



**UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION**

**FOR ASIA AND THE PACIFIC**

**AND**

**WORLD METEOROLOGICAL ORGANIZATION**

**REPORT OF THE TYPHOON COMMITTEE**

**ON ITS FIFTEENTH SESSION**

**Bangkok, Thailand  
9 - 15 November 1982**



9 November 1982

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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

PROVISIONAL LIST OF PARTICIPANTS <sup>1/</sup>

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Representative: Mr. Zou Jingmeng, Director-General, State Meteorological Administration, Beijing

Alternates: Mr. Fang Qi, Leading Member, Operational Management Department, State Meteorological Administration, Beijing

Mr. Ji Feng, First Secretary and Deputy Permanent Representative of China to ESCAP, Embassy of the People's Republic of China, Bangkok

Mr. Song Guangyao, Deputy Chief, Regional Co-operation Division, Foreign Affairs Department, State Meteorological Administration, Beijing

Mr. Sun Guihua, Engineer, Ministry of Water Conservancy and Power, Beijing

Mr. Zhao Wenxu, Foreign Affairs Department, State Meteorological Administration, Beijing

DEMOCRATIC KAMPUCHEA

Representative: S.E. Monsieur Pech Bun Ret, Ambassadeur, Représentant permanent du Kampuchea Démocratique auprès de la CESAP à Bangkok

Alternates: Madame So Se, Conseiller de la Mission permanente du Kampuchea Démocratique auprès de la CESAP à Bangkok

Monsieur Khay Chhiek Bun Kim, Assistant du Représentant permanent du Kampuchea Démocratique auprès de la CESAP à Bangkok

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1/ Delegates wishing to make additions or amendments to the list should submit them in writing to the Conference Officer, and hand them over to the staff at the Documents Distribution Counter.

A final list of participants will be issued on the final day of the Meeting.



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Mr. Claro S. Doctor Meteorologist, c/o UNDP, Manila

Opening Statement by the WMO Representative - TC.15

Mr. Chairman,

Mr. Deputy Executive Secretary, Ladies and Gentlemen

May I firstly convey to you the warm greetings of the Secretary-General of WMO, Professor Aksel Wiin-Nielsen, and his wish that this fifteenth session of the Typhoon Committee should be highly successful. As many of you will know, Professor Wiin-Nielsen takes a close personal interest in the WMO Tropical Cyclone Programme and, especially, in the work of this Committee which has long shown itself to be a pace-setter in these increasingly important WMO activities.

Although the Committee will be reviewing its entire programme at this session the major theme is bound, once again, to be the progress of TOPEX. By common consent it seems to be agreed that the recently completed First Operational Experiment was highly successful. Our discussions here this week will no doubt reveal more fully the degree of this success and also the extent of the shortcomings we must look to before the 1983 Second Operational Experiment.

It has been my personal privilege to have been present at least briefly at one of the Experiment Sub-Centres and for a longer period at the International Experiment Centre in Tokyo during the FOE. In recent weeks I have also had the opportunity to talk to those mostly closely associated with TOPEX in three of the other participating members of the Committee. Throughout these visits I have been greatly impressed by the enthusiasm of all concerned and by their sense of dedication to the TOPEX concept. One of the most pleasing aspects of the Experiment, especially at the IEC, has been the very high degree of harmony and co-operation that has evidently prevailed between the scientists of the eight members involved.

On behalf of WMO I should therefore like to thank all who have contributed their hard work and expertise to the TOPEX operations this year. I believe that most would agree that our special thanks are due to the Government of Japan and, more particularly to the Japan Meteorological Agency for hosting and guiding the operations at the IEC - and to the Japan International Co-operation Agency for its invaluable contributions to all three of the TOPEX components. It is no exaggeration to say that without the help of these two agencies the FOE could hardly have taken place.

/In recording



In recording these thanks, we should not overlook many other important contributions. From the United Nations Development Programme, from WMO Members through the Voluntary Co-operation Programme, and also from the Office of the United Nations Disaster Relief Co-ordinator and the League of Red Cross Societies for their direct participation in programme activities. Last, but by no means least, the efforts of members themselves have, ultimately, been the decisive factor. It is common knowledge that for many it has not been easy to provide the national resources called for by TOPEX but in the end they were mostly forthcoming.

But the achievements to date should not be allowed to obscure the need for continuing and, if possible, increased support in the year ahead. Effectively we stand at the midpoint of the operational phase of TOPEX. What happens in 1983 will be of supreme importance in the final analysis of the success of TOPEX. It is to be hoped that all those participating in or supporting TOPEX will renew their determination to see this phase completed fully with the best possible results. It may also be judicious to remind ourselves that TOPEX is not simply a scientific exercise to test forecasting techniques or to amass data. The objective is the better protection of those at risk from typhoons and, consequently, the improvement of their lives. It is a cause towards which, I am sure, most of us are more than happy to work and make our contribution.

In WMO a high priority has been given to TOPEX and, I am glad to tell you, our support to both the Experiment and to the wider programme of the Typhoon Committee will continue at the highest level resources will permit.

Thank you, Mr. Chairman.

15 November 1982

ORIGINAL: ENGLISH

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

TYPHOON COMMITTEE  
Fifteenth session  
9-15 November 1982  
Bangkok

*Annex 10.1  
Service Bureau*

DRAFT REPORT OF THE TYPHOON COMMITTEE  
ON ITS FIFTEENTH SESSION

I. ORGANIZATION OF THE SESSION

1. The fifteenth session of the Typhoon Committee was held in Bangkok from 9 to 15 November 1982.

Attendance

2. The session was attended by representatives of China, Hong Kong, Japan, Lao People's Democratic Republic, Malaysia, the Philippines, the Republic of Korea, Thailand and the Socialist Republic of Viet Nam. Observers from France, 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 League of Red Cross Societies (LRCS), the Committee for Co-ordination of Investigations of the Lower Mekong Basin, International Civil Aviation Organization (ICAO) and the Technical Support Unit of the Panel on Tropical Cyclones.

