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WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS SEVENTEENTH SESSION

**Manila, Philippines
4 - 10 December 1984**

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

Typhoon Committee
Seventeenth Session
4-10 December 1984
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I. ORGANIZATION OF THE SESSION

1. The seventeenth session of the Typhoon Committee was held at Manila from 4 to 10 December 1984.

Attendance

2. The session was attended by representatives of China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea, Thailand, and Viet Nam. Observers from Australia, Brunei, France, Federal Republic of Germany, Indonesia, the Union of Soviet Socialist Republics and the United States of America attended the session. Observers were also present from the United Nations Development Programme (UNDP), the Office of the United Nations Disaster Relief Co-ordinator (UNDRO), and the League of Red Cross and Red Crescent Societies (LRCS).

Opening Address

3. At the opening session, a welcome address was delivered by Dr. Roman L. Kintanar, Administrator, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). Dr. Emil C. Javier, Minister of the National Science and Technology Authority delivered the opening address. Messages from the Executive Secretary of ESCAP and the Secretary-General of WMO were read by the representatives of these organizations.

4. In extending a warm welcome to all the participants, Dr. Kintanar informed the Committee that he looked forward to the useful deliberations of the meeting which would definitely be beneficial to the region in general and to the Philippines in particular.

5. In his opening address, Minister Emil O. Javier warmly greeted and welcomed the representatives to the session. He pointed out that the Philippines was one of the countries most prone to typhoon attacks. As a result of the experience gained in coping with typhoon disasters, the Filipinos had developed certain qualities, - namely endurance, resilience and optimism - which had served them well in coping with the current difficult economic situation in the country. While noting with satisfaction the achievements of the Committee during its 16 years of existence which included the pooling of resources to detect, track and forecast typhoons, the establishment of flood forecasting and warning systems, exchange of information, experience and technology and provision of opportunities for training, he stressed that much more remained to be done and much assistance was still required. In closing, he thanked ESCAP, WMO, Japan, China and other international organizations and countries which had assisted the Philippines in its efforts to prevent and minimize typhoon damage.

6. In his message, the Executive Secretary of ESCAP expressed his thanks to the Philippine Government for its generosity in hosting the session of the Committee for the fifth time. Because of the recurrent and mounting flood damage in the region caused by typhoons, there was a need for the Typhoon Committee to marshal all conceivable and available technological, human and financial resources to minimize or prevent such damage. In this regard, he mentioned part of the support that ESCAP had extended to the Committee during 1984 through a project on flood-risk analysis which was a basic pre-requisite to and an important component of the comprehensive approach to flood loss prevention and management. He therefore expressed his satisfaction that the Committee had retained this activity in its updated medium- and long-term plan.

7. The representative of the Secretary General in his address highlighted some of the important questions that the session would have to examine with a view to arriving at suitable decisions or establishing a policy for the future. The first related to the merger of the Technical Support Unit (TSU) of the WMO/ESCAP Panel on Tropical Cyclones and the Typhoon Committee Secretariat and its location at central place in Southeast Asia. Such a merger was recommended by the Panel at its 11th Session (Maldives, February, 1984) for better programme

management of the two bodies and efficient use of resources. The other concerned a serious search by the Committee for alternative sources of funding for its activities including cash contributions by Members, in view of UNDP's intention to phase out programme and institutional support. The third matter related to the establishment of a Regional Centre for Tropical Disturbance Advisories as a continuation of the operational aspects of TOPEX, that had proved to be of mutual benefit to Members. He finally expressed the hope that constructive decisions could be arrived at on these questions.

Election of Officers

8. The Committee elected Dr. Roman L. Kintanar (Philippines) as Chairman and Mr. Luo Jibin (China) as Vice-Chairman. Mr. Luo Jibin also served as Chairman of the Drafting Committee.

Agenda

9. The Committee adopted the following agenda:

1. Opening of the session.
2. Election of officers.
3. Adoption of the agenda.
4. The Committee's activities during 1984:
 - (a) Meteorological component;
 - (b) Hydrological component;
 - (c) Disaster prevention and preparedness component;
 - (d) Training;
 - (e) Research.
5. Typhoon Operational Experiment (TOPEX):
 - (a) Report of the Evaluation Meeting;
 - (b) Report on the eighth and ninth session of the Management Board;
 - (c) Report on the TOPEX Sub-Experiment.
6. Medium- to long-term programme of the Committee.
7. Support for the Committee's programme.
8. Programme for 1985 and beyond.
9. Review of the 1983 and 1984 typhoon seasons.
10. Co-ordination with other activities of the WMO Tropical Cyclone Programme.

11. Consideration of the agenda for the eighteenth session.
12. Date and place of the eighteenth session.
13. Scientific lectures.
14. Adoption of the report.

II. THE COMMITTEE'S ACTIVITIES DURING 1984
(WRD/TC/17/1)

10. The Committee reviewed and evaluated the overall progress made in implementing its programme during 1984, as set out in document WRD/TC/17/1. Five components, namely, (a) meteorological, (b) hydrological, (c) disaster prevention and preparedness, (d) training and (e) research were discussed in detail.

A. Meteorological component
(Agenda item 4 (a))

11. The Committee noted with satisfaction that considerable progress had been made by members in improving their observing facilities and capabilities for typhoon forecasting and warning services, especially with the launching of the new geostationary meteorological satellite GMS-3 by Japan, the establishment of additional radars, and upgrading telecommunication speeds to 200 or 9600 bps between certain NMCs and the appropriate RTH.
12. Work on the TOPEX sub-experiment and in post-TOPEX operational activities as recommended by the Evaluation Meeting had been carried out effectively. During this period, China, Hong Kong, Japan and the Philippines made intensified surface and radar observations. These data and typhoon forecasts had been exchanged over the GTS using the WMO format. Reports on the sub-experiment were distributed to members.
13. The Committee's review covered meteorological satellites, upper-air observations, radar stations and the exchange of radar fixes, ocean weather ships and buoys, reconnaissance flights and meteorological telecommunications.
14. Japan had successfully launched a new Geo-stationary Meteorological Satellite (GMS-3) to replace GMS-2. Regular operation began in September 1984 providing vital information to ensure accurate typhoon positioning and improved forecasting and warning capabilities. The Committee expressed its gratitude to the Government of Japan for its effort in launching the new GMS-3 and also

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expressed the hope that GMS could be upgraded in the future with a capability for transmitting hourly pictures and platform data for the further improvement of the typhoon positioning and forecasting. The Committee requested the Japan Meteorological Agency (JMA) to provide as soon as possible information regarding the technical specifications of the proposed GMS-4 satellite in view of the importance of knowing whether the ground receivers being used by members could still be used to intercept information from GMS-4 without the need for drastic modifications.

15. In view of the fact that members of the Committee had experienced difficulties, particularly in typhoon positioning and forecasting, during the interruption of GMS operation, the Committee strongly recommended that members should make provision for a TIROS-N orbiting satellite receiver as a standby arrangement.

16. Most GMS or GMS-TIROS-N satellite ground receivers had functioned satisfactorily. However, some had received spare components through the UNDP supported regional typhoon programme for urgent repairs. As the performance of most satellite ground receivers had started to deteriorate as a result of age, more spare parts and test equipment would be needed for uninterrupted operation in the future.

17. The Committee welcomed the establishment of a spare parts depot system at TCS as planned by WMO to keep essential components to meet members urgent requirements for recommissioning of their equipment. The Committee requested WMO to make special efforts in seeking funds to make similar arrangements for radar and telecommunication equipment.

18. China acquired a new GMS-TIROS-N satellite ground receiving equipment through the UNDP national project. It was installed in Beijing and was operating satisfactorily. A new 10-cm radar equipped with Digital Video Integrating Processor (DVIP) had undergone a year of testing with excellent results. This prototype radar would be manufactured and would replace existing radars at Fuchou and some other stations. Application of the Constant Altitude Plan Position Indicator (CAPPI) device to the radars in China was planned. An Operation Manual based on experience gained during TOPEX would be used in China. Three strong wind anemometers were made locally, two being installed in coastal areas and one in the North-West of China. Surface and radar intensified observations were undertaken during the typhoon season in 1984. Upper-air intensified observations were scheduled in 1985. Redrawing of a vast volume of stream line charts for TOPEX was completed by China. They had been sent to WMO for printing and distribution to members.

19. The Royal Observatory, Hong Kong, established a new system to improve the accuracy of radar rainfall intensity estimation by using the newly installed radar and a number of automatic rainfall reporting stations.
20. In Japan, the 5-cm radar at Maze was renovated in March 1984.
21. In Malaysia, a new 10-cm radar was purchased in 1984 and would be installed in Butterworth in 1985.
22. In the Philippines, installation at the main forecast centre and airport office, of additional periphery devices such as colour-enhancement for display and picture animation for satellite cloud imagery was under consideration by PAGASA. A new 10-cm radar installed at Baler (98334) on the east coast of Luzon Island became fully operational in 1984. Installation of additional 10-cm radars at Busuanga in Palawan Island (South China Sea) and Tanay (near Manila) were underway. With a view to overcoming difficulties in getting the necessary supplies and consumables for upper-air observations, the Philippines planned to manufacture balloons locally.
23. In Thailand, two 5.6-cm radars were purchased in 1984 for installation at Chumphon and Songkhla in Southern Thailand in 1985. Installation of new upper-air ground equipment (403 MHZ OMEGA type) at Songkhla and Chiang Mai was completed. These become fully operational in September 1984.
24. As several members in the region continued to face difficulties in maintaining their electronic equipment to a satisfactory operational level due largely to a dearth of competent technicians to carry out proper maintenance and calibration, the Committee suggested more frequent visits of the Telecommunication and Electronics Expert of TCS to members to assist them in surmounting this problem.
25. In order to cope with the vast volume of data exchanged over telecommunication channels in the region, the following circuits had been upgraded.
- Tokyo- Hong Kong, Tokyo-Seoul, Tokyo-Bangkok
Tokyo-Manila, 200 bps, implemented in January,
March and October 1984, respectively,
Tokyo-Beijing, 9600 bps, September 1984.
26. With a view to improving the efficiency of data exchanges in the region, a computer model PDP 1144 was added to the existing computer in Beijing, China: 15 SSB transceivers were installed in Southern Thailand in September 1984

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- and an additional 15 SSB transceivers were also purchased to improve night-time data collection. Ten (10) SSB transceivers including test equipment and spare parts were provided to Viet Nam under the UNDP Regional Typhoon Programme.
27. In order to improve the telecommunication system and to ensure efficient data collection and transmission in the Philippines, a feasibility study was completed with the assistance provided by the Government of Japan. Final arrangements for its implementation were under consideration.
28. Recognizing that the reconnaissance flights being undertaken by the USA were vital and essential for typhoon warning purposes, the Committee, therefore, reiterated its strong hope that the operation of these reconnaissance flights would be continued by the USA in this region. The Committee, therefore, noted with appreciation the United States confirmation that it expected to continue to carry out meteorological reconnaissance flights in the typhoon area in the years ahead. The Committee also welcomed information from the USA that it was hoped that new updated instrumentation might be introduced in about five years time with possible new aircraft to replace existing aircraft in the 1990's.
29. The Committee revised the priority list established at its seventeenth session as shown below.

Priority list as revised by the Typhoon Committee at its
seventeenth session

Observing facilities

(a) Upper-air stations

98223 Laoag (Philippines))	12 GMT RS/RW national projects
98645 Cebu (Philippines))	External assistance needed
47187 Cheju (Rep. of Korea))	

(b) Weather radar

Xisha (China)	National/external assistance needed
Cheju (Republic of Korea)	National/External assistance needed
Tanay (near Manila, Philippines)	National project
Haiphong (Viet Nam)	External assistance needed
Vientiane (Lao PDR)	External assistance needed

(c) Satellite receiving equipment (GMS/TIROS-N satellite)

Hanoi (Viet Nam)	External assistance needed
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/Telecommunication

Telecommunication

(a) Improvement of national data collection facilities

Lao People's Democratic Republic)	
Philippines)	National/bilateral
Viet Nam)	projects/external
)	assistance needed

(b) Regional telecommunication links

Bangkok-Hanoi (new circuit)	National project
Beijing-Guanghou-Hong Kong	National/bilateral project

(c) Other telecommunication facilities

Thailand - Strengthening of RTH, Bangkok	National/external assistance Needed
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B. Hydrological component
(Agenda Item 4 (b))

30. The Committee reviewed the activities implemented under this component during the previous twelve months on the basis of the information provided in the documentation and reported at the session.

