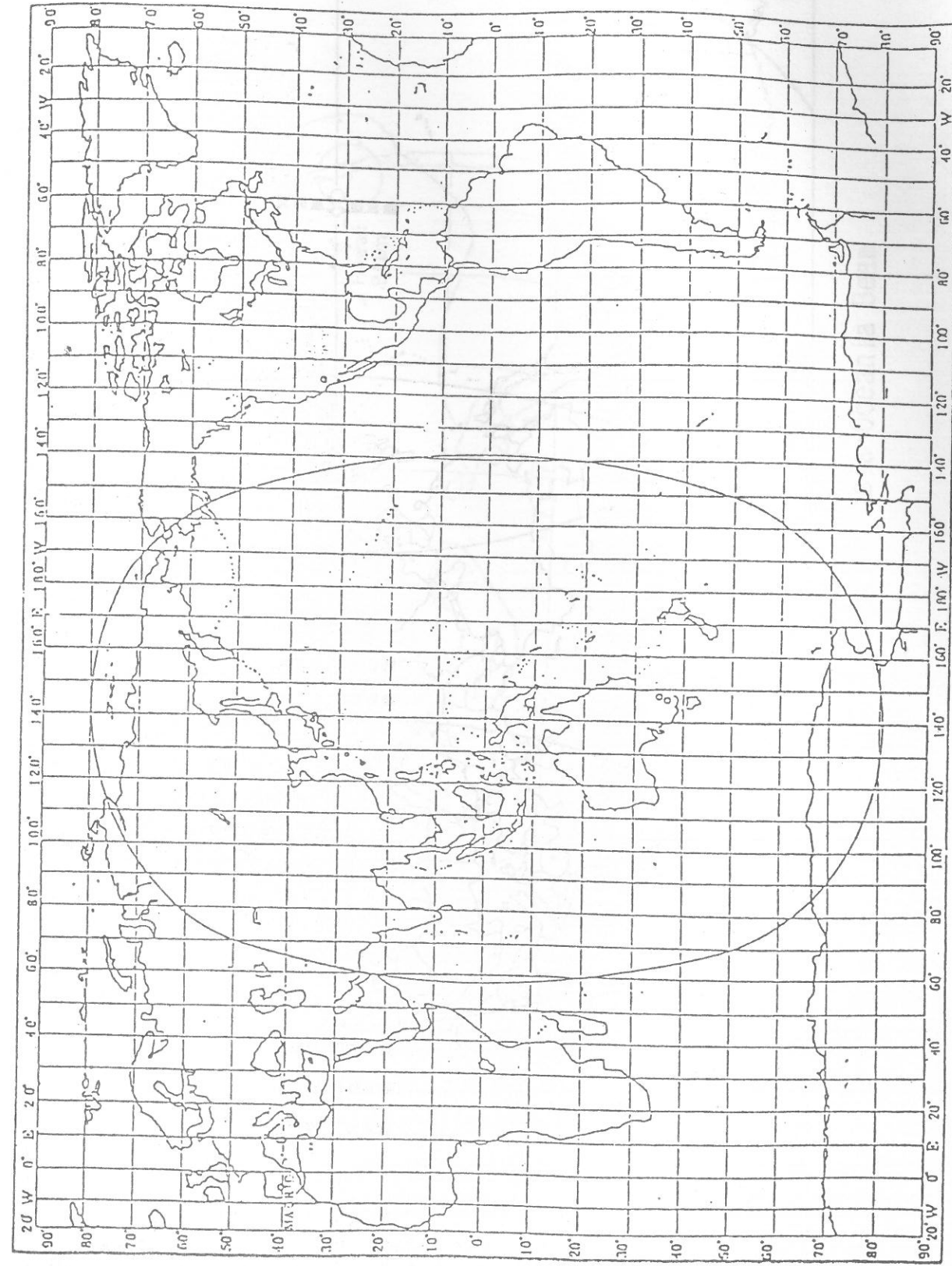


Fig. 4

GMS SERVICE AREA

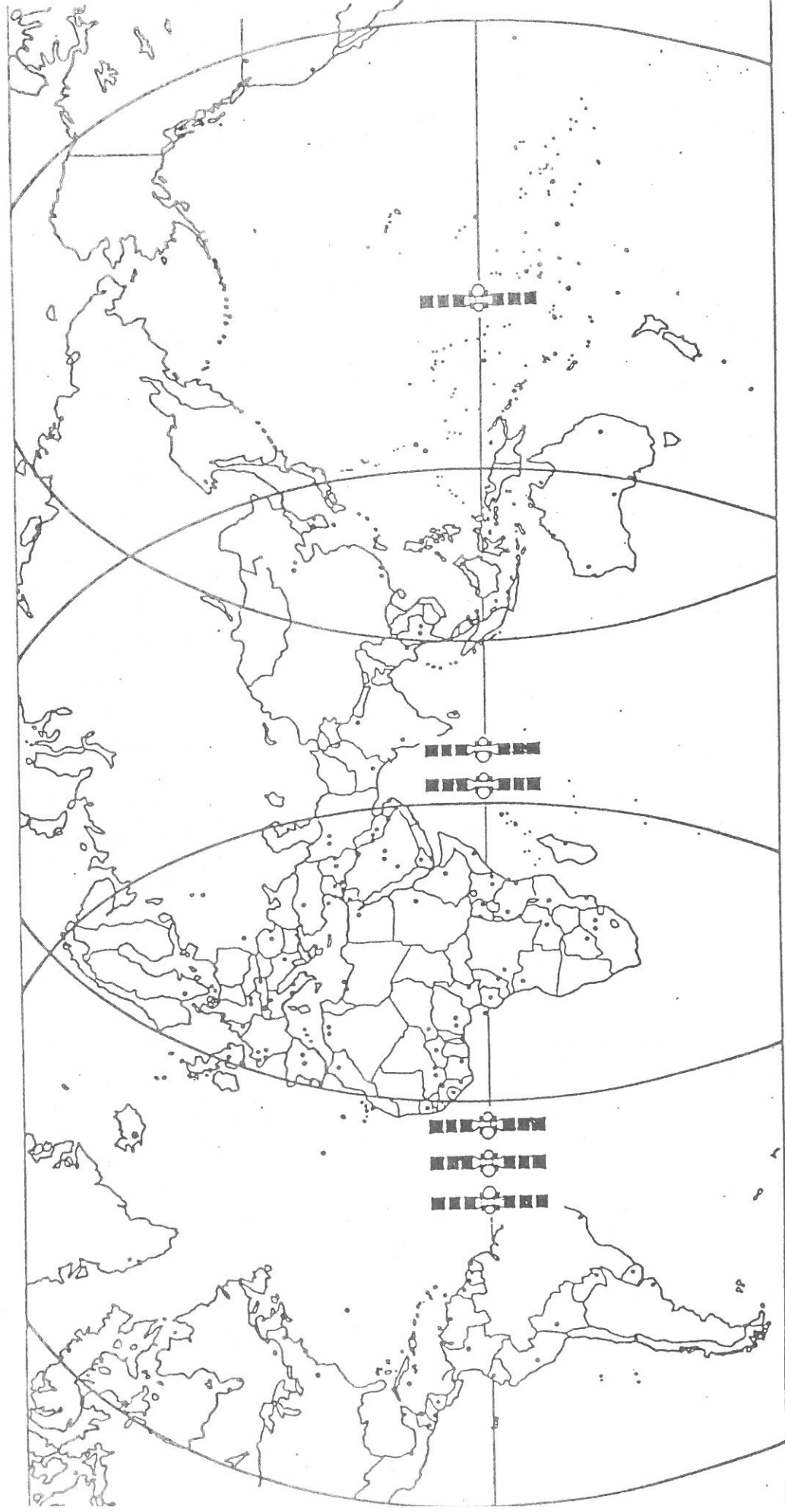


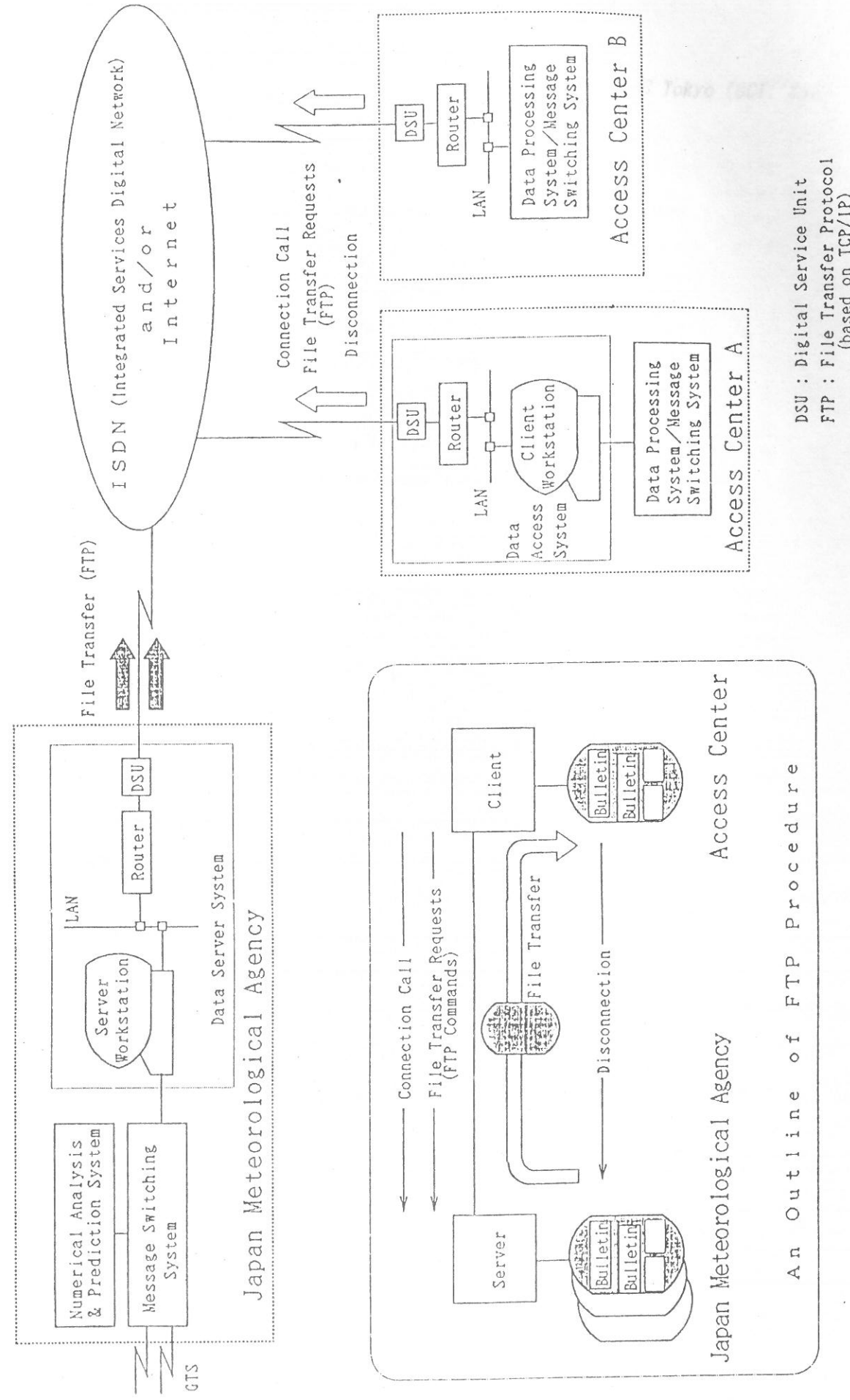
Fig. 5 INTELSAT SERVICE AREA



C-Band (6GHz, 4GHz) East Asia-Oceania Beam

Fig. 6

JCSAT-3 SERVICE AREA



Answers to the questionnaire on the products distribution of RSMC Tokyo (OCT.'94)

Q1 A possibility to utilize this service

A: Utilize it within a year	6 countries
B: Utilize it within 2 or 3 years	1 country
C: Utilize it after 3 years or more	1 country
D: Not utilize it	0 country

Q1-1 Which means would you prefer Internet or ISDN ?

Q1-2 If you prefer Internet, which is your access mechanism?

Internet	5 countries
leased circuit	2 countries
dial-up circuit	3 countries

ISDN	3 countries
------	-------------

Q1-3 What equipment would you use to obtain the data ?

Personal computer	3 countries
Workstation	5 countries
Main frame	1 country
others	1 country (Minicomputer)

Some countries use 2 types of equipment.