3. Following the <sup>query</sup> request addressed to the Co-ordinator of the Typhoon Committee Secretariat <sup>if</sup> that it be permitted to send an observer to the session with the assent of the Committee, a cable invitation was sent to Indonesia.

Opening addresses

4. A message from Mr. S.A.M.S. Kibria, Executive Secretary of ESCAP, was delivered by Mr. K. Nakagawa, Deputy Executive Secretary. A statement was also made by the representative of the WMO Secretariat.



5. In his message, the Executive Secretary noted the new item in the agenda concerning the review of damage from typhoons during the 1981 and 1982 seasons which he considered particularly useful. He expressed the hope that subsequent sessions would continue to discuss this item which served as a grim reminder of the problems facing the Committee and at the same time would facilitate the compilation of statistics on typhoon damage which had continued to increase with the years. <sup>7415</sup> ~~Thus~~ <sup>as well as DPP</sup> called for a comprehensive programme for flood loss prevention and management ~~including~~ disaster prevention and preparedness such as that adopted by the Committee at its eleventh session.

6. Turning to organizational matters, the Executive Secretary paid tribute to members for resolving the issue of institutional support almost completely through TCDC or technical co-operation among developing countries. On the issue of programme support he explained that the role of ESCAP (which he stressed was not a funding institution) vis-a-vis intergovernmental bodies like the Typhoon Committee was a supporting one comprised of substantive backstopping, assistance in organizing and servicing the sessions of the institutions and seeking to the extent possible extrabudgetary funding for their programmes and activities. He concluded by wishing the Committee success in its deliberations.

7. The representative of the WMO secretariat conveyed the greetings of the Secretary-General of WMO to the Committee and his wish that the fifteenth session should be highly successful. He commented with satisfaction on the success of the TOPEX First Operational Experiment and on the enthusiasm which members of the Committee had shown in its execution. On behalf of WMO the representative thanked all who had contributed their hard work and expertise to the TOPEX operations. He noted, however, that the achievements to date should not be allowed to obscure the need for continuing and, if possible, increased support in the year ahead. TOPEX was not simply a scientific exercise but had the objective of giving better protection to those at risk from typhoons and thereby improving their standard of living. WMO would continue to give high priority to TOPEX to the extent that resources would permit.

#### Election of officers

8. The session elected Mr. P. Sham (Hong Kong) as Chairman of the Committee for the year 1982/1983 and Dr. Lim Joo Tick (Malaysia) as Vice-Chairman, and Mr. C.P. Arariles (Philippines) 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 agenda
  4. The Committee's activities during 1982
    - (a) Meteorological component
    - (b) Hydrological component
    - (c) Disaster prevention and preparedness component
    - (d) Training
    - (e) Research
  5. Typhoon Operational Experiment (TOPEX)
    - (a) Report on the Second Planning Meeting for TOPEX
    - (b) Report of the Management Board for TOPEX on its fourth and fifth sessions
    - (c) Report on the TOPEX First Operational Experiment
  6. Support for the Committee's programme
  7. Programme for 1983 and beyond
  8. Review of the 1981 and 1982 typhoon seasons
  9. Co-ordination with other activities of the WMO tropical cyclone programme
  10. Consideration of the agenda for the sixteenth session
  11. Date and place of the sixteenth session
  12. Scientific lectures
  13. Adoption of the report



## II. THE COMMITTEE'S ACTIVITIES DURING 1982

(agenda item 4 (a))  
(WRD/TC.15/1)

10. The Committee reviewed and evaluated the over-all progress made in implementing its programme during 1982, as set out in document WRD/TC.15/1. Five Components, namely, (a) meteorological, (b) hydrological, (c) disaster prevention and preparedness, (d) training and (e) research were discussed in detail.

### A. METEOROLOGICAL COMPONENT

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 for the TOPEX First Operational Experiment.

12. The First Operational Experiment had been successfully completed during the period from 1 August to 15 October 1982. The experiment had been very valuable in improving typhoon forecasting techniques by the exchange of ideas, methods and the experience of the participants, especially at the International Experiment Centre (IEC) in Tokyo. The Experiment was also a demonstration of the vital importance of regional co-operation in the field of typhoon forecasting and disaster prevention. (See also the discussion under agenda item 5).

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 Geostationary Meteorological Satellite (GMS-2) to replace GMS-1; regular operation had begun in December 1981. Special efforts were made to transmit hourly pictures during the TTE periods of the First Operational Experiment. The ocean ship "Tango" had been replaced by a new ocean buoy, No. 8, located at 29°N; 135°E in March 1982. The buoy had been reporting throughout the year and would continue to do so except for maintenance of the equipment in March/April each year.

15. In the Philippines, a new GMS HR satellite picture receiving system was installed and commenced operation in May 1982. The radars at Mactan, Basco and Daet were modified with WSR-77 radar kits which are provided with DVIP and colour display units. The radar at Virac was completely replaced with a new WSR-77 model and a similar type of radar was being installed at Baler and was expected to be operational by early 1983. A total of eight radars were expected to be used for typhoon tracking in 1983. A new Microcora radiosonde equipment provided by Finland through WMO VCP was installed and would be fully operational by 1983.