31. The Committee was pleased to note that steady progress had been made by several members in the installation of new flood forecasting and warning systems and in the upgrading of existing systems.

32. The development of a co-ordinated programme of activities on flood risk analysis and mapping was welcomed by the Committee, this being seen as an essential first step in any scheme for comprehensive flood loss prevention and management.

33. Activities on flood risk assessment and mapping had been included in the Committee's long-term plan as long ago as 1978, but it had only been in the last one to two years that it had been possible to prepare any specific plans for such activities. With the support of the Japan-ESCAP Co-operation Fund (JECF), ESCAP had fielded a mission in September-October 1984. This mission had visited members of the Typhoon Committee to advise on techniques for flood risk assessment and mapping and to select a demonstration area to which these techniques would be applied and which would serve as a pilot project for the benefit of all

/members.

members. The mission had recommended that the Upper Klang River Basin in Malaysia be selected for this purpose. The Committee endorsed this recommendation and Malaysia expressed its pleasure at being able to host the pilot project, particularly as it fitted well with planned and on-going related activities at the national level. It was hoped that the project could be implemented with the minimum of delay. Malaysia looked forward to the mission, composed of an expert from Japan and the TCS hydrologist, which would visit Malaysia early in 1985 to prepare detailed plans for the project. The Committee was also pleased to note that an expert group meeting would be organized by ESCAP in 1985 at which representatives of members would review the results of this activity on flood risk analysis with a view to recommending future action which may be necessary.

34. The Committee was informed of the close relationship that existed between WMO's support for the hydrological component of the Committee's activities and the Organization's Hydrology and Water Resources Programme. This had been further strengthened in September 1984 when WMO's Commission for Hydrology at its seventh session appointed a rapporteur who was requested, among other tasks, to assist in WMO's support of the Typhoon Committee over the next four years.

35. Another development of direct relevance to the work of the Committee was the agreement by UNDP to continue support for the development of the Hydrological Operational Multi-Purpose Sub-Programme (HOMS) in the region through 1985 and 1986. A recent meeting in Bangkok (October, 1984) had laid plans for a series of sub-projects in this regard, half of which related to flood forecasting and all of which foresaw the participation of members of the Typhoon Committee.

36. In China, two booklets entitled Standards for Hydrological Information and Forecasting, and Standards for Hydrological Telemetry Systems had been prepared for publication as an aid to the effective implementation of flood forecasting work. Efforts were being made to improve the flood forecasting systems on a number of major rivers. A national conference on automation of hydrological measurement and forecasting systems was held in Beijing in November 1984 for the purpose of reviewing past experience and developing plans for future work.

37. Hong Kong had recently improved the flash flood warning system originally installed in 1983. A storm water management model (SWMM) was expected to be installed in late 1984 as a HOMS activity which would involve participation by experts from other members of the Typhoon Committee.

38. In Japan, twenty radar raingauge systems would be operated in future, covering almost the whole of the country. In the Tokyo area, information based on the radar raingauge system was being broadcast on television everyday for public information. As of the end of March 1984, information as to the areas inundated by past floods in 120 river basins had been made public for use in work on comprehensive flood loss prevention and management. Furthermore, estimates were being prepared of these areas which might be inundated in the future. Consideration was being given to the establishment of an information center, for further improvement of effective information management to meet increasing demands by the public for various kinds of information concerning river basins. Sustained efforts were being made to collect accurate basic hydrological data, such as that on rainfall and stream discharges, and to improve the usefulness of radar raingauges and sophisticated computer systems in flood forecasting and warning.

39. In the Philippines, the first stage of the project on the establishment of flood forecasting and warning systems for the efficient operation of dams in Luzon was expected to commence in early 1985. This stage concerned the construction of systems for two out of five of the major dams in Luzon.

40. Flood forecasting and warning systems would be completed in Sabah and Sarawak in Malaysia in 1985.

41. In the Republic of Korea, the basic investigation for the establishment of a flood forecasting system has begun on the Nagdong River Basin and the installation was expected to be completed in 1986.

42. The Government of Thailand was considering the construction of medium-sized dams in the upper part, and pumping facilities in the lower part, of the Pasak River Basin. This made it more than ever important that the flood forecasting activities on the Pasak River be strengthened for which external assistance would be required.

43. Consideration was being given to the establishment of a pilot flood forecasting and warning system on the Ka River in Viet Nam.

/C. DISASTER

C. Disaster prevention and preparedness (DPP) component
(Agenda item 4 (c))

44. The Committee reviewed the activities under this component of its programme as described in document WRD/TC.17/1 and noted the following additional information.

45. Members continued to report on damage caused by typhoons and floods using a standard format prepared with the help of UNDRO and LRCS, in order to further improve the gathering of disaster damage statistics. As requested at its sixteenth session, additional information was incorporated in this format, especially on meteorological information such as typhoon track, amount of rainfall, etc.

46. The Committee was informed that a meeting held at Jamaica in November 1984, sponsored by the USAID, had demonstrated an increasing interest in disaster prevention and preparedness as opposed to past attention which had been devoted primarily to relief activities.

47. The Japanese Government undertook the establishment of mudflow forecasting and warning systems as part of comprehensive mudflow countermeasures. Under the DPP component Japan placed emphasis on research on science and technology, disaster prevention, land protection and disaster rehabilitation. In July 1984, in order to strengthen disaster countermeasures, a "Disaster Prevention Bureau" was set-up in the Land Agency. The central disaster prevention telecommunication network which connects some prefectural governments and the central government will be completed in 1985. Also communication between the city governments and residents had been improved as part of the campaign to improve warning dissemination and information.

48. In Malaysia, work had also been progressing on disaster prevention and preparedness, with the organization of the National Flood Control Programme which is charged with taking measures before, during and after the occurrence of disasters involving flooding. Evacuation centres had also been identified which are capable of giving care and protection for the whole country.

49. In the Philippines, two sets of guidelines were disseminated to DCC's in disaster prevention and preparedness activities, one in connection with tropical cyclones entering the Philippine area of responsibility (PAR) and the other with respect to flooding. The responsibilities of agencies involved in disasters had also been identified in cases before, during and after their occurrences. Brochures on flood conditions, as part of public education and information, would be ready for distribution by 1985.

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50. In this connection, the Committee was informed that the theme for the 1985 World Meteorological Day "Meteorology and Public Safety" would be an opportune time to convince governments to consider disaster prevention and preparedness as factors in national planning. The TCS was requested to co-ordinate with members, other agencies and institutions in carrying out case studies of events in which DPP programmes could be shown to have resulted in the mitigation of damage. The studies could then be used as evidence in getting government support for this programme. As a step in the development of this programme members had adopted the use of a common format for damage assessment.

D. Training component
(Agenda item 4 (d))

51. The Committee reviewed and noted the activities under this component of its programme as described in document WRD/TC.17/1.

52. The Committee was pleased to note a number of training events organized during the year in which members had participated. In addition to those listed in the document, the following had also been organized:

(a) Seminar in Technology disaster prevention, Tsukuba, Japan, 27 September to 15 December 1984;

(b) Training course on river engineering, Tokyo, July to November 1984;

(c) Postgraduate course in Hydrology, Department of Engineering, University College, National University of Ireland, Galway, Ireland, starting 1 October 1984.

53. The Committee was informed in addition of the following meetings or courses organized by WMO:

(a) Technical meeting on flood forecasting in Asia, Bangkok, Thailand, 24-27 October 1984;

(b) HOMS workshops,

(i) Madras, 24-28 September 1984;

(ii) Bangkok, 29-31 October 1984;

(c) Regional Training course on application of Remote Sensing Techniques to Flood Plan Zoning, Bangkok, Thailand, 22 October to 9 November 1984;

(d) RA-V Working Group on Hydrology (1st session), Quezon City, Philippines 26-30 November 1984; and

(e) Workshop on Water Resources assessment activities, Quezon City, Philippines, 29 November to 1 December 1984.

54. The Committee was also pleased to note the national training activities conducted by members as described in the document.

55. At its sixteenth session, the Committee had considered that the attachment of personnel to advanced centres to observe and study new systems and techniques was another method of acquiring skills. Some members indicated their willingness to accept such attachments, provided the cost of doing so would be met from external sources. The requirements set by members for such attachments were distributed during the session.

56. The Committee expressed its gratitude to the Government of Japan for organizing group training courses for members of the Committee, as well as other agencies and organizations and that such training opportunities, in addition to those new programmes, be made available in the future for members of the Committee.

57. In the light of the dearth of training opportunities in DPP, the Committee also expressed its desire that with the assistance of WMO, ESCAP, UNDRO and LRCS, efforts be made to create more opportunities for training in disaster prevention and preparedness.

E. Research component
(Agenda item 4 (e))

58. The Committee reviewed the activities under this agenda item described in document WRD/TC.17/1, and noted the following additional information.

59. The WMO Ninth Congress (1983) and subsequent sessions of the Executive Council had emphasized the importance of promoting tropical cyclone research and supported a proposal by CAS to organize a Workshop on Tropical Cyclones, to be held in Bangkok in November 1985. It would be the first tropical cyclone workshop bringing together researchers and forecasters from all cyclone-affected regions. The Committee felt that this type of workshop is very useful and recommended that one research meteorologist and one operational forecaster from each member of the Committee should attend. It expressed the view that all possible sources of funding should be tapped for that purpose. The Committee noted with satisfaction that excellent facilities were being provided by the host government for the workshop.

60. Studies on the numerical prediction of storm tracks were being undertaken in China using numerical simulation. In other studies, the three-dimensional typhoon structure parameters used in the 5-level primitive equation forecasting model had been improved to facilitate understanding of the interaction between storms and the sub-tropical high. Studies had also been made on irregular tracks of tropical storms, using a synoptic-diagnostic analysis of "S" shape track, binary storm rotation and looping track. Off-shore storm formation and development through the calculation of the thermal wind vorticity of the upper- and lower levels of air flow had also been studied. Case studies on torrential rainfall associated with storms were also being made, using TOPEX data.
61. In Japan, storm water reduction measures based on the infiltration system were applied in the field. Research on rainfall forecast by utilizing radar is underway. Two reports "Technology for disaster prevention, Vol. 8" and "Final report of the Seminar on technology for disaster prevention Vol. 7" were sent to members by Japan.
62. Research was underway in Malaysia using the TOPEX data set and attempts were being made to develop a long-range forecast of the onset of the monsoon based on studies of the characteristics of the "southern oscillation".
63. The Committee was informed that the Philippine proposal to establish a Regional Natural Disaster Center (for Asia) which had been initially fully supported at the fifth meeting of ASEAN Experts on Natural Disasters held in Singapore in October 1983 would now revert to the original proposal for a national center.
64. The Committee took note of the information presented by the Soviet delegation on the scientific studies carried out in the USSR on the problem of tropical meteorology. The Committee noted the readiness of the USSR to co-operate with members in the Committee's programme and to expand co-operation in tropical cyclone studies based upon the first and second operational experiments of TOPEX. It was also willing to train specialists in meteorology by providing WMO Voluntary Co-operation Programme scholarships, and to provide experts to develop national meteorological services and to participate in joint international experiments. The USSR was also willing to provide the TCS and members with information and publications on the problems of tropical meteorology.