Q1-4 What equipment would you use to process the data ?

Personal computer	2 countries
Workstation	3 countries
Main frame	3 country
others	1 country (Minicomputer)

A country uses 2 types of equipment.

Q2 Present status and outlook of Internet and ISDN service in your country.

Internet	
connected/accessible/available	4 countries
will be a node in this year	1 country
available within a year	2 countries
have a plan to establish	1 country

ISDN	
accessible/available	2 countries
will be available, but not to be used	1 country
available within a year	1 country
have a plan to establish	1 country

Q1-5 What products(area,layer,Valid time,etc) would you want to obtain?

GPV for Typhoon Analysis and Prediction	6 countries
all supplied data	6
GPV by Global Spectral Model(GSM)	8 countries
without detail	4
Area : global	1
global or definite	1
definite	3
without detail	3
Layer: included by supplied level	3
all supplied levels + 925hPa	2
without detail	3
Time level :	
+72h(12hourly) & +196h(24hourly)	1
+36h(6hourly) & +120h(12hourly)	1
+72h(6hourly)	1
+12h	1
+3days	1
without detail	3
GPV by Global Objective Analysis	1 country
all supplied data	1

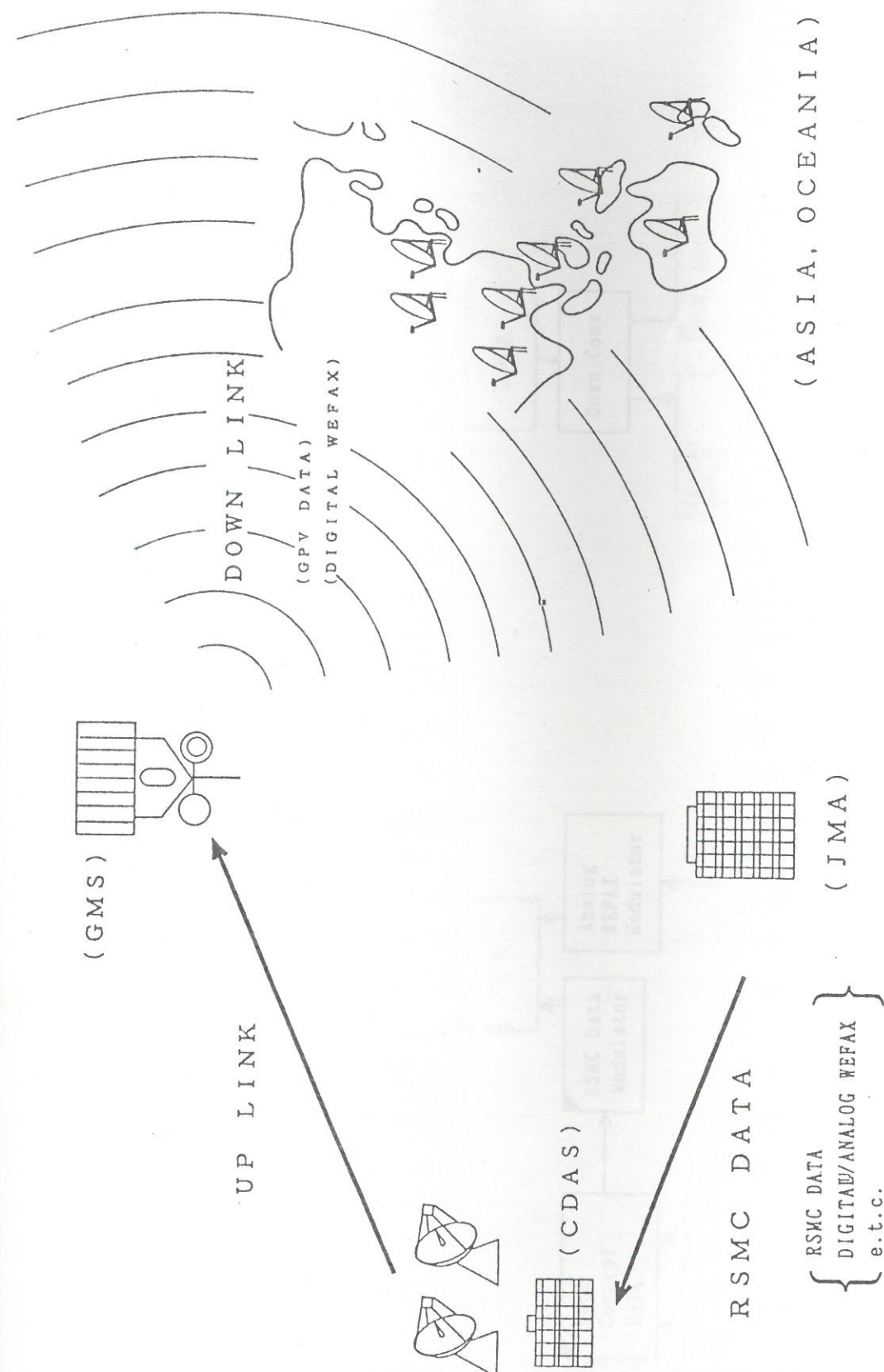
Q1-7 For what purpose would you use the products?