16. In Thailand, installation of new 5.6 cm radars at Haad Yai, Donmuang Airport and Chiang Mai was completed. These radars were put into operation in early 1982. The radar at Haad Yai participated in the TOPEX intensified observations this year in place of Chumphon which was out of operation pending replacement of thyatron tubes. It was expected to be back in operation by the end of 1982, as the thyatron tubes ordered by WMO have been received by Thailand.

17. In Hong Kong, a replacement 10 cm radar with CAPPI and DVIP colour display units was expected to be installed and become operational early in 1983. Up-grading of Hong Kong-Tokyo point-to-point circuit in order to reduce delays in data reception was under consideration.

18. In compliance with the requirements of the TOPEX intensified upper-air observations, a number of hydrogen gas cylinders, gauges, hydrogen generators and radiosonde transmitters were provided to the Philippines, the Republic of Korea and Thailand, either through the WMO VCP by China or from UNDP funds.

19. A test exercise on message exchange between the IEC and ESC's was successfully completed on 12 May 1982. This exercise was aimed at ensuring prompt and reliable data exchange between IEC and ESC's.

20. The number of radar stations which undertook TOPEX special observations during the First Operational Experiment was as follows: China 5, Hong Kong 1, Japan 20, Korea 1, Malaysia 6, the Philippines 5 and Thailand 2; the number of upper-air observation stations that carried out intensified observations was China 18, Hong Kong 1, Japan 9

/(including



(including research vessel, Keifu-Marui), Malaysia 3, the Philippines 6, Republic of Korea 1, Thailand 7, and Viet Nam 3. The total number of special observations during the FOE was 2,500 surface, 564 upper-air, 357 radar and 108 GMS satellite.

21. Procurement of the equipment and spare parts needed by members to ensure special observations for TOPEX was effected by WMO with the assistance of TCS. SSB transceivers, teleprinters, radar spare parts, radiosonde transmitters and strong wind recorders etc. were provided to China, Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam, either through UNDP funds or WMO/VCP.

22. In China, a radar picture transmission system with DVIP Colour display units provided under the UNDP Regional Typhoon Programme was installed at Beijing and put into operation in early 1982. With a view to improving data exchange nationally and internationally, the upgrading of telecommunication systems through computer switching systems was under consideration and external assistance was expected to be available to implement the project. Dongtou radar and Fuchou radar stations were overhauled in 1982, so as to meet the requirement of typhoon tracking for TOPEX.

23. In Malaysia, a 10-cm radar installed at Kluang in September 1981 had become operational and participated in the TOPEX observations in 1982. The rawinsonde observation station at Bintulu is expected to carry out 12 GMT observations during the second operational experiment in 1983 in addition to the present 00 GMT observations.

24. With a view to improving the telecommunication systems and ensuring efficient data collection in the Philippines, the Government of Japan had sent teams of experts to survey the existing facilities. Plans for a combined UHF-VHF-SW (SSB) telecommunication network were submitted to the Government of the Philippines for its consideration.

25. The Committee noted with appreciation that the United States had confirmed that it expected to continue to carry out meteorological reconnaissance flights in the typhoon area in the years ahead.

26. In the light of the information available, the Committee revised the priority list established at the fourteenth session as shown below:

Priority List Revised by the  
Fifteenth Session of the Typhoon Committee

Observing facilities:

(a) Upper-air stations:

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

(b) Weather radar:

Shantou (China)	National project
Xisha (China)	National/External assistance needed
Cheju (Republic of Korea)	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:

(a) Improvement of national data collection facilities:

Lao People's Democratic Republic	)	
Philippines	)	
Thailand (night-time reception)	)	National/bilateral projects/ external assistance needed
Viet Nam	)	

(b) Regional telecommunication links:

Bangkok-Hanoi (new circuit)	National project
Beijing-Guangzhou-Hong Kong	National/external assistance
(strengthening of existing circuit)	
Manila-Singapore	National project
Bangkok-Vientiane (strengthening of existing circuit)	Bilateral project

(c) Other telecommunication facilities:

Thailand - Strengthening of RTH	National/external assistance
Bangkok	needed



B. HYDROLOGICAL COMPONENT  
(Agenda item 4 (b))

27. The Committee reviewed the accomplishments under the hydrological component during 1982 as reported in document WRD/TC.15/1 and noted the progress made by members during the year. The review covered the establishment, improvement and operation of flood forecasting and warning systems as well as measures for comprehensive flood loss prevention and management.

28. The Committee noted that further steps were required to be taken by members concerned for the establishment of pilot flood forecasting systems in the Lao People's Democratic Republic and Viet Nam and for the proposed extension of flood forecasting and warning systems to Sabah and Sarawak in Malaysia.

29. The Committee noted the following additional developments reported by the members.

30. An on-line telecommunication system was completed in the Puyang river basin in China in 1982. Further improvement of the system was under planning as the system needed manual data inputs at each observation station. In the Xizhi river basin, improvement of the telecommunication facilities of the flood forecasting system was under way. The first phase of the improvement programme will be completed by the flood season of 1983. All the equipment for the system was produced in China.

31. Malaysia was evaluating tenders for supply and installation of equipment for establishing flood forecasting systems in the Kinabatangan river basin in Sabah and in the Sadong river basin in Sarawak. The completion of the systems which had been originally scheduled for 1983 might be delayed due to budget constraints.

32. Arrangements between the Philippines and Japan had been finalized for establishing flood forecasting and warning systems for dam operation. The actual field survey for detailed design had been started recently.

33. Viet Nam was planning to select a basin for a pilot flood forecasting and warning system. In this connection, Viet Nam requested the ESCAP secretariat and the TCS to provide assistance in the study of the basin which would be selected for the system.