III. TYPHOON OPERATIONAL EXPERIMENT (Agenda item 5)

A. Report on the Evaluation Meeting (WRD/TC.17/2)

65. The Committee examined a summary of the report of the Evaluation Meeting for TOPEX which had been held in Tokyo from 12-16 March 1984. The main purpose of that meeting had been to review the results of the operational phase of TOPEX and to make recommendations for the application of its lessons to the Committee's future programme.
66. It was noted that the Evaluation Meeting had considered reports submitted by individual participating members and also by the Co-ordinators of the three components of TOPEX and that a large number of technical and scientific presentations had been made. On the basis of that material, the meeting had concluded that TOPEX had been highly successful and that it was desirable to build upon the progress made during the experimental period by further vigorous action. The many recommendations made for each of the components of TOPEX were discussed in detail by the Typhoon Committee.
67. Participating members reported on the action they had taken to implement the recommendations during the 1984 typhoon season. Although there remained deficiencies in national systems, TOPEX activities had been very useful in defining them and there was an evident need to continue the work necessary to overcome them. It was suggested that it would be useful to set priorities to the extent possible and the Committee decided to reconsider this matter when dealing with agenda item 6 medium- to long-term programme of the Committee.
68. It was noted that it had not been possible for the Evaluation Meeting for TOPEX to study the outcome of the Hydrological Component in any detail because the activities under the component had only very recently terminated. However, as recommended by the Evaluation Meeting, it had been arranged for those who had been involved in these activities to attend the WMO Technical Meeting on Flood Forecasting in Asia (Bangkok, 24-27 October, 1984) and to review in some detail a draft report on the Hydrological component. WMO expected to publish the final version of this report in early 1985. Both the Evaluation Meeting and the Technical Meeting made proposals for activities that might be undertaken by the Typhoon Committee as a follow-up to this component of TOPEX. These were endorsed by the Committee and incorporated, as appropriate, in its programme for 1985 and the medium- to long-term plan. In particular, it invited those members who had been monitoring their flood forecasting systems during

TOPEX to continue to do so, and all members who wished to do so to designate and monitor additional systems, using a water year of 1 April to 31 March and the same procedures as during TOPEX, amended as recommended by the Technical Meeting on Flood Forecasting in Asia. In addition, it was felt that one very effective means of exchanging experience and transferring technology in this field would be by means of visits between members of the experts involved, possibly in the form of study tours, visiting the forecasting systems currently being monitored. Financial support might be sought from UNDP.

B. Report on the eighth and ninth session of the Management Board (WRD/TC.17/3)

69. The Committee considered a summary of the reports of the eight and ninth sessions of the Management Board for TOPEX held in Tokyo, respectively, in December 1983 and March 1984. In endorsing the reports, the Committee gave attention to two specific matters referred to it for decision by the Board. The first of these concerned the Board's proposal that, with the end of the operational phase of TOPEX, it would be preferable to incorporate the Sub-Experiment into the research component of the Committee's programme. The Committee agreed that as its medium- to long-term plan (1984-1992) already provided for post-TOPEX research the Sub-Experiment itself could be discontinued. It was further agreed that the activities under the research component should be closely co-ordinated with the activities being pursued by the WMO CAS Working Group on Tropical Meteorology.

70. The second question referred to the Committee by the Board was that of its own future. In the report of its ninth session the Board had pointed out that its terms of reference called for it to manage all phases of TOPEX from planning to evaluation of the results. It, therefore, considered that it had completed its task with the successful conclusion of the Evaluation Meeting. The Committee concurred with this view and decided that the Management Board should be dissolved. It wished to record its appreciation to all members of the Board for the excellent work they had performed and, especially, to the Chairman (Mr. I. Shimizu) who had guided the Board's work with great skill and understanding.

71. In relation to the TOPEX period mention was made of the value of the focal points designated by members for each of the components. They had proven their worth as a direct channel of communication, thus speeding up action and

/facilitating

facilitating co-operation between members. In the light of this experience, it was proposed that the system of focal points used during TOPEX should be continued by the Committee in its further work. WMO was requested to take the steps necessary to maintain the system.

C. Report on the TOPEX Sub-Experiment (WRD/TC.17/4)

72. A document by the Co-ordinator of the research activities under the TOPEX Sub-Experiment (Dr. T. Kitade) was submitted to the Committee on his behalf by the representative of Japan. It provided information on the status of these activities up to October 1984, and included progress reports on 15 studies being carried out by members of the Typhoon Committee. Some of the studies made direct or indirect use of TOPEX observational data.

73. The Committee noted with satisfaction that most members of the Typhoon Committee had already designated research correspondents. Attention was again, as in past years, focussed on the need for research activities not to be confined to meteorology but to cover the entire spectrum of the Committee's programme. It was consequently the view of the Committee that there should be a Co-ordinator of the research activities for each of the three main components of the programme; namely the meteorological, the hydrological, and the disaster prevention and preparedness components. The Committee further felt that it was desirable to set forth the functions of the Co-ordinators and established an ad hoc group to draw up these functions. They are given below, as adopted by the Committee:

(i) To maintain close contact with focal points (or research correspondents);

(ii) To collect and disseminate information regarding activities relevant to the component for which he is the Co-ordinator;

(iii) In collaboration with focal points (or research correspondents) to suggest regional projects which might be carried out individually or jointly by members;

(iv) To report to the annual session of the Typhoon Committee on his activities.

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74. During the discussion of this item reference was made to some more general considerations arising from the Typhoon Operational Experiment. It was thought that TOPEX, and the evident success it had achieved, provided an excellent example of the way in which the application of limited additional resources could lead to significant improvements in the typhoon forecasting and warning system and, thus, to measurable economic benefits. The Committee proposed that a special publication be prepared, not for scientists but for administrators and laymen, to demonstrate convincingly to governments the benefits to be gained by improved services. It was suggested that a detailed comparison of the situation before and after TOPEX, perhaps on a country basis, with figures, would constitute a convincing argument.

75. The Committee requested the Co-ordinator of the TCS to raise this question with WMO with a view to finding a way in which a suitable publication could be prepared and produced. It was further suggested that the target date for its availability should be 30 June 1985.

IV. MEDIUM- TO LONG-TERM PROGRAMME OF THE COMMITTEE (Agenda Item 6)

76. The Committee recalled that its medium- to long-term plan had been accepted in principle at its sixteenth session although some changes and amendments were felt to be desirable. A list of the points calling for changes had been compiled by that session. It had been considered that the work required to amend the plan could be carried out by correspondence without the need to reconvene the working group that had prepared the initial version of the plan. The Committee had also decided that the views of members should be sought between sessions on any other changes required.

77. The Committee accordingly reviewed the plan in the light of the consultations that had taken place in the interval since the sixteenth session. A revised version of the plan incorporating the changes agreed upon is given in Annex I.

78. The Committee also gave further consideration to the recommendations adopted at the Evaluation Meeting for TOPEX. It decided to endorse these recommendations as given in the report of that meeting.

/V. SUPPORT

V. SUPPORT FOR THE COMMITTEE'S PROGRAMME (Agenda item 7) WRD/TC.17/6

79. The Committee considered document WRD/TC.17/6 which reviewed the support required for institutional arrangements and the programme activities.

Institutional Support

80. The Committee considered the recommendation of the WMO/ESCAP Panel for the merger of the TSU and the TCS and its location at a place in Central South-East Asia. It felt that the present secondment of experts to the TCS would not be assured if the TCS was combined with the TSU and relocated out of Manila. A question was also raised as to whether a single secretariat could service two independent intergovernmental bodies. Furthermore, considering the different regional character of two inter-governmental bodies, and the satisfactory support provided by the TCS to Members, the Committee decided to maintain the status quo and retain the TCS in Manila. It therefore did not endorse the recommendation of the WMO/ESCAP Panel on Tropical Cyclones.

81. The Committee however as a step towards further collaboration with the Panel Members could call on the expert services of TCS staff during their travel on duty in Panel countries.

82. The representative of UNDP stated that the question of a combined secretariat for the Panel on Tropical Cyclones and the Typhoon Committee was a matter for the two intergovernmental bodies to decide. He stressed, however, that while UNDP had always advocated the efficient utilization of UNDP resources, this should not be the paramount consideration of the Committee in making a decision on this matter. He also confirmed that UNDP would respect the wishes of members and that the Committee's decision one way or other would not affect future UNDP support to the Committee.

83. With regard to the staffing of the TCS, the Philippines agreed to provide a co-ordinator for the TCS for another year. The Philippines also agreed to provide a meteorologist for a further period and facilities for the TCS at Manila. The Committee was informed that Japan would continue to provide the services of a hydrologist for the TCS.

84. The Committee expressed its gratitude to the Philippines for providing the co-ordinator, the meteorologist, and facilities for the TCS, and to Japan for providing a hydrologist.

85. As regards the attachment of an expert in disaster prevention and preparedness to TCS, the Committee noting the heavy loss of life and damage in the area during the 1984 typhoon season, felt that expert services on at least a part-time basis were highly desirable. It further noted that an UNDRO expert had visited the area after a recent typhoon to assist. The Committee requested UNDRO and LRCS to help in meeting these needs to the greatest possible extent. Advice might also be provided by short-term experts under TCDC arrangements.

86. The Committee noted that the services of the telecommunications and electronics expert was being continued with UNDP support till June 1986 and expressed its appreciation for this support by UNDP.

87. The Committee considered the question of annual cash contributions by members for institutional support to its programme in the light of the long-term management of its activities.

88. The Committee noted that among the regional and subregional institutions established under the aegis of ESCAP, the Typhoon Committee was the only body to which the members did not make any annual cash contributions, considered that it was time for the members to consider the matter seriously. In response to a query as to the procedure involved in making cash contributions to such bodies, the Committee was informed that one possibility would be to make pledges either at the annual session of the Committee or during the annual ESCAP Commission session. It was agreed that members would bring this matter to the attention of their respective governments for study and consideration.

Programme support

89. The Committee was informed that ESCAP had allocated \$67,300 from the JECF for a project on the improvement of disaster prevention systems based on risk analysis of disasters arising from typhoons and heavy rainfall.

90. The representative of UNDP confirmed that his organisation had approved \$426,000 for the project RAS/84/054 "Programme support for the Typhoon Committee" for the years 1985-86. The Committee noted that this represented an increase over the sum of \$312,000 earmarked for the project in 1983, for the two years, and was the result of strong representations made by the Committee for additional support and the positive recommendations of the UNDP evaluation mission carried out in May 1984.

/91. The

91. The UNDP recognised that Members attached great importance to the work of the Typhoon Committee, and that they had made important contribution in terms of facilities and services in the various areas of the programme activities. The considerable inputs by UNDP in the past had made it possible for members to obtain funding nationally for improved tropical cyclone forecast and warning systems. The UNDP recognised that it would be a long while before members could rely on their own resources, independently of UNDP support, to realize the objectives of the programme.

92. In view of the above, the representative of the UNDP was pleased to inform the Committee that his organisation was prepared to provide an additional \$100,000 to the \$426,000 approved for the project for 1985-86.

93. As for continuation of UNDP support after 1986, this would depend on circumstances prevailing at that time, and a willingness on the part of members to increase their country inputs to meet the institutional and operational requirements of the programme. Members were also urged to impress on Aid Co-ordinators in their respective countries the importance of the programme for increasing their forecasting and warning capabilities. This would give the project a higher status and priority and enable UNDP to allocate it further resources.

94. The Committee expressed its deep appreciation to the UNDP for the additional support provided for 1985-86, and was encouraged by prospects of continued assistance beyond 1986.

95. The Committee was informed of the possibility of utilizing TCDC arrangements to carry out operational and research activities over a wider area of its programme including exchange visits of experts between members. It decided to extend these arrangements for training and accordingly requested the TCS to (a) carry out an enquiry among members and compile a list of their training requirements by 31 March 1985, and (b) circulate the list among members with a view to finding which of them was able to meet the requirements stated.

96. The possibility of tapping the private sector for support was also considered. The Committee recognised that this could be a lengthy and time-consuming process with the results not easily predictable. It nevertheless requested the WMO and TCS to pursue this source of funding and expressed the hope that it would lead to positive results.

/VI.

VI. PROGRAMME FOR 1985 AND BEYOND
(Agenda item 8)

97. In considering its programme for 1985 and beyond, as set out in document WRD/TC.17/7, the Committee took into account the ongoing programme of work and the modified medium- to long-term programme it had adopted.