Weather forecast / Warning	4 countries.
Operation	2 countries
NWP	2 countries
Research	3 countries
Provision to Service Centers	1 country
If GTS is unavailable, as back-up	1 country
Distribution through GTS	1 country

Q1-8 What kind of the non-NWP products would you want to obtain from the system?

Global observational data :	
SYNOP,SHIP,TEMP,PILOT	3 countries
SATEM, SARAD, SATOB, ARFOR, AMDAR, WINTEN	1 country
Sea surface temperature(SST)(anomaly & monthly mean)	4 countries
Sea wave data	1 country
Snow-depth, Sea-ice information	1 country
SIGMET	1 country
Circumpolar 500hPa height/temperature analysis	1 country
Chart :	
Significant weather prognostic chart	1 country
Wave height chart	1 country
Flight level wind/temperature forecast chart	1 country
Weather forecast, Storm/Typhoon Warning,	1 country
Observation data if not received from GTS circuit	1 country

APPENDIX XX



GMS : Geostationary Meteorological Satellite
CDAS : Command and Data Acquisition Station
JMA : Japan Meteorological Agency

Fig. 1 RSMC DATA TRANSMISSION VIA GSM

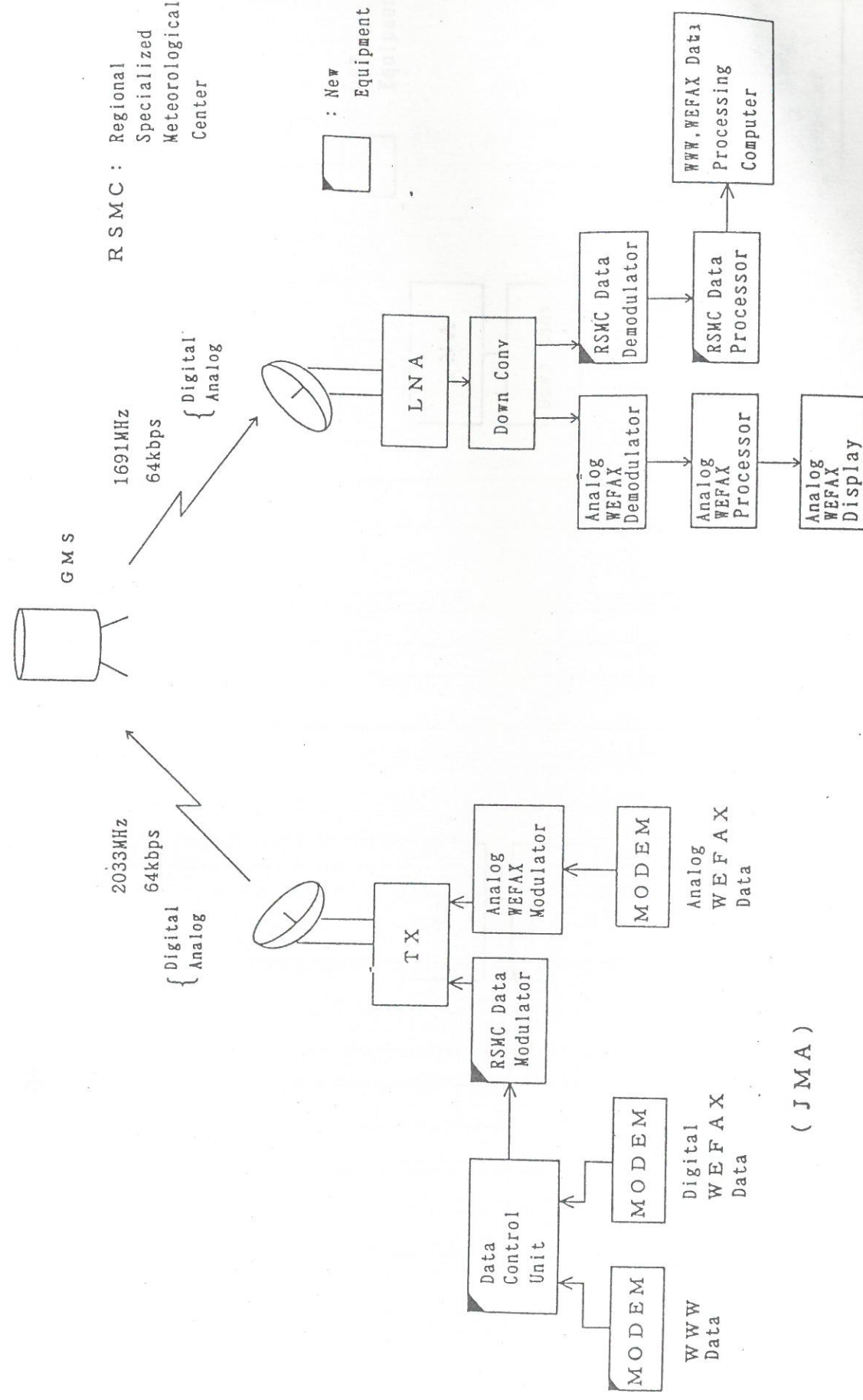
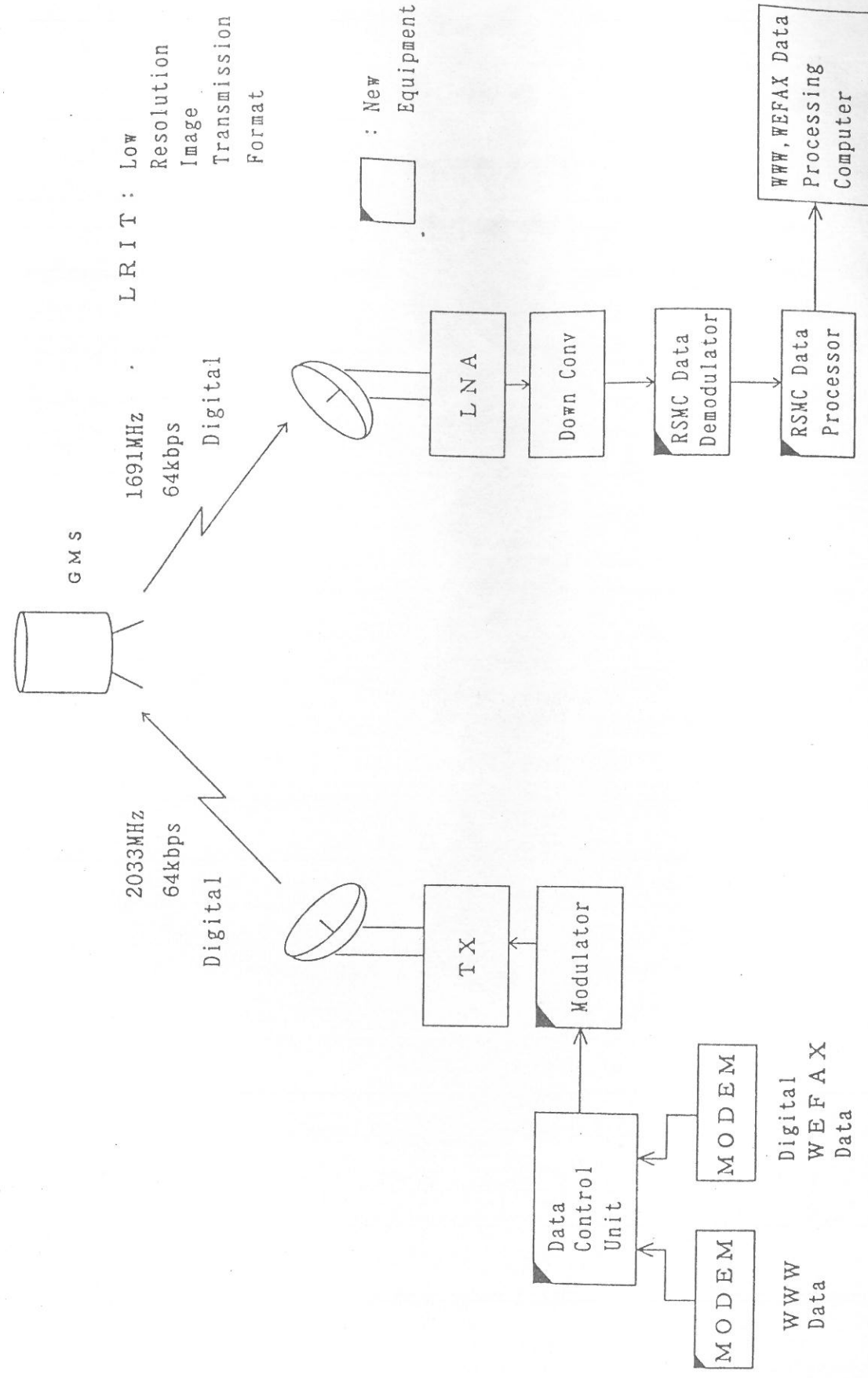