34. The Committee also reviewed the status of the implementation of the five main items of the hydrological component of the long-term programme of work adopted at its eleventh session. Relatively satisfactory progress had been made by members in item 10 (operation, maintenance and improvement of existing flood forecasting and warning systems) and item 11 (establishment of flood forecasting and warning systems in other river basins). With the support of ESCAP and WMO which had organized five out of the nine seminars under item 14 (Regional training seminars), there was also satisfactory progress under this item.

35. There was, however, concern over the lack of progress under item 12 (establishment of pilot areas for comprehensive flood loss prevention and management) and item 13 (application of flood plain management for a pilot area or basin). It was recalled that a mission organized by ESCAP with the support of Japan had assisted the members in selecting pilot basins for comprehensive flood loss prevention and management. However, there appeared to be no progress at all in item 12(ii) (investigation, survey and study of the pilot areas) and item 13(ii) (determination of magnitudes and corresponding frequency of heavy floods in each flood-prone area. It was pointed out that implementation of these items could be undertaken only by the members from their national resources. Moreover, the implementation of these items was a prerequisite to the implementation of the succeeding items in the work programme which would probably require external assistance.

36. The Committee was also informed that the ESCAP secretariat, in requesting the Government of Japan to continue providing the services of a hydrologist for the TCS had specifically mentioned in the job description that the principal function of the hydrologist would be to advise and assist the members in the implementation of the hydrologic component of the programme of work approved at the eleventh session.

37. After some discussion, the Committee decided to request the TCS to write to the members inquiring what had been done under items 12(ii) and 13(ii) mentioned above and the difficulties they encountered in this regard. It was also agreed that the TCS hydrologist in consultation with the ESCAP secretariat would prepare a checklist of the data required as well as of the activities needed to be carried out by the members under



these two items. TCS was requested to report on this matter at the sixteenth session.

38. The Committee noted the usefulness of photographing flood situations and marking flood levels as a basis for the preparation of flood risk maps. The Committee requested the Philippines to disseminate through the TCS information on the activities it had carried out in this regard. It was also suggested that newspaper photographs of flood situations might be useful in determining flood levels.

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C. DISASTER PREVENTION AND PREPAREDNESS (DPP)

(Agenda item 4 c)

39. Consideration of this item was based mainly upon the action taken by members in response to the recommendations which had been made as a result of the visit of the consultant to most members of the Typhoon Committee. The information provided by members is reported below.

40. In China, to further popularize DPP the State Meteorological Administration, in co-operation with the Shanghai Scientific and Educational Film Studio was producing a film on typhoons, consisting of three components, namely: (a) typhoon formation and development; (b) typhoon watch, forecasting and warning dissemination; and (c) the need to strengthen international co-operation in carrying out typhoon watch and forecasting. This film was expected to be completed in 1983, and hopefully, to be shown at the 16th session of the Committee.

41. Hong Kong had carried out a review to determine more efficient ways of responding to tropical cyclone warnings issued by the Royal Observatory.

42. In Japan a "Disaster Prevention Week" to foster greater awareness in disaster prevention, with emphasis on natural disasters including typhoons and earthquakes, including a disaster prevention fair and disaster prevention drills had been instituted. A national disaster preparedness day would be held on 1 September each year.

43. Malaysia had Disaster Prevention and Preparedness Committees on the district, state and national levels. During the period under review 2,184 evacuation centres, capable of looking after 620,000 victims, had been set up to meet any flooding and other disaster eventualities.

44. The Committee was informed that a Manual on "How to Assess Damage and Impact", published in 1982 by the Office of the Civil Defense of the Philippines, had been circulated to agencies involved in disaster prevention and preparedness, with special emphasis on the WD/IE component of TOPEX. A survey was undertaken during the FOE, particularly in the pilot communities designated in each of the six regions affected by typhoons. The result of the survey was very similar to that of the Pre-Experiment.

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45. With a view to strengthening communication facilities in the Philippines, additional SSBs were acquired and installed in remote disaster-prone areas to ensure that warnings are properly disseminated and a feedback on disaster impact as well as relief requirements is obtained. In addition, a warning system by the use of sirens to alert people in downstream municipalities of Angat Dam in Bulacan (Central Luzon) was up-graded and was being regularly tested.

46. The Committee learned that the establishment of a Philippine Training and Research Center for Disaster Prevention and Preparedness was held in abeyance as a review of the project proposal was being made at ministerial level. An UNDR0 Relief Co-ordinator had visited the Philippines in August 1982 and was briefed on Disaster Management Systems. Mention was also made of the need to strengthen the capacity of the United Nations System to respond to natural disasters and other disaster situations.

47. Furthermore, future plans on DPP in the Philippines included improvement of communication facilities in disaster-prone areas, the feasibility of insuring houses of light construction in disaster-prone areas, the translation of typhoon warnings and bulletins to local dialects and preparations for the Second Operational Experiment.

48. In Thailand the procurement of <sup>61</sup>aluminum barges was being undertaken for public assistance and relief from flooding disasters. In addition, 627 short-wave radio receivers and transmitters were procured in connection with disaster prevention and preparedness activities.

49. In Viet Nam, activities on DPP were also being considered as the result of two storms in 1982 causing extensive damage.

50. The Committee expressed its appreciation to WMO, UNDR0 and LRCS for the valuable consultant services they had provided, and to the Government of Japan for providing a roving mission on warning dissemination and information exchange. The recommendations of the consultant, as well as those of the roving mission, were discussed at PM-II and MB V and were being acted upon by the members.

D. TRAINING  
(Agenda item 4 (d))

51. The Committee considered the information on training in document WRD/TC.15/1 and noted that members had availed of a number of training opportunities during the year.

52. The following developments during 1982 were noted. Country reports of participants who attended the workshops on regional development and the application of HOMS in Asia and the South-West Pacific, held in Manila and Bangkok in November 1981, had been compiled and were ready for distribution.