98. The programme for 1985 and beyond adopted by the committee is given in Annex II. The Committee urged members to make every effort to implement them to the extent that resources are available, with the assistance of TCS.

99. The Committee considered a proposal to establish a Regional Centre for Tropical Disturbance Advisories in the region.

100. The Committee agreed that this new idea and concept was worth considering but would require time for preparation and study by the members since it involved the questions of funding, equipment and staffing as well as a demonstration of the need for the Centre and its end-products. Moreover, it was necessary to resolve the matter of priority when considering the allocation of resources between requirements for upgrading national capabilities and establishing a regional center.

101. The representative of UNDP reminded the Committee of the position of his organization on the subject of institutional support and advised the Committee that UNDP would take a very cautious attitude towards the establishment of this internationally staffed centre.

102. It was agreed that the proposal would be developed in more detail in order to enable the members to study the matter more thoroughly.

VII. REVIEW OF THE 1983 AND 1984 TYPHOON SEASONS
(Agenda item 9)
(WRD/TC.17/8)

103. The Committee discussed the proposal put forward by Hong Kong for the production of an annual publication which would provide information on the typhoon season, its effects on members and on the Committee's activities during the previous year.

104. The Committee was firmly of the view that the idea was excellent and important not only to give wider publicity to the Committee and boost its image but also for members to use in seeking greater support from their governments. The Committee accordingly decided to go ahead with the preparation of such an annual publication and considered ways of producing and financing it.

105. The Committee was pleased to accept an offer by Hong Kong to designate a Chief Editor of the Editorial Board who would work in close co-operation with editors designated by each member. National editors would be responsible for providing information on each of the five components of the Committee's programme for inclusion in the publication.

106. It was also pointed out that some similar material is published once a year in the ESCAP Water Resources Journal. Attention was drawn to the need to avoid duplication with that publication.

107. As regards the cost of printing the Committee's annual review, it was recognized that no provision existed at present in the approved budgets at either ESCAP or WMO. During the discussion the representative of UNDP indicated that the project supporting the Committee's programme might be a source of funding for this purpose and that further consideration could be given to the question during the Tripartite Review scheduled to take place during the seventeenth session.

108. A summary report on the damage caused by typhoons and floods during the typhoon seasons of 1983 and 1984 was distributed to all participants during the session.

VIII. CO-ORDINATION WITH OTHER ACTIVITIES OF THE
WMO TROPICAL CYCLONE PROGRAMME
(Agenda item 10)
(WRD/TC.17/9)

109. The Committee's discussion of this item was based on the information contained in the "Tenth Status Report on the Implementation of the WMO Tropical Cyclone Programme". This annual publication described activities and developments under both the general and regional components of the TCP. This information was noted by the Committee.

110. In considering whether the present arrangements for the co-ordination of activities and exchange of information between the regional cyclone bodies were satisfactory, the view was expressed that it was desirable at each session for there to be representation of the other bodies. It was recalled that arrangements had already been agreed to this effect by each of the four cyclone bodies. However, difficulties of funding the travel sometimes precluded attendance, as at the current session of the Committee.

IX. CONSIDERATION OF THE AGENDA FOR THE EIGHTEENTH SESSION
(Agenda item 11)

111. The Committee agreed that it would no longer be necessary to include TOPEX in the agenda for the eighteenth session.

112. It was suggested that the scientific lectures should include the DPP component possibly with the assistance of UNDRO and LRCS. The subject could be on the experience gained by the experts of these bodies during their missions to the region.

113. It was also suggested that more time - possibly one whole day - should be allowed for scientific lectures or exchange of scientific information. While this was considered a good idea, its realization would depend on the time and expertise available without extending the usual period of the meeting. To accommodate this suggestion, evening sessions could be held for the scientific lectures.

114. The Committee requested the ESCAP and WMO secretariats, in close consultation with TCS, to prepare the detailed agenda for the eighteenth session taking the above suggestions into account.

X. DATE AND PLACE OF THE EIGHTEENTH SESSION
(Agenda item 12)

115. The representative of China extended an official invitation to the Committee to hold its eighteenth session in China. The Committee in accepting this gracious and kind invitation expressed its thanks and deep appreciation to the Government of China. The date and place would be determined later in consultation among China, ESCAP, WMO and the TCS.

XI. SCIENTIFIC LECTURES
(Agenda item 13)

116. The following scientific lectures were presented by Dr. Robert C. Sheets, Hurricane Specialist, National Hurricane Center, Miami, Florida, USA.

(a) The National Weather Service Hurricane Probability Programme.

(b) A new Technique for Tracking Hurricanes and Impacts on Forecast Tracks.

117. The Committee expressed its thanks to the lecturer for his interesting presentations.

/XII.

XII. ADOPTION OF THE REPORT
(Agenda item 14)

118. The Committee adopted its report on 10 December 1984.

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TYPHOON COMMITTEE: MEDIUM- TO LONG-TERM PLAN (1985-1992)

HYDROLOGICAL COMPONENT	Medium Term		Long-Term					IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92	
I. FLOOD FORECASTING AND WARNING									
(i) Establishment and operation of new flood forecasting and warning system;									Includes real-time data collection and hydrological modelling.
(ii) Monitoring of performance of existing flood forecasting systems;									Using standard TOPEX monitoring and forecast accuracy formats, as amended.
(iii) Improvement of existing flood forecasting and warning systems, making use, where appropriate, of the results of TOPEX.									By members at national level with bilateral or multi-lateral support if available, e.g. UNDP. Technical co-operation between Committee members will also be used (TDC).
(iv) Establishment and operation of flood forecasting and warning systems for dam operations;									By members, co-ordinated by WMO and with support of ICS and WMO.
(v) Establishment and operation of flood forecasting and warning systems for inundation from storm surges;									By members at National level with bilateral or multi-lateral support if available, e.g. UNDP. Technical co-operation between Committee members will also be used (TDC). - ditto -
(vi) Missions of experts to provide technical guidance on items (i), (iii), (iv) and (v).									- ditto -
(vii) Exchange of technical visits among flood forecasters;									At the request of members, with bilateral and multi-lateral support (e.g. UNDP).
(viii) Development of guidance on hydrological technology, including hydrological models, for tropical cyclone regions.									At the request of members, co-ordinated by WMO.
									By WMO, in consultation with members, on the basis of OHP (HOMS). With UNDP support if available.

TYPHOON COMMITTEE: MEDIUM- TO LONG-TERM PLAN (1985-1992)

HYDROLOGICAL COMPONENT	Medium Term		Long-Term					IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92	
II. COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT									
1) Establishment of pilot area for comprehensive flood loss prevention and management by each member;									
(i) Investigation and survey including:									
a) Determination of flood prone areas subject to heavy damage;									
b) Determination of magnitude and corresponding frequency of floods in each flood-prone area;									
c) Assessment of potential flood damage in each area for various flood magnitudes;									
d) Preparation of flood risk maps.									
(ii) Preparation of comprehensive plans;									
(iii) Implementation of selected aspects of comprehensive plans;									
2) Mission of experts to provide technical guidance to members on item (i).									

Detailed programme will be established by respective members.

At request of members, with bi-lateral or multi-lateral support if available.

TYPHOON COMMITTEE: MEDIUM- TO LONG-TERM PLAN (1985-1992)

HYDROLOGICAL COMPONENT	Medium Term		Long-Term					IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92	
3) Flood risk analysis and mapping in demonstration area(s);									
(i) Collection of data and information and land survey;									
(ii) Flood risk analysis and mapping;									
(iii) Preparation of guidelines and manuals;									
(iv) Workshop on flood risk analysis and mapping;									
(v) Extension to other areas.									
III. URBAN STORMWATER MANAGEMENT									
(i) Missions of experts to provide technical guidance on the appreciation of numerical models.									

TYPHOON COMMITTEE: MEDIUM- TO LONG-TERM PLAN (1985-1992)

DISASTER PREVENTION AND FIREARMS COMPONENT	Medium Term		Long-Term					IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92	
I. PUBLIC AWARENESS									
(i) Improvement of public awareness, coupled with studies of human response warnings;									
(ii) Production of materials related to public information and education;									
II. DISASTER MANAGEMENT									
(i) Establishment/updating of prevention and preparedness plans at different levels.									
(ii) Strengthen coordination and cooperation between departments/agencies;									
(iii) Improvement of communication systems for warning dissemination and relief operations;									
(iv) Improved damage assessment and reporting;									
(v) Development and exchange of information and guidance materials on structural and non-structural measures for mitigating disasters									
(vi) Case studies of response to major disasters;									

Work under the WMO TCP Projects 12 and 14 is also relevant.

DISASTER PREVENTION AND PREPAREDNESS COMPONENT	Medium Term		Long-Term					IMPLEMENTATION	REMARKS	
	85	86	87	88	89	90	91			92
(vii) Joint missions to evaluate DPP procedures and to provide advice on local problems;	---	---	---	---	---	---	---	---	→	At request of members with bi-lateral or multi-lateral support if available.
(viii) Establishment of disaster research and training institutes.	---	---	---	---	---	---	---	---	→	National with bi-lateral or multi-lateral support if available.
(ix) Publication and information on Typhoon Committee activities.	---	---	---	---	---	---	---	---	---	WMO/ESCAP/TCS.
III. <u>REGIONAL CO-OPERATION</u>										
(1) Study of enhanced co-operation among members.	---	---	---	---	---	---	---	---	---	Study to be carried out by TCS in consultation with TC members and UNDRD/LRCS.

TRAINING COMPONENT	Medium Term						Long-Term				IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92				
I. <u>METEOROLOGY</u>			↑								Conferences, seminars and overseas training programmes through external support, including roving missions and TCDC arrangements.	
(i) Engineering applications of tropical cyclone climatological data;		↑									TCS to provide on-the-job training by its electronics experts.	
(ii) Applications of radar and satellite data in tropical cyclone tracking, forecasting and very short-range precipitation forecasts;											Short-term fellowships with external support	
(iii) Calibration, maintenance and repair of electronic meteorological instrumentation;			↑								At the request of the TC annual seminars of about one month and roving missions (1985 and 1987) could be provided if the fund would be available for this purpose. It is desirable that necessary fund could be provided by UNDP, UNDEO and other international organizations concerned.	
(iv) Software for integrating satellite/radar/rainfall data;											Continuation of group training courses of about 4 months provided by the Japan International Co-operation Agency.	
(v) Quantitative Precipitation Forecast (QPF) models;												
(vi) Tropical cyclone forecasting:												
(vii) Meteorology												

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TYPHOON COMMITTEE: MEDIUM- TO LONG-TERM PLAN (1985-1992)

RESEARCH COMPONENT	Medium Term						Long-Term					IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92					
- storm surge in estuaries : - typhoon warning services for oil-rigs and small platforms. (11) Exchange of information on research activities; b) <u>Post-TOPEX Research</u> (1) Utilization of TOPEX data set (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modelling, and with the aim of improving existing methods of predicting formation, development and steering; (11) Establishment and operation of a tropical cyclone data bank for the Western Pacific and East Asia with compatible software exchanges between members. (111) Development of an operational NWP model for typhoon movement and development. (11) Research on irregular tracks of tropical cyclones such as sudden turning of tracks, looping and binary.											Mainly through national or regionally coordinated programmes. Activity centres may be identified to serve as focal points for a few priority items. National and bi-lateral with support of international organizations. Mainly through national efforts but TC to coordinate and obtain funds to facilitate post-TOPEX research activities. There would also be a need for short-term attachment programmes to enable scientists to carry out research at the various institutes in TC members which have such facilities. TCS to examine existing facilities and to draw up master plan for consideration of members. Members of Committee. Members of Committee.		