Fig. 2 GMS RSMC System Circuit
(Analog & Digital Parallel Operation)



(JMA)

Fig. 3 GMS LRIT System Circuit

ESCAP/WMO TYPHOON COMMITTEE TRUST FUND

Interim Account for the Biennium 1994/1995

As at 31 July 1994

	\$	\$
Balance of fund as at 1 January 1994		219,323
Advances received	36,000	
Other income	5,259	41,259
<u>Total revenue</u>		<u>260,582</u>
Less: Expenditure		
TCS Co-ordinator Services	9,000	
Administration Costs -- Local	3,937	
Administration Costs -- WMO	1,919	
Bank Charges	47	
Publications and Reports	1,782	
Missions		
<u>Total Expenditure</u>		<u>16,685</u>
<u>Balance at 31 July 1994</u>	\$	<u>\$ 243,897</u>

Represented by:

Cash at Bank	247,117
Less : Unliquidated obligations	<u>3,220</u>
	\$ <u><u>243,897</u></u>

Contributions received

	<u>1,994</u>	<u>1,995</u>	Total
Malaysia	12,000		12,000
Hong Kong	12,000		12,000
Macau	12,000		12,000
<u>Total</u>	<u>36,000</u>	<u>0</u>	<u>36,000</u>

ESCAP/WMO TYPHOON COMMITTEE TRUST FUNDInterim Account for the Biennium 1992/1993As at 31 December 1993

	\$	\$	\$
Balance of fund as at 1 January 1992		134,025	
Adjustment for cancellation of prior period obligations		<u>9,580</u>	143,605
Advances received	120,000		
Other income	<u>12,174</u>		<u>132,174</u>
<u>Total revenue</u>			275,779
Less: Expenditure			
Joint Session TC and Panel	1,841		
Administration Costs – Local	13,902		
Administration Costs – WMO	6,423		
Bank Charges	50		
Spectrum Technical Conference	9,749		
Support Seminar Forecasting – Nanjing	6,932		
Publications and Reports	12,538		
Missions	<u>5,021</u>		
<u>Total Expenditure</u>			<u>56,456</u>
<u>Balance at 31 December 1993</u>		\$	<u><u>219,323</u></u>

Represented by:

Cash at Bank		219,930
Less : Unliquidated obligations		<u>607</u>
	\$	<u><u>219,323</u></u>

<u>Contributions received</u>	<u>1,992</u>	<u>1,993</u>	<u>Total</u>
Malaysia	12,000	12,000	24,000
Thailand	12,000	12,000	24,000
China	12,000	12,000	24,000
Korea Rep. of	12,000	12,000	24,000
Japan	12,000		12,000
Macau		12,000	12,000
<u>Total</u>	<u>60,000</u>	<u>60,000</u>	<u>120,000</u>