53. One of the group training courses being organized in Japan on maintenance of weather radar had been re-titled as a training course in meteorology.

54. A seminar on Flood Vulnerability Analysis was organized by ESCAP in Bangkok from 7 to 13 September 1982, for the benefit of members of the Committee and the Panel on Tropical Cyclones.

55. China hosted a seminar on Typhoon Forecasting at Hangzhou from 25 to 27 October 1982. Seconded scientists from the TOPEX IEC and representatives from WMO and TCS and an invited lecturer participated in the seminar.

56. In Thailand volunteers for national defence attended the training course for Volunteers for Civil Defence, in accordance with the national Civil Defence Act. Other training courses on civil defence including information dissemination were also organized.

57. China likewise reported that a seminar on satellite picture interpretation and application, and on radar echo analysis and interpretation had been conducted, both for a duration of one-month. They had taken place from February to March 1982 and August to September 1982, respectively. A seminar on Flood Forecasting Models had also been organized in July 1982 at Beijing.



58. In Hong Kong training courses for scientific assistants have been conducted and it was planned to conduct a training course on Tropical Meteorology for newly recruited staff.

59. The Republic of Korea reported that training courses on theory and the practical application of electronic test equipment and on hydrology had been held with assistance of the TCS.

60. In the Philippines, an integrated training seminar/workshop on disaster preparedness incorporating topics on typhoons including the operations plan "PAGMAMASID" was conducted in 1982 in two pilot provinces. Training courses were also conducted in disaster-prone areas.

61. In connection with the Regional Training Center in Manila, the Committee was informed that in 1982 five fellowships had been obtained under the VCP programme. Likewise training courses for Class II and Class IV meteorological personnel, and for electronic technicians for the maintenance and operation of river basins equipment, as well as a training course on hydrology (class III) had been held.

62. The Committee learned that a training course on hydrological forecasting would be held at the Davis Campus of the University of California, USA from 5 July to 23 September 1983. It was also emphasized that under the regular programme of the USA they would continue to provide, under VCP, both short- and long-term fellowships. Further, a regional seminar for Meteorological National Instructors had been scheduled at Colombo, Sri Lanka, from 15 to 26 November 1982; participants from Typhoon Committee members would participate.

63. In Malaysia a regional training seminar on the Analysis, Interpretation and Application of Satellite Imagery had been organized by the Malaysian Meteorological Service with assistance from UNDP. The Philippines and Thailand had participated together with the other members of ASEAN.

64. The Committee was of the opinion that past experience revealed a need for the wider and earlier dissemination of information and/or invitations for training activities. More detailed specifications of the nature of the event and of the qualifications required of participants should be given.

65. In Thailand, a seminar on flood forecasting under the auspices of the Asian Institute of Technology (AIT) and WMO was scheduled to be held in February 1983.

66. The Committee expressed its appreciation to China for hosting the seminar on Typhoon Forecasting and to the Government of Japan in organizing training courses for members of the Committee.

/E. RESEARCH



E. RESEARCH  
(Agenda item 4 (e))

67. The Committee reviewed the research activities undertaken by members during 1982 reported in document WRD/TC.15/1.
68. The Committee was informed that members had furnished TCS with up-dated lists of publications on research of interest to them, as well as lists of on-going research activities. The up-dated lists were consolidated by TCS and circulated to members. Members wishing to have copies of publications could obtain them from the member directly or through TCS.
69. In Hong Kong research work on rainfall distribution and probability analysis for engineering design purposes in Hong Kong had been undertaken. Japan reported that an up-dated summary reports published by the National Research Center for disaster prevention had been submitted to TCS during the session.
70. The Regional Scientific Conference on Tropical Meteorology organized under the auspices of the Meteorological Society of Japan and co-sponsored by WMO, the American Meteorological Society and the Japan Meteorological Agency was held from 18 to 22 October 1982 at Tsukuba, Japan.
- 70a. Malaysia reported that it would initiate research activities relating to the TOPEX Sub-Experiment, particularly in relation to the investigations of induced effects of typhoons <sup>on the</sup> and general circulation and weather patterns in Asia and the Pacific areas. In the Philippines studies had been completed on the monthly and semi-monthly frequency distribution of tropical cyclones; rainfall patterns associated with tropical cyclones and their movement, analysis of sea surface temperatures in the development of tropical cyclones, and on improvement in forecasting techniques using persistence, climatology and numerical weather prediction models.
71. In relation to DPP the Philippines is also undertaking research on social behaviour of communities during disasters and on the translation of technical terms of warning terminologies into terms understandable by laymen. Thailand, although still in the early stages, was undertaking case studies on warning dissemination and information exchange.
72. The Republic of Korea reported that it was undertaking a continuing study on typhoon paths.
73. The Committee was informed of the importance of encouraging members to actively participate in conferences and symposia similar to those organized by the Meteorological Society of Japan in October 1982 and

by the Philippine Meteorological Society from 20 to 23 November 1982, which could serve as a forum of exchange of ideas and of a closer interaction and co-ordination of research activities. The Committee requested that abstracts of papers and the proceedings of such undertakings be provided to members or that they be informed that copies were available at the TCS.

74. The Committee was reminded of the need to expand its research activities to include not only the Meteorological Component, but also the Hydrological and the Disaster Prevention and Preparedness Components.

75. Attention was also drawn to the system whereby members had, in the past, designated research correspondents. Their responsibility had been to collect and exchange information on research activities and to participate jointly in selected projects. The Committee felt it would be beneficial to reintroduce this system and requested the TCS to initiate action accordingly.

/III.