TYPHOON COMMITTEE: MEDIUM- TO LONG-TERM PLAN (1985-1992)

RESEARCH COMPONENT	Medium Term		Long-Term					IMPLEMENTATION	REMARKS
	85	86	87	88	89	90	91	92	
II. <u>HYDROLOGY</u>									
(i) Research and study on comprehensive flood loss prevention and management;									Mainly through national or regionally coordinated programmes.
(ii) Research and study on flood risk analysis including flood risk mapping;									
(iii) Review of the existing flood runoff models and development of appropriate models for the region;									
(iv) Further study on application of meteorological input in flood forecasting;									
(v) Comparison of the performance of the different models using the Post-TOPEX data set (Post-TOPEX Res.)									
III. <u>DISASTER PREVENTION AND PREPAREDNESS</u>									
(i) Studies on socio-economic impact of disasters;									National with advice of UNDR0/LRCS/ESCAP/WMO. - ditto - - ditto -
(ii) Vulnerability and risk assessment of disaster prone areas;									
(iii) Socio-economic implications of inaccurate typhoon and flood forecasts and warning.									

ANNEX II

PROGRAMME FOR 1985 AND BEYOND

(a) Meteorological component

- (i) Operation and maintenance of electronic equipment (R/W, radar, radar picture transmission, satellite receiving and telecommunication equipment),
- (ii) Establishment of new radar stations at key locations in the Philippines, the Republic of Korea and Viet Nam,
- (iii) Replacement and/or upgrading of old radar sets in Malaysia, the Philippines, the Republic of Korea and Thailand,
- (iv) Provision of equipment and spare parts for weather radar and satellite data receiving stations,
- (v) Establishment and improvement of satellite data receiving stations for reception of cloud imagery and other data from GMS and TIROS-N satellites,
- (vi) Installation of a computer processing system at selected locations with a view to integrating satellite, radar and rainfall data so as to provide a spatial distribution of rainfall amounts over a large region,
- (vii) Review of national data collection facilities and data exchanges needed for typhoon warning services, taking remedial measures when necessary,
- (viii) Review of existing arrangements for dissemination of typhoon warnings with a view to introducing improvements, where necessary,
- (ix) National collection of tide gauge and water level data for use in storm surge prediction,
- (x) Promotion of interdisciplinary co-operation and research at the interface between the meteorological and disaster prevention and preparedness components,
- (xi) Conducting studies on human response to warnings,
- (xii) Improvement of the operation of those centres with responsibilities for the provision of processed information needed by Committee members for their forecasting and warning systems,

- (xiii) Enhancement of co-operation in typhoon monitoring, forecasting and warning,
- (xiv) Planning of measures to be taken within the Committee's programme to identify and conduct studies, in association with the Integrated WWW System Study, which would assist in defining a cost-effective best mix of observing systems in support of typhoon forecasting and warning,
- (xv) Provision or improvement of meteorological and telecommunication facilities included in the priority list established by the Committee,
- (xvi) Monitoring of data exchange on existing point-to-point telecommunication circuits with a view to their improvement where necessary,
- (xvii) Enhancement of Typhoon Committee members' facilities for reception/dissemination of meteorological information with automation and upgrading of GTS centres to accommodate higher-speed data transmissions,
- (xviii) Improvement of data completeness and quality, including real-time and non-real-time monitoring,
- (xix) Procurement and installation of equipment and spare parts for telecommunication, radar, satellite data receivers, etc., under the UNDP fund for 1985,
- (xx) Development of instruments to meet specific needs in tropical cyclone areas,
- (xxi) Undertaking and exchange of intensified observations (surface, upper-air and radar), to the extent possible typhoon forecasts, including products of different objective methods in accordance with the TOPEX Operational Manual,
- (xxii) Commissioning of a comprehensive study on ways to provide adequate data over tropical-cyclone-prone ocean areas,
- (xxiii) Continued execution of the Sub-Experiment items incorporated into the Research Component of the Committee's programme.

//(b) Hydrological

(b) Hydrological component

- (i) Establishment of flood forecasting and warning systems in the Nam Ngum and Se Bang Hieng River basins in the Lao People's Democratic Republic, the Pasak River basin in Thailand and one river basin to be selected in Viet Nam,
- (ii) Further improvement of existing flood forecasting and warning systems in China, Malaysia, the Philippines and the Republic of Korea,
- (iii) Monitoring of performance and forecast accuracy of existing flood forecasting systems,
- (iv) Exchange visits by experts to flood forecasting systems being monitored, possibly in the form of study tours,
- (v) Organizing missions by experts to provide technical guidance on item (i) and (ii) at the request of members, with bilateral or multilateral support if available, making use where appropriate of technology available through HOMS,
- (vi) Establishment and operation of flood forecasting and warning systems for dam operations in the Philippines,
- (vii) Development of guidance on hydrological technology, including hydrological models, in consultation with members on the basis of the OHP(HOMS),
- (viii) Develop and use improved techniques for QPF, taking advantage of data provided by satellite and radar,
- (ix) Investigation, survey and study of the pilot area selected for comprehensive flood loss prevention and management,
- (x) Conducting a preliminary survey and formulation of detailed implementation programme for flood risk analysis and mapping in a demonstration area(s) including an expert group meeting with multilateral support,
- (xi) Collection data and information, and land surveys for flood risk analysis and mapping in a demonstration area(s) through national efforts of hosting member(s) of project and on request, with multilateral and bilateral support,

//(xii) Organizing

- (xii) Organizing missions by experts to provide technical guidance to members on item (vi) at the request of members, with bilateral or multilateral support if available,
- (xiii) Review of the existing arrangements for dissemination of flood warnings with a view to introducing improvements, where necessary.

(c) Disaster prevention and preparedness component

- (i) Taking follow-up to foster disaster prevention and preparedness with reference to the recommendations made by relevant mission,
- (ii) Taking follow-up action on the Philippine project to establish a Philippines training and research centre for disaster prevention and preparedness, through consultancy services where appropriate,
- (iii) Improvement in the dissemination of timely warnings of typhoons, floods and storm surges, with particular attention to remote areas,
- (iv) Compilation of information on loss of human life and damage caused by typhoons, including damage to houses, public facilities, agricultural products, etc.,
- (v) Promotion of interdisciplinary co-operation and research programmes among the meteorological, hydrological and disaster prevention and preparedness components,
- (vi) Improvement of public awareness on storm warnings, coupled with studies of human response, to warnings,
- (vii) Establishment/updating of disaster prevention and preparedness plans at different levels,
- (viii) Strengthening national co-ordination and co-operation between departments/agencies involved in disaster prevention and preparedness activities,
- (ix) Improvement of communication systems for warning dissemination and relief operations,
- (x) Improvement of damage assessment and reporting,
- (xi) Development and exchange of information and guidance materials on structural and non-structural measures for mitigating disasters,

/(xii)

- (xii) Conducting case studies on major disasters,
- (xiii) Organizing joint missions to evaluate disaster prevention and preparedness procedures and to provide advice on local problems,
- (xiv) Promoting enhanced co-operation among members on disaster prevention and preparedness matters,
- (xv) Provision of advice and assistance in the field of training in disaster prevention and community preparedness, through consultancy services where appropriate,
- (xvi) Production of materials related to public information and education on the activities of the Typhoon Committee, particularly storm warning and disaster prevention and preparedness,
- (xvii) Establishment of disaster research and training institutes.

(d) Training

- (i) Organization of one month typhoon forecast training at Guanzho or Shanghai, China. Members may send one or two persons to attend the training,
- (ii) Organization of training in radiosonde manufacturing in China for PAGASA, the Philippines,
- (iii) Organization of seminars on the socio-economic impact of disasters, vulnerability and risk assessment and technology for disaster prevention,
- (iv) Training of personnel through fellowships under UNDP, TCDC, VCP or other bilateral schemes on: (a) tropical cyclone forecasting, (b) meteorology, (c) flood loss prevention, (d) river engineering, (e) technology for disaster prevention, and (f) maintenance of electronic equipment,
- (v) Training by TCS staff assisted by counterpart staff in meteorology, hydrology and electronics, in particular the calibration, maintenance and repair of electronic equipment, including on-the-job training,
- (vi) Exchange of information and identification of training facilities available among WMO members in areas of concern and survey of available fellowship and scholarship assistance,

/(vii)

- (vii) Participation in study tours and seminars relevant to the Committee's programme organized by members or international bodies,
- (viii) Organization of training courses/seminars with bilateral/multilateral assistance on (a) flood forecasting, (b) disaster prevention and preparedness, (c) socio-economic impact of disasters, (d) disaster vulnerability and risk assessment, (e) meteorology, (f) hydrology, and (g) electronics,
- (ix) Provision of short-term fellowships with external support on:
 - (a) utilization of software for integrating satellite/radar/rainfall data, (b) quantitative precipitation assessment and forecast models, (c) storm surge and wave prediction, (d) flood forecasting,
- (x) Exploration of the possibility of: (a) providing facilities for training of personnel in disaster prevention and preparedness, (b) flood loss prevention, and (c) establishment of a Typhoon Committee training centre for the maintenance of electronic equipment,
- (xi) Exchange forecasters between tropical cyclone forecasting and warning centre.

(e) Research

- (i) Stimulation of research activities through consultancy services, visits of study groups and exchange visits by research personnel,
- (ii) Promotion of the exchange of information on typhoon-related research activities and their results, including development outside the region,
- (iii) Encouragement of co-operation in the study of typhoon-related topics, among researchers in the field of meteorology, hydrology and social sciences,
- (iv) Initiation and/or continuation of research on the following topics,

/1. In

1. In meteorology

- (a) Utilization of TOPEX data sets (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modelling with the aim of improving existing methods of predicting formation, development and steering,
- (b) Establishment and operation of a typhoon data bank for the western Pacific and East Asia with compatible software exchange between members,
- (c) Development of an operational numerical weather prediction model for typhoon movement and development,
- (d) Methods of typhoon location and accuracy,
- (e) Development mechanism and forecasting,
- (f) Disastrous weather associated with typhoons,
- (g) Objective forecasting of precipitation,
- (h) Meso- and micro-scale weather systems related to typhoons,
- (i) Interaction between typhoons and the tropical circulation,
- (j) The possibility of extended track forecasting methods,
- (k) Sensitivity of objective methods to initial data distribution and quality,
- (l) Compilation of a forecasters' guide for western north Pacific typhoon prediction.

2. In hydrology

- (a) Research and study on comprehensive flood loss prevention and management,
- (b) Research and study on flood risk analysis, including flood risk mapping,
- (c) Review of the existing flood run-off models and development of appropriate models for the region,
- (d) Further study on application of meteorological inputs to flood forecasting.

3. In disaster prevention and preparedness

- (a) Studies on the socio-economic impact of disasters,
- (b) Vulnerability and risk assessment of disaster-prone areas,
- (c) Socio-economic implications of inaccurate typhoon and flood forecasts and warnings.