TCS  
letter



### III. TYPHOON OPERATIONAL EXPERIMENT (TOPEX)

(Agenda item 5)

76. Because of the close inter-relationship of the three sub-items forming this agenda item the Committee decided to discuss them simultaneously rather than separately. Its principal conclusions are, however, recorded under each of the three headings.

#### A. REPORT ON THE SECOND PLANNING MEETING FOR TOPEX (WRD/TC.15/2)

77. A summary of the main decisions of the Second Planning Meeting for TOPEX (PM-II) was submitted to the session (document WRD/TC.15/2) which also had the advice of the Chairman of PM-II, Mr. C.P. Arafiles (Philippines). The primary purpose of the meeting, which was held in Tokyo from 18 to 22 February 1982, had been to continue the detailed planning of TOPEX with the emphasis on the arrangements for the First Operational Experiment (1 August-15 October 1982). The Committee noted that a number of very important decisions had been made by PM-II and that the full report of the meeting had been published by WMO as TOPEX Report No. 5 under the Tropical Cyclone Programme series.

78. PM-II had reviewed the earlier planning up to the time of the 1981 Pre-Experiment and had taken up the recommendations made by the Committee at its fourteenth session and by the fourth session of the Management Board for TOPEX. Other activities such as those of the TOPEX Roving Mission were also taken into account. However, PM-II had devoted its time mainly to the further planning of the three TOPEX components.

79. The Committee considered that the work performed by PM-II had played a significant role in preparing for the FOE and had thereby contributed greatly to its smooth running. Noting that a Third Planning Meeting for TOPEX would take place in February 1983 the Committee suggested that that meeting, in conjunction with the scheduled sessions of the Management Board, should review the FOE arrangements and determine the changes desirable for the Second Operational Experiment. The more detailed decisions calling for action by the Management Board at its sixth session are reported under agenda item 5(c) below.

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#### B. REPORT OF THE MANAGEMENT BOARD FOR TOPEX ON ITS FOURTH AND FIFTH SESSIONS (WRD/TC.15/3)

80. The Committee considered the reports of the fourth and fifth sessions of the Management Board on the basis of a presentation made by its chairman, Mr. I. Shimizu (Japan), and the summary of its work at those sessions contained in document WRD/TC.15/3. It was the consensus that the Management Board had fully and very efficiently executed the functions attributed to it by the twelfth session of the Typhoon Committee and, in so doing, had contributed substantially to the success of TOPEX to date. In endorsing the reports of the two sessions, the Committee wished to express its gratitude to the members of the Board and drew attention to a number of questions which it would be necessary for the Board to follow up at its sixth session (see agenda item 5(c) below).

#### C. REPORT ON THE TOPEX FIRST OPERATIONAL EXPERIMENT

81. *done* The Committee heard a report on the First Operational Experiment (FOE) presented by the Director of the International Experiment Centre (IEC). It also had the benefit of reports prepared by the Directors of the individual Experiment Sub-Centres (ESCs) on their experience during the FOE. The Committee noted that detailed consideration of many of the questions raised in these reports and the recommendations made as a consequence for the Second Operational Experiment (SOE) would receive detailed consideration at the sixth session of the Management Board and, subsequently, at the Third Planning Meeting for TOPEX. It therefore confined its discussion to general comments on the outcome of the FOE and the provision of guidelines and advice for the further conduct of TOPEX.

82. It was generally agreed that the complex operations conducted during the FOE from 1 August to 15 October 1982 had been entirely successful. Many factors had contributed to this success, including the support extended by a variety of international sources. Particular mention was made of the contributions of Japan through the Japan Meteorological Agency (JMA) in hosting the IEC and in providing excellent facilities, and to those of the Japan International Co-operation Agency and WMO in furnishing the funds needed to second scientists to the IEC. The close and friendly co-operation between the seconded scientists and the staff of the JMA, and the fruitful collaboration between the IEC and the ESCs had also been of considerable importance.



83. The Committee wished to thank all who had contributed to the FOE. It extended its particular congratulations to the Director of the IEC (Mr. I. Shimizu) for the way in which he had guided the IEC operations and to the Directors of the ESCs for the excellent spirit of co-operation they had shown.

84. The FOE had demonstrated that the planning decisions had been correct and had led to the smooth and successful conduct of the Experiment. The selection of the four typhoons had been good as they had interesting characteristics which would be worthy of further study in the years ahead. The intensified observations performed during the TTE periods had played a valuable role in minimizing the damage caused by the typhoons. It was felt that the programme for the Second Operational Experiment (SOE) should follow broadly similar lines.

85. Following a discussion on the desirable arrangements for staffing the IEC during the FOE, it was felt that it would be necessary to augment the staff of the IEC to the extent possible for the SOE. Some difficulties in manning the Centre had been experienced during the FOE periods when it was necessary for it to remain open on a 24-hour basis. The need expressed by the seconded scientists for it to remain open at weekends in order to monitor developments in the synoptic situation was supported by the Committee.

86. It was accordingly agreed that for the SOE members should endeavour to second two scientists each to the IEC. It was, however, recognized that problems of the availability of suitable staff at the national level, as well as funding difficulties, might make this impossible. It was also agreed that the arrangements for the 24-hour or weekend staffing of the IEC should be flexible and at the discretion of the Director of the IEC. The National Meteorological Services of participating members should be advised of these arrangements beforehand so that the seconded scientists would be prepared.

87. The Committee was also of the opinion that, after the selection of a suitable typhoon, the IEC should ensure that its instructions to ESCs were fully followed. Maximum advantage should be taken of the experience gained during the FOE in order that even better results could be obtained during the SOE. The need to improve the TOPEX Operational Manual (TOM) was also mentioned and, in this respect, the Committee noted that

/arrangements

arrangements were already in hand to provide a revised version in accordance with the recommendations made by the seconded scientists. WMO.