4 December 1984

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

Typhoon Committee
Seventeenth session
4-10 December 1984
Manila

ORDER OF THE DAY

Tuesday, 4 December 1984

1000-1200 hours

TINDALO ROOM, MANILA HOTEL

1. Opening Remarks by Vice-Chairman of Typhoon Committee for 1984, Mr. Ho Tong Yuen
2. Welcome Address and Introduction of Guest of Honor by Dr. R.L. Kintanar, Administrator, P.A.G.A.S.A.
3. Address by Minister Emil Q. Javier, National Science and Technology Authority
4. Message of Mr. S.A.M.S. Kibria, Executive Secretary of ESCAP to be delivered by Mr. A. S. Manalac
5. Address by Mr. K. Rajendram, Representative of Secretary-General of the World Meteorological Organization

 INTERVAL 15 MINUTES

6. Election of Officers
7. Adoption of the agenda
8. Agenda item 4. The Committee's activities during 1984:
 - (a) Meteorological component

1330-1630 hours

9. Agenda item 4(a) - Continued
10. Agenda item 4(b) - Hydrological component

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

Typhoon Committee
Seventeenth session
4-10 December 1984
Manila

TENTATIVE PROGRAMME

Tuesday, 4 December 1984

0900-0945 hours

Registration

1000-1200 hours

Opening session

Agenda item 2 - Election of officers

Agenda item 3 - Adoption of the agenda

Agenda item 4(a) - Meteorological
component

1330-1630 hours

Agenda item 4(a) - Continued

Agenda item 4(b) - Hydrological
component

Agenda item 4(c) - Disaster prevention
and preparedness
component

Wednesday, 5 December 1984

0900-1200 hours

Agenda item 4(d) - Training

Agenda item 4(e) - Research

Agenda item 5(a) - Report on the
Evaluation Meeting

1330-1630 hours

Agenda item 5(b) - Report on the 8th
and 9th sessions of
the Management Board

Agenda item 5(c) - Report on the TOPEX
Sub-Experiment

Agenda item 6 - Medium- to long-term
programme of the
Committee

Thursday, 6 December 1984

0900-1200 hours

Agenda item 6 - Continued

Agenda item 8 - Programme for 1985
and beyond

Agenda item 7 - Support for the
Committee's programme

1330-1630 hours

Agenda item 9 - Review of the 1983
and 1984 typhoon
seasons

Agenda item 10 - Co-ordination with other
activities of the WMO
Tropical Cyclone
Programme

Agenda item 11 - Consideration of the
agenda for the 18th
session

Agenda item 12 - Date and place of the
18th session

Friday, 7 December 1984

0900-1200 hours

Agenda item 13 - Scientific lectures

Saturday, 8 December 1984

0900-1200 hours

Drafting Committee

Monday, 10 December 1984

0900-1200 hours

Agenda item 14 - Adoption of the report

Closing session

ON THE OPENING OF THE SEVENTEENTH SESSION OF THE
TYPHOON COMMITTEE, 4 December 1984

The tropical cyclone is frequently described as the most devastating natural phenomenon. According to the Mariners Worldwide Climatic Guide, an annual average of 25.3 typhoons and near-typhoon-strength storms develop in the Western North Pacific region. Within the Philippine Area of Forecast Responsibility, an average of 19 tropical cyclones develop yearly and about half of these attain typhoon intensity. Associated with the typhoon phenomena are strong winds, flooding, storm surges, and mountainous waves. Needless to say, the economies of our countries suffer great setback whenever a strong typhoon comes by, not to mention the loss of lives which we suffer. The Philippines, recently experienced three devastating storms. Tropical Storm Maring of August 27-30 caused widespread flooding in Northern Luzon causing 53 deaths and about ₱72 million damage. This was followed by Typhoon Nitang of August 31 to September 4, which crossed the Visayas causing 1652 deaths and ₱2 billion damage. And lately, we had Typhoon Undang of November 3 to 6 also crossing the Visayas leaving 630 dead or missing and damage of about ₱200 million.

It is our fortune as well as our misfortune to be located in the most prolific typhoon producing region of the world. While it is true that tropical cyclones bring us our much needed rains, at times, much more than we wish would happen, they overdo their beneficent job of rainmaking, and bring more destruction than benefit. While we cannot outlaw destructive

typhoons, we can do something to minimize their destructive effects. Thus international associations such as the Typhoon Committee are perhaps the best weapons we can devise to combat their destructive effects. The weapon I refer to here is joint effort coupled with sharing of resources and technology, and exchange of ideas on how best we can strengthen our defenses against these phenomena.

I understand that the Typhoon Committee have formulated five aspects as components under which you have directed your joint efforts. Under the meteorological component, you have pooled your resources to watch, track, and forecast the development and movement of tropical storms within our common region. I am pleased to note that your recently concluded Typhoon Operational Experiment or TOPEX has brought about closer coordination in the matter of exchange of observations and typhoon forecasts. Under the hydrological component, you have exerted great efforts to strengthen your defenses against floods. The Philippines have been able to set up four flood forecasting systems in four of our largest river basins in Luzon, with the assistance from the Typhoon Committee. I understand that similar flood forecasting and flood management systems are also being developed in your countries with guidance and technical assistance from the Typhoon Committee. Under the Disaster Prevention and Preparedness Component you have jointly formulated surveys and plans of action by which you may minimize and mitigate the effects of disasters caused by typhoons and floods. Under the Training

Component, you have jointly pursued efforts of training your personnel on the business of tracking and forecasting tropical cyclones, and under the research component, you have pursued common research efforts to better understand the typhoon phenomena and improve your methods of dealing with its destructive effects.

Recently, the Philippine Meteorological Service, or PAGASA, has been transferred to the National Science and Technology Authority from the Ministry of National Defense. I consider this as a significant change because the basis upon which a meteorological service operates is science and technology. My Ministry will, therefore, fully support and assist the scientific and technological development of PAGASA not only in its efforts to strengthen our defenses against typhoons, but also in harnessing the science of meteorology for our economic development. This, I am sure, is a great challenge to our people in the meteorological service, but I fully appreciate the helping hand, and technological assistance made available to us by our neighboring meteorological services. I wish to mention in particular the Japan Meteorological Agency and the Meteorological Service of the People's Republic of China. The commendable interest which our colleagues from Thailand, ^{South Korea,} Malaysia, ^{and other members of this Committee} and Hong Kong, in solving common problems of our meteorological services are also worthy of notice.

We, people engaged in the business of science to improve our quality of life, are aware that we cannot cope with the demands of our increasing population if we work alone. We have to work

together, and this 17th session of the Typhoon Committee is indeed our avenue of working together. May I wish you a most fruitful and innovative meeting.

PROGRESS REPORT OF THE TYPHOON COMMITTEE
(For the period July to November 1984)

G E N E R A L

The main activities of the Committee during the period centered on the execution of post-TOPEX programmes suggested by the Evaluation Meeting for TOPEX held in March 1984 at Tokyo.

Intensified observations applied on to surface and radar were carried out by China, Hong Kong, Japan, the Philippines and the Republic of Korea during typhoons which entered an specified observation range. These data and typhoon forecast information were disseminated through GTS.

With the assistance of Japan Meteorological Agency (JMA) valuable data sets containing surface, radar, upper-air, ship, aircraft and satellite information collected at International Centre for TOPEX at Tokyo during the TOPEX period were distributed in the microfilm and magnetic forms not only to members of the Typhoon Committee but also made available to WMO members at its reproduction cost of US\$10,000.

The members have since been using these data in undertaking various special studies in accordance with the guidelines set out for the sub-experiment of the Committee. Its preliminary reports presented by members of sub-experiment were reported to the seventeenth session of the Typhoon Committee.

During the second part of 1984, a number of typhoons struck the Typhoon Committee region that caused tremendous damage to members, particularly the Philippines and Viet Nam suffered most severe losses to lives and properties. The representatives from UNDRO and the meteorologist of TCS had undertaken damage survey

and study the nature of destruction, efficiency of warning dissemination, human responses, disaster prevention and preparedness measures, etc. for references.

Survey was conducted jointly by the hydrologist of TCS and ESCAP consultant with the assistance provided under the Japan-ESCAP Co-operation Fund on improvement of natural disaster prevention systems based on flood risk analysis approaches. Survey mission visited Hong Kong, Malaysia, the Philippines, the Republic of Korea, Thailand and Viet Nam to assess the possibility of implementing flood risk analysis programme.

The hydrologist of TCS participated in the technical meeting on Flood Forecasting in Asia during 24 - 27 October 1984 and also Regional Work-shop on Planning and Implementation of HOMS in Asia and the South-West Pacific during 29 -31 October both held at Bangkok

METEOROLOGICAL COMPONENT

A new GMS-3 meteorological satellite was successfully launched by the Japanese Government to replace the obsolated GMS-2 satellite in August 1984, and has been put into regular operation to provide vital satellite information since September 1984. Members of the Typhoon Committee as such greatly benefited from the reception of GMS-3 data to ensure accurate and timely typhoon warning services.

With a view to cope with the need of exchanging vast volume of meteorological data between the members, the following telecommunication circuits were upgraded:

Bangkok-Tokyo, Manila-Tokyo with 200 bps in October 1983; and, Beijing-Tokyo with 9600 bps in September 1984.

To assist in improving national data collection system in Viet Nam, 10 sets of SSB transceivers with test equipment and spare parts were provided under the UNDP Regional Programme.

In Thailand, two sets of new 5.6 cm. radars were installed at Chumphon and Songkhla in Southern Thailand.

China acquired a new GMS-TIROS-N satellite ground receiving equipment through UNDP national project, installed in Beijing and has been used satisfactorily. A locally made new 10-cm radar equipped with DVIP device became operational after one year test showed reliable results.

The Royal Observatory, Hong Kong established a new system to improve the accuracy of radar rainfall intensity estimation by using the newly installed radar and number of automatic rainfall reporting station.

In the Philippines, a new 10 cm radar installed at Baler (98234), east coast of the Luzon Island became fully operational. Installation of additional 10-cm radars at Busuanga in Palawan Island (South China Sea) and Tanay (near Manila) were underway.

The telecommunication and Electronics expert rendered his assistance in calibration and repair of the radars and satellite ground receivers and also obtained spare parts and test equipment through WMO for urgent need of recommissioning some member's equipment.

HYDROLOGICAL COMPONENT

Continued efforts have been made to establish and/or

improve the flood forecasting and warning system in the major river basins in China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea, Thailand and Viet Nam.

In Hong Kong, processing of data from the network of automatic telemetering raingauges was improved and a storm water management model, SWMM, in the form of a HOMS component was installed.

In Japan, the Government started the establishment of mudflow forecasting and warning system in the hilly mudflow risk areas as part of comprehensive mudflow countermeasures. Seven radar rain gauge stations were operated so as to obtain more accurate rainfall data, including areal rainfall, areal distribution of rainfall and its movement and additional radar rain gauge stations were under construction.

In Malaysia, flood forecasting and warning systems in Sabah and Sarawak were completed.

In the Philippines, the Government has completed detailed designs for the establishment of flood forecasting and warning systems for the efficient operation of major dams in the country and is now taking the necessary steps for their construction.

In Thailand, in order to improve flood forecasting in the Pasak River basin, the Government is considering establishing three additional water level and rainfall telemetering stations.

In Viet Nam, the Government is considering the establishment of a pilot flood forecasting and warning system in the Ka River basin.

In addition to the improvement of flood forecasting and warning systems, some members began studies on flood risk analysis

and mapping which is the first step in estimating the flood risk and applying measures for comprehensive flood loss prevention and management in the areas vulnerable to floods. In support of this activity, a project on flood risk analysis and mapping was initiated under the Japan-ESCAP Co-operation Fund whereby a roving mission was dispatched to the TC members to select a demonstration area for the project, with the view of improving disaster prevention system through risk analysis of natural disasters related to typhoons and heavy rainfall. The Upper Klang River basin in Malaysia was selected as demonstration area among the TC members.

DISASTER PREVENTION AND PREPAREDNESS (DPP) COMPONENT

Members continued to report on damage caused by typhoons and floods on standard format developed with the help of UNDRO and LRCS to improve gathering damage statistics.

The Royal Observatory of Hong Kong continued to take the major leading role in collaborating with other government departments and voluntary organizations in fighting natural disasters by issuing and disseminating timely warnings on hazardous weather conditions. Also with the view to avoiding delays and minimizing transmission errors, dissemination of severe weather warning/advisory bulletins from the Royal Observatory where standard warning terminologies and precautionary announcements were pre-stored in disk; forecasters can then recall various forms for interactive warning preparation on a video display monitor so as to shorten warning preparation time.

In the Philippines, public information boards (PIBs) giving information on weather, flooding, etc. were installed at places frequently visited by the public. Further, as part of its information and education campaign, the office of Civil Defense prepared different information materials such as "Facts of Civil Defense", Barangay Disaster Manuals, "Disaster Manual on Establishments", "Calamities and Disaster Preparedness Plan", "How to Assess Disaster Damage", and posters on points to remember in case of a disaster.

In Thailand, continued progress was made in the establishment of a Civil Defense School, to take charge of training volunteers and to undertake case studies on disaster prevention and preparedness.