88. With regard to the recommendations made by the Director of the IEC in his report, and those contained in the reports of the Directors of the ESCs, the Committee decided to note them and to endorse them to the Management Board for further consideration. The Board was empowered to continue the planning and execution of TOPEX both during the remainder of the operational phase and, subsequently, during the continued execution of the Sub-Experiment. Because of the importance of further developing the Sub-Experiment portion of TOPEX the Committee requested the Management Board to discuss more specific arrangements at its sixth session.

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IV. SUPPORT FOR THE COMMITTEE'S PROGRAMME  
(WRD/TC.15/4)  
(Agenda Item 6)

89. The Committee considered document WRD/TC.15/4 which reviewed the position as regards institutional support, the Committee's programme activities and arrangements for the annual sessions.

Institutional support

90. With regard to the post of Co-ordinator for the TCS, the function of which had been carried out by the Director-General of PAGASA, the Committee while noting that the current arrangements were of an interim nature expressed its strong desire that the Philippines continue to provide the services of a Co-ordinator. The Philippines agreed to do so for a further period on the understanding that other arrangements should be considered in the future.

91. The Committee also expressed the hope that the Philippines would continue to provide the services of a meteorologist for the TCS. The Philippines agreed to continue to provide the meteorologist as well as the facilities for the TCS in Manila.

92. With regard to the hydrologist, the Committee was informed that ESCAP had requested the Government of Japan in September 1982 to provide a hydrologist for the TCS as the assignment of the present hydrologist would expire in March 1983. Japan indicated its willingness to consider this request seriously.

93. The post of telecommunication and electronics expert which was being funded by UNDP to the end of 1982 under the current project was one giving rise to concern of the Committee. The Committee was pleased to learn that confirmation had recently been received by WMO that UNDP would continue to support the expert services to the end of 1983. Noting the valuable contribution of the TEE expert and the urgent need for his services, the Committee strongly requested UNDP to continue the funding of the TEE post until the end of 1984 as an operational contribution to its programme.

94. The Committee expressed its warm appreciation to the Philippines for providing a co-ordinator, a meteorologist, and facilities for the TCS, to Japan for providing a hydrologist, and to UNDP for support of the TEE expert.

95. The Committee also expressed the hope that UNDRO and LRCS would as in previous years provide assistance to the Committee by providing the services of an expert on disaster prevention and preparedness as necessary.

96. Having in mind the stability of the Typhoon Committee, the Philippine representative proposed that consideration be given by members to making annual cash contributions for the institutional support to the Typhoon Committee. As the representatives present had not discussed this matter with their governments, the Committee authorized the TCS Co-ordinator in consultation with ESCAP and WMO to seek the views of the members in this regard through correspondence. It was agreed that the proposal to be sent to the members should contain as much information as possible to enable governments to reach a decision. Such information should include the objective, rationale, fund management and an estimate of the initiated total target together with an indication of how it might be used.

Programme activities

97. The Committee reviewed the possible sources of support for its programme activities. Apart from UNDP, these included the WMO VCP, WMO Special Temporary Voluntary Fund (STVF) for TOPEX, ESCAP extrabudgetary resources, UNEP and TCDC.

98. The Committee noted that a new project RAS/81/054 "Programme Support to the Typhoon Committee" covering the period 1982-1984, during which period a sum of just over US\$1 million was being made available, had been commenced by UNDP. In this connection, the Committee was informed that under the training component of this project there was a provision for a seminar entitled "Flood vulnerability analysis and principles of flood plain management for flood loss prevention and management" which was a combination of two separate seminars listed as items 14(ii) and 14(iii) of the Committee's long-term programme under the hydrological component. In view of the undesirability and impracticability of combining these two



subjects under one seminar, ESCAP organized only a seminar on flood vulnerability analysis in 1982. As there were savings in the amount provided for the proposed combined seminar which ESCAP considered sufficient for holding in 1983 a seminar on the principles of flood plain management for flood loss prevention and management, the Committee recommended that the necessary steps be taken by ESCAP in consultation with WMO to organize the seminar.

99. The Committee noted the statement of the Chief Technical Adviser to the Panel on Tropical Cyclones that a seminar on the applications of radar to tropical cyclone forecasting would be held as part of the Panel's programme in 1983. He hoped that sufficient funds would be available for the participation of TC members.

99a. The Committee expressed its gratitude to UNDP for the extension of its support to the Committee.

100. With regard to the WMO VCP the Committee was informed that, in addition to the information included in the document WRD/TC.15/4, contributions to Committee members over the past five or six years totalled approximately US\$1.3 million. No further contributions had been made to the TOPEX Special Temporary Voluntary Fund which, as reported in the document totalled US\$3,000. The Committee was reminded of the proposal of the Management Board for TOPEX that members should initiate the Fund with token contributions of US\$1,000. Members were urged to act upon that proposal. It was further suggested that the time was ripe for WMO to follow-up its earlier request to Members by another letter soliciting contributions to the Fund.

101. The Committee requested WMO to provide support to the Second Operational Experiment similar to that provided for the FOE.

102. The Committee noted that in response to the request made by the Committee at its fourteenth session and the view expressed by the Commission at its thirty-eighth session, ESCAP had informed the Co-ordinator of TCS that it would be prepared to consider, together with all other ESCAP requirements, requests for support for any activities within the framework of the Typhoon Committee's programme of work, on the basis of the priority criteria established by ESCAP.

103. The Committee was informed that the TCS Co-ordinator had requested the members to submit appropriate proposals for projects to take advantage of the offer made by ESCAP. Accordingly the following proposals had been received.