TRAINING COMPONENT

Members of the Committee availed of a number of training activities organized either under UNDP, WMO/VCP, bilateral or multilateral scheme during the period, on the following:

- (a) Hydrological techniques course, Denver, Colorado ,
12 June to 10 August 1984;
- (b) Training courses on hydrological forecasting, University of
California, Davis, United States of America, 25 June to 7
September 1984;
- (c) Tropical meteorology and tropical storm forecasting,
University of Miami, United States of America, 27 February
to 4 May 1984;
- (d) Seminar in Technology disaster prevention, Tsukuba, Japan,
27 September to 15 December 1984;
- (e) Training course in Meteorology, Tokyo, Japan, 29 September
1983 to 30 January 1984;
- (f) Meteorological telecommunications technicians, India
12 March to 30 June 1984;
- (g) Training programme on geologic and hydrologic hazards,
United States of America, 5 to 30 March 1984;
- (h) Group training course in meteorology, Tokyo, 27 September
1984 to 28 January 1985;
- (i) International course for hydrologists, Delft, the
Netherlands, September 1984 to July 1985; and
- (j) Postgraduate course in Hydrology, Department of Engineering,
University College, National University of Ireland, Galway,
Ireland, starting 1 October 1984.

In addition, WMO organized training and related activities that enhanced the technical and scientific capabilities of participants from members, as follows:

- (a) Technical meeting on flood forecasting in Asia, Bangkok, Thailand, 24-27 October 1984;
- (b) HOMS workshops:
 - (i) Madras, 24-28 September 1984;
 - (ii) Bangkok, 29-31 October 1984;
- (c) Regional Training course on application of Remote Sensing Techniques to Flood Plain Zoning, Bangkok, Thailand, 22 October to 9 November 1984;
- (d) RA-V Working Group on Hydrology (1st session) Quezon City, Philippines, 26-30 November 1984; and
- (e) Workshop on Water Resources Assessment activities, Quezon City, Philippines, 29 November to 1 December 1984.

A number of national training activities were conducted by members by way of enhancing the technical scientific capabilities of their staff.

RESEARCH COMPONENT

Members continued efforts to expand their research activities not only on the meteorological and hydrological components but also on disaster prevention and preparedness. Appreciable progress has also been undertaken on the studies made by the Sub-Committee on the Sub-experiment of TOPEX based on the data collected during the operational phase of TOPEX.

In Hong Kong, an objective index to assess the potential of tropical cyclonegenesis has been developed and tested operationally. Objective methods to forecast tropical cyclone movement were also tested, including a statistical synoptic method and modified persistence-climatology method. Alternative ways of making use of space mean geopotential data were investigated. Composite background fields associated with various categories of tropical cyclones were also evaluated.

In the Philippines, three technical papers have been completed, on subject matters as objective analysis of the wind field, improvement of typhoon track forecasting and on recognizing days suitable for seeding, which were ready for publication. A number of on-going research work were also being undertaken not only on the meteorological and hydrological aspects but also on and related subjects on disaster prevention and preparedness (DPP)

PROBLEMS

Most of members of the Typhoon Committee have acquired, in recent years, quite a number of highly sophisticated electronic equipment such as satellite receivers and radars which are vital, from the point of view of collection of meteorological information, to ensure reliable weather forecasts and typhoon warnings in particular. However, some of members have been experiencing serious difficulties in getting necessary spare parts on time to meet the urgent need for recommissioning their equipment due to mainly the restriction of foreign exchange and/or because of tedious purchasing procedures.

Some members also have been experiencing shortage of trained technicians in maintaining their electronic equipment to a satisfactory operational level from time to time.

To surmount the above-mentioned problems members stressed their desire of assistance through the Regional Typhoon Programme in providing adequate number of essential spare components and test equipment to meet their urgent need for timely recommissioning of the equipment without long interruption. Members suggested that long term training programmes should be organized to assist members to be able to avail electronics technicians in their need. Some members has also requested TCS to arrange frequent visit of their Telecommunication and Electronics expert to render the assistance in providing on-the-job training in maintenance, calibration and repair of the electronics equipment.

PROGRAMME FOR 1985 AND BEYOND

(a) Meteorological component

- (i) Operation and maintenance of electronic equipment (R/W, radar, radar picture transmission, satellite receiving and telecommunication equipment,
- (ii) Establishment of new radar stations at key locations in the Philippines, the Republic of Korea and Viet Nam,
- (iii) Replacement and/or upgrading of old radar sets in Malaysia, the Philippines, the Republic of Korea and Thailand,
- (iv) Provision of equipment and spare parts for weather radar and satellite data receiving stations,
- (v) Establishment and improvement of satellite data receiving stations for reception of cloud // imagery and other data from GMS and TIROS-N satellites,
- (vi) Installation of a computer processing system at selected locations with a view to integrating satellite, radar and rainfall data so as to provide a spatial distribution of rainfall amounts over a large region,
- (vii) Review of national data collection facilities and data exchanges needed for typhoon warning services, taking remedial measures when necessary,
- /(viii)

- (viii) Review of existing arrangements for dissemination of typhoon warnings with a view to introducing improvements, where necessary,
- (ix) National collection of tide gauge and water level data for use in storm surge prediction,
- (x) Promotion of interdisciplinary co-operation and research at the interface between the meteorological and disaster prevention and preparedness components,
- (xi) Conducting studies on human response to warnings,
- (xii) Improvement of the operation of those centres with responsibilities for the provision of processed information needed by Committee members for their forecasting and warning systems,
- (xiii) Enhancement of co-operation in typhoon monitoring, forecasting and warning,
- (xiv) Planning of measures to be taken within the Committee's programme to identify and conduct studies, in association with the Integrated WWW System Study, which would assist in defining a cost-effective best mix of observing systems in support of typhoon forecasting and warning,
- (xv) Provision or improvement of meteorological and telecommunication facilities included in the priority list established by the Committee,
- (xvi) Monitoring of data exchange on existing point-to-point telecommunication circuits with a view to their improvement where necessary,

/(xvii)

- (xvii) Enhancement of Typhoon Committee members' facilities for reception/dissemination of meteorological information with automation and upgrading of GTS centres to accommodate higher-speed data transmissions,
 - (xviii) Improvement of data completeness and quality, including real-time and non-real-time monitoring,
 - (xix) Procurement and installation of equipment and spare parts for telecommunication, radar, satellite data receivers, etc., under the UNDP fund for 1985,
 - (xx) Development of instruments to meet specific needs in tropical cyclone areas,
 - (xxi) Undertaking and exchange of intensified observations (surface, upper-air and radar), to the extent possible typhoon forecasts, including products of different objective methods in accordance with the TOPEX Operational Manual,
 - (xxii) Commissioning of a comprehensive study on ways to provide adequate data over tropical-cyclone-prone ocean areas,
 - (xxiii) Continued execution of the Sub-Experiment items incorporated into the Research Component of the Committee's programme.
- (b) Hydrological component
- (i) Establishment of flood forecasting and warning systems in the Nam Ngun and Se Bang Hieng River basins in the Lao People's Democratic Republic, the Pasak River basin in Thailand and one river basin to be selected in Viet Nam,
 - /(ii)

- (ii) Further improvement of existing flood forecasting and warning systems in China, Malaysia, the Philippines and the Republic of Korea,
- (iii) Monitoring of performance and forecast accuracy of existing flood forecasting systems,
- (iv) Exchange visits by experts to flood forecasting systems being monitored, possibly in the form of study tours,
- (v) Organizing missions by experts to provide technical guidance on item (i) and (ii) at the request of members, with bilateral or multi-lateral support if available, making use where appropriate of technology available through HOMs.
- (vi) Establishment and operation of flood forecasting and warning systems for dam operations in the Philippines.
- (vii) Development of guidance on hydrological technology, including hydrological models, in consultation with members on the basis of the OHP(HOMS),
- (viii) Develop and use improved techniques for QPF, taking advantage of data provided by satellite and radar.
- (ix) Investigation, survey and study of the pilot area selected for comprehensive flood loss prevention and management,

- (x) Conducting a preliminary survey and formulation of detailed implementation programme for flood risk analysis and mapping in a demonstration area(s) including an expert group meeting with multilateral support.
- (xi) Collecting data and information, and land surveys for flood risk analysis and mapping in a demonstration area(s) through national efforts of hosting member(s) of project and on request, with multilateral and bi-lateral support,
- (xii) Organizing missions by experts to provide technical guidance to members on item (vi) at the request of members, with bilateral or multilateral support if available.
- (xiii) Review of the existing arrangements for dissemination of flood warnings with a view to introducing improvements, where necessary.

(c) Disaster prevention and preparedness component

- (i) Taking follow-up to foster disaster prevention and preparedness with reference to the recommendations made by relevant missions,
- (ii) Taking follow-up action on the Philippine project to establish a Philippine training and research centre for disaster prevention and preparedness, through consultancy services where appropriate,
- (iii) Improvement in the dissemination of timely warnings of typhoons, floods and storm surges, with particular attention to remote areas,
- (iv) Compilation of information on loss of human life and damage caused by typhoons, including damage to houses, public facilities, agricultural products, etc.,
- (v) Promotion of interdisciplinary co-operation and research programmes among the meteorological, hydrological and disaster prevention and preparedness components,
- (vi) Improvement of public awareness on storm warnings, coupled with studies of human response to warnings,

/(vii)

- (vii) Establishment/updating of disaster prevention and preparedness plans at different levels,
- (viii) Strengthening national co-ordination and co-operation between departments/agencies involved in disaster prevention and preparedness activities,
- (ix) Improvement of communication systems for warning dissemination and relief operations,
- (x) Improvement of damage assessment and reporting,
- (xi) Development and exchange of information and guidance materials on structural and non-structural measures for mitigating disasters,
- (xii) Conducting case studies on major disasters,
- (xiii) Organizing joint missions to evaluate disaster prevention and preparedness procedures and to provide advice on local problems,
- (xiv) Promoting enhanced co-operation among members on disaster prevention and preparedness matters,
- (xv) Provision of advice and assistance in the field of training in disaster prevention and community preparedness, through consultancy services where appropriate,
- (xvi) Production of materials related to public information and education on the activities of the Typhoon Committee, particularly storm warning and disaster prevention and preparedness,
- (xvii) Establishment of disaster research and training institutes.

/(d)

(d) Training

- (i) Organization of one month typhoon forecast training at Guanzho or Shanghai, China. Members may send one or two persons to attend the training,
- (ii) Organization of training in radiosonde manufacturing in China for PAGASA, the Philippines,
- (iii) Organization of seminars on the socio-economic impact of disasters, vulnerability and risk assessment and technology for disaster prevention,
- (iv) Training of personnel through fellowships under UNDP, TCDC, VCP or other bilateral schemes on: (a) tropical cyclone forecasting, (b) meteorology, (c) flood loss prevention, (d) river engineering, (e) technology for disaster prevention, and (f) maintenance of electronic equipment,
- (v) Training by TCS staff assisted by counterpart staff in meteorology, hydrology and electronics, in particular the calibration, maintenance and repair of electronic equipment, including on-the-job training,
- (vi) Exchange of information and identification of training facilities available among WMO members in areas of concern and survey of available fellowship and scholarship assistance,
- (vii) Participation in study tours and seminars relevant to the Committee's programme organized by members or international bodies,

/(viii)

- (viii) Organization of training courses/seminars with bilateral/multilateral assistance on (a) flood forecasting, (b) disaster prevention and preparedness, (c) socio-economic impact of disasters, (d) disaster vulnerability and risk assessment, (e) meteorology, (f) hydrology, and (g) electronics,
- (ix) Provision of short-term fellowships with external support on: (a) utilization of software for integrating satellite/radar/rainfall data, (b) quantitative precipitation assessment and forecast models, (c) storm surge and wave prediction, (d) flood forecasting,
- (x) Exploration of the possibility of: (a) providing facilities for training of personnel in disaster prevention and preparedness, (b) flood loss prevention, and (c) establishment of a Typhoon Committee training centre for the maintenance of electronic equipment,
- (xi) Exchange forecasters between tropical cyclone forecasting and warning centre.

(e) Research

- (i) Stimulation of research activities through consultancy services, visits of study groups and exchange visits by research personnel,
- (ii) Promotion of the exchange of information on typhoon-related research activities and their results, including development outside the region,

/(iii)

(iii) Encouragement of co-operation in the study of typhoon-related topics, among researchers in the field of meteorology, hydrology and social sciences,

(iv) Initiation and/or continuation of research on the following topics,

1. In meteorology

- (a) Utilization of TOPEX data sets (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modelling with the aim of improving existing methods of predicting formation, development and steering,
- (b) Establishment and operation of a typhoon data bank for the western Pacific and East Asia with compatible software exchange between members,
- (c) Development of an operational numerical weather prediction model for typhoon movement and development,
- (d) Methods of typhoon location and accuracy,
- (e) Development mechanism and forecasting,
- (f) Disastrous weather associated with typhoons,
- (g) Objective forecasting of precipitation,
- (h) Meso- and micro-scale weather systems related to typhoons,
- (i) Interaction between typhoons and the tropical circulation,

/(j)

- (j) The possibility of extended track forecasting methods,
- (k) Sensitivity of objective methods to initial data distribution and quality,
- (l) Compilation of a forecasters' guide for western north Pacific typhoon prediction.

2. In hydrology

- (a) Research and study on comprehensive flood loss prevention and management,
- (b) Research and study on flood risk analysis, including flood risk mapping,
- (c) Review of the existing flood run-off models and development of appropriate models for the region,
- (d) Further study on application of meteorological inputs to flood forecasting.

3. In disaster prevention and preparedness

- (a) Studies on the socio-economic impact of disasters,
- (b) Vulnerability and risk assessment of disaster-prone areas,
- (c) Socio-economic implications of inaccurate typhoon and flood forecasts and warnings.

Action proposed

The Committee is invited to:

- (a) Approve in principle, or modify as it may wish, the items of work outlined above to which special attention should be given in 1985,
- (b) Consider further action and resources necessary to accelerate implementation of its programme.

RECOMMENDATIONS ADOPTED AT THE EVALUATION MEETING FOR TOPEX
(With an indication of their current status)

A. Meteorological componentStatus

1. The experience obtained from TOPEX which has proved useful and feasible should be applied to routine typhoon operations by all Typhoon Committee members. C
2. In view of the proven usefulness of intensified observations, Typhoon Committee members are encouraged to make and disseminate on the GTS hourly SYNOPS whenever the centre of a tropical cyclone (which has been assigned an international number by Japan) is within 300 km, hourly RADOBs if it is within radar range and 6-hourly TEMPs when it is within 500 km, beginning from 1984. C
3. Typhoon Committee members are encouraged to exchange subjective and objective forecasts and typhoon forecast reasonings over the GTS with the proper WMO abbreviated headings. C
4. With reference to the priorities established by the sixteenth session of the Typhoon Committee, the GTS and GOS within the Committee's area should be further improved. Telecommunication circuits and centres should be upgraded and automated, as necessary. C
5. JMA will distribute through the GTS satellite guidance messages in the form of SAREP (FM85-VI) Part A 4 times a day whenever a numbered tropical cyclone is within 100-140°E and to the north of the equator. C

Status

I - Already implemented

A - Action in hand

C - Continuing

6. The governments of Japan and the United States of America are requested to continue operating the GMS and the typhoon reconnaissance flights respectively and to make the data available to all Typhoon Committee members.

C

7. The TOPEX data set should be made available on request to all Members of WMO at cost. A set should also be deposited at WDC-A so that other researchers and scientific organizations could also have access to and utilize the data.

A

8. The streamline charts for 850 and 200 mb during the SOE should be published by WMO in 1984 after JMA has replotted the charts and China re-analysed them. If possible, they should be produced both on paper (A3 size) and microfilm and made available free of charge to participating members.

A

9. With the availability of the TOPEX data set, Typhoon Committee members should strengthen their studies on typhoons, in particular typhoon movement forecasts (including recurvature and abnormal tracks) and intensity forecasts.

C

10. The studies for the Sub-Experiment should be included in the medium- to long-term programme of the Typhoon Committee. Close co-operation between the members in conducting research is encouraged.

C

11. The expert designated by Japan (Dr. T. Kitade) should serve as the Chairman of a Typhoon Committee Sub-Committee of research correspondents to co-ordinate typhoon research within the Committee's area.

I

A

12. The extended abstracts of research papers for the TOPEX Sub-Experiment should be published by WMO under the series of TOPEX publications.

A

13. An international archive of typhoon data should be established within the Typhoon Committee's area to facilitate typhoon research.

C

14. Annual seminars on typhoon research should be held. WMO should consider providing funds to enable Committee members to participate in conferences, symposia and workshops on typhoons organized by meteorological societies.

C

15. The scientific papers presented at the TOPEX Evaluation Meeting, after any necessary editing, should be published as an appendix to the meeting report, which should itself be a publication in the TOPEX series.

A

16. More efforts should be put into research on air-sea interaction (e.g. wave and storm surge forecasting) associated with the occurrence of tropical cyclones.

C

17. Typhoon Committee members are encouraged to install additional observing stations and facilities (such as buoys) in data-sparse areas.

C

B. Hydrological component

1. The TCS is requested to bind and distribute the monitoring and forecast accuracy reports for the third water year as it had done for the previous two years.

I

2. In accordance with the plans of the WMO Secretariat, a draft of the final report on the Hydrological Component should be prepared and reviewed in detail by the national experts responsible for the hydrological forecasting systems reported under TOPEX.

I

3. If at all possible, the review of this report should be undertaken as a joint exercise at a meeting of the experts concerned.

I

4. It is strongly recommended that the regional technical meeting on flood forecasting, planned to be convened in Asia by WMO in the latter half of 1984, be used for the meeting mentioned in 3) above and that, if possible, WMO support the attendance of the experts concerned.

I

5. With the possibility of the above meeting in mind, the Typhoon Committee members concerned are encouraged to continue to monitor their flood forecasting system, at least until the end of October 1984.

I

6. Realizing the current and potential importance of quantitative precipitation forecasts for flood forecasting, Typhoon Committee members are encouraged to increase their efforts to develop and use suitable QPF models.

C

C. Warning dissemination and information exchange component

1. The present "focal point system" for the WD/IE Component should be maintained in the implementation of the medium- to long-term plan of the Typhoon Committee.

I

2. Typhoon Committee members should carry out case studies from time to time after a major disaster in order to identify deficiencies and measures to overcome them. C
3. In addition to collecting statistics on the cost of disaster damage, Typhoon Committee members should collect data on the socio-economic effectiveness of typhoon warning services. These data would be of great importance in demonstrating to governments the direct economic value of typhoon forecasting and warning services. C
4. Counter disaster plans should exist not only at national levels but also at community levels in all disaster-prone areas. C
5. Community participation should be ensured in disaster preparedness, in particular in urban areas. C
6. The newspapers, radio and television should be further exploited for the education of the public, especially those living in the flood-prone areas. C
7. Recommendations for follow-up action to be taken by Typhoon Committee members: C
 - (a) China
 - (i) Improvement of communication networks by setting radio telecommunication links as well as replacement of outmoded equipment by new equipment.
 - (ii) Co-ordination between the Meteorological Office and radio broadcasting stations to increase the frequency of typhoon warnings.
 - (iii) Continuation of Disaster Data Reporting System.
 - (iv)

(iv) Promotion of public education, in particular, on preventive measures against disasters.

(b) Hong Kong

Improvement of warning system for disasters with short lead times, such as landslides, by installing additional rainfall monitoring and telecommunication equipment.

(c) Japan

(i) Improvement of mutual communication of locally acquired information among residents.

(ii) Improvement of the acquisition system of past experience and knowledge related to disasters.

(iii) Further improvement of community participation in disaster preparedness.

(d) Malaysia

(i) Improved links between agencies involved in disaster prevention and preparedness, particularly in training programmes.

(ii) Compilation of records of past floods and particularly of maximum water levels.

(iii) Drills for flood fighting and evacuation.

(iv) Improvement of flash flood monitoring and warning.

(e) Philippines

(i) Organization of Disaster Co-ordinating Councils at local levels covering all disaster-prone areas.

(ii) Formulation of a disaster preparedness plan for all types of hazards existing in the country.

(iii) Improvement of forecasting/warning by equipping provinces and municipalities with reliable communications devices.

(iv) Improvement of communication/information by establishing regional collection and dissemination centres.

(v) Establishment of a publication system on disaster preparedness.

(vi) Establishment of a Disaster Research and Training Centre.

(vii) Intensification of training on disaster preparedness at community level.

(f) Republic of Korea

(i) A greater use of audio-visual means and print media for public education.

(ii) Closer co-operation between the agencies concerned with disaster prevention and preparedness.

(iii) Collection and analysis of data and documents on past disasters.

(g) Thailand

(i) Early establishment of a Civil Defense School.

(ii) Closer co-operation among agencies concerned.

(iii) Improvement of communications networks to cover remote disaster-prone areas as well as those linking agencies concerned.

Status

(iv) Procurement of helicopters, automobiles, flat bottom boats to be used for warning dissemination and damage assessment.

(v) Training of key personnel at all levels.

(h) Viet Nam

Improvement of a communications network for warning dissemination and data collection.

8. The film "Typhoon" made by China during TOPEX should be made available through the TCS to all Typhoon Committee members, to the WMO film library and should be shown to the WMO Executive Council at its thirty-sixth session in June 1984.

Conditions relative to attachment offered by
members and required

A. Attachments Provided:

1. Hong Kong:

(a) The Royal Observatory could provide attachments for personnel from other Typhoon Committee members on the following subjects for a normal duration of about four weeks:

- (i) The design, fabrication and installation of automatic weather stations.
- (ii) Processing of marine climatological data.
- (iii) The design and implementation of automated message switching systems.

The Training Unit of the Royal Observatory also runs the following courses which could be offered to personnel from other Typhoon Committee members and the details of these courses are available upon request:

- (iv) "Course on Meteorology of Southeast Asia" (6 weeks) for Class I & II Meteorological Personnel.
- (v) Meteorological Training Course for Weather Forecaster " (25 weeks) for Class II Meteorological Personnel.

- (vi) "Initial Training Course for Scientific Assistant" (20 weeks) for Class III/IV Meteorological Personnel.

The minimum cost for board and lodging for one day in Hong Kong is approximately HK\$500 (US\$65)

(b) Technical/Financial Assistance Schemes

It is not possible to provide financial assistance to personnel on attachment to the Royal Observatory. However, attachment fees for (a),(i), (ii) and (iii) could be waived. Courses described in para (a)(iv), (v) and (vi) are available at costs which are being worked out.

2. Malaysia

- (i) Two-week attachment programmes at the Malaysian Meteorological Services Forecasting Office and Marine Meteorological and Oceanographic Division to acquire skills in weather and wave forecasting in the equatorial region.
- (ii) The Drainage and Irrigation Department offers expertise in local fabrication and adaptation of parts for some hydrological instruments.

(NOTE: External Assistance Required)

B. Attachment Requirements:

1. China:

- (a) Three personnel to the Yodo River Basin centre in Japan for a period of one month (preferably mid 1985), to observe and study the whole system of the centre and learn its experience in operating such a system..

2. Hong Kong:

- (a) Attachment of Royal Observatory Staff to other Advanced Centres

- (i) Attachment of one officer to the Institute of Atmospheric Physics of the Academia Sinica, Beijing, China for one month preferably in October or November 1985.

The aim of the attachment is to carry out diagnostic studies of atmospheric circulation systems with applications to short-range forecasting.

- (ii) Attachment of one senior forecaster to the National Meteorological Centre of the State Meteorological Administration, Beijing, China or the Typhoon Research Institute, Shanghai for one month preferably in August or September 1985. The aim of the

attachment is to observe and study techniques used in forecasting of severe weather with particular emphasis on tropical cyclones.

3. Malaysia:

- (a) Attachment to the Japan Meteorological Agency (JMA) to acquire techniques relating to the development of computer software for integrating telemetric rainfall, radar and satellite data; 2 months by mid 1985 with external support.