- (i) Development of capability of members for storm surge forecasting and warning (Philippines).
- (ii) Typhoon-related disaster risk analysis and disaster risk maps (Japan).
- (iii) Exchange technical visits among flood forecasters of members (Malaysia).

104. The Committee considered that the project proposed by Japan was related to the other two proposals. The Committee, therefore, requested TCS to formulate a comprehensive and concrete proposal based on these three proposals and any others that might be submitted in consultation with the ESCAP secretariat.

105. The Committee was also pleased to note that in response to the request made by the Commission at its thirty-eighth session, the ESCAP secretariat had prepared a project proposal on the improvement of systems of compilation of damage caused by typhoons and floods. The project included a roving mission which would conduct a survey of the present systems on damage survey with the end in view of identifying deficiencies and recommending improvements. The mission would also conduct a training seminar on the subject in each of the countries visited. Although subject to confirmation, the Committee was pleased to note that the ESCAP would submit the proposal for funding under the Japan-ESCAP Co-operation Fund.

106. The Committee noted and expressed appreciation of the generous support extended by UNEP for the reopening of IEC from 30 November to 3 December 1981.

107. In reviewing the potential support through TCDC, China expressed its readiness to send 2 or 3 meteorological experts on missions to TC members during the typhoon seasons of 1983 and 1984 for a duration of one to three months for each mission on request provided the per diems of the experts would be borne by the requesting <sup>members</sup> countries or other external sources. China would bear the travel costs of the experts.

108. Japan was considering a continuation in 1983 of the support to IEC activities for the Second Operational Experiment by funding the secondment of scientists and holding another Seminar on Hydrology and Warning Dissemination and Information Exchange in the same manner as in 1982.



109. The Committee expressed its appreciation of the support provided by the Governments of China and Japan.

110. The representative of Malaysia informed the Committee of its need for technical assistance for consultancy services in flood risk mapping in the Klang River Basin in Malaysia. In this connection, it was pointed out that completion of items 13(ii) and 13(iii) in the long-term programmes of the hydrological component were pre-requisites to the preparation of flood risk maps.

111. The Committee was informed of an example of substantial assistance provided by the private sector to organizations of the United Nations system and discussed similar possibilities of securing such assistance for support of the Committee. Noting that such a step would be fully consistent with the purposes of Article 3, Sections (f) and (g) of its statute, the Committee requested ESCAP, WMO and the TCS to pursue such possibilities. The representative of WMO reported on the negotiations which had been initiated by WMO and the TCS.

#### Annual sessions

112. The Committee reviewed current arrangements and support for the Committee's annual sessions. The Committee expressed their satisfaction of the current arrangements for its annual sessions of the Committee and decided that the same arrangements be continued.

#### Support for TOPEX

113. The Committee noted with appreciation the efforts made by WMO in providing support from its regular budget for Planning Meetings and sessions of the Management Board, and for the secondment of scientists to the IEC. It urged WMO to continue this support in 1983 at the highest possible level.

114. The Committee further expressed its thanks to WMO for providing the services of a Secretariat officer in the area to assist in co-ordinating the arrangements for TOPEX. It considered that these services had been very valuable and requested the Secretary-General of WMO to continue to make the officer's services available to members in the area in preparation for the SOE in 1983, including participation during the latter part of the operations at the IEC.

#### V. PROGRAMME FOR 1983 AND BEYOND (WRD/TC.15/5) (agenda item 7)

115. In considering its programme for 1983 as set out in document WRD/TC.15/5, the Committee took into account the short-term and long-term programme of work which was approved by the Committee at its eleventh session and expected assistance from UNDP, WMO VCP and bilateral sources. The execution of the Second Operational Experiment of TOPEX which is one of the important activities of the Committee in 1983 was fully considered.

116. The Committee expressed a strong desire for continuous support from other international bodies such as UNDRO and LRCS which had played a leading role in fostering the programme of work in disaster prevention and preparedness which was one of the major objectives of the Committee.

117. Recognizing that a number of activities of particular interest to the Committee would be carried out by the individual members and some of those are to be executed by joint efforts of all members, the Committee directed that special attention should be given, with the assistance of TCS, to the following items of work in 1983:

#### (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 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, and the training of technicians in proper calibration and maintenance of weather radars and satellite data receiving equipment;

(v) Provision or improvement of meteorological and telecommunication facilities included in the priority list established by the Committee;

(vi) Review of efficiency of data exchanges on existing point-to-point telecommunication circuits with a view to improvement, where necessary;

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(vii) Establishment of satellite data receiving equipment for reception of cloud imagery and other data from GMS and TIROS-N satellites;

(viii) Review of national data collection facilities and data exchanges needed for typhoon warning services, taking remedial measures when necessary;

(ix) Review of the existing arrangements for dissemination of typhoon and flood warnings with a view to introducing improvements, where necessary;

(x) Preparation for and execution of the TOPEX Second Operational Experiment on the basis of the programme recommended by the Planning Meetings and the decisions made by the Management Board for TOPEX;

(xi) Collection and dissemination of tide gauge and water level data for use in storm surge prediction;

(xii) Procurement and installation of equipment and spare parts for telecommunication, radar satellite data receivers, etc., under the UNDP fund provided for 1983.

(b) Hydrological component

(i) Investigation, survey and study of the pilot areas selected for comprehensive flood loss prevention and management, including flooding by storm surges;

(ii) Further improvement in the operation of existing flood forecasting and warning systems in China, Malaysia, the Philippines and the Republic of Korea;

(iii) 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 Kinabatangan basin in Sabah and Sadong basin in Sarawak, Malaysia, the Pasak river basin in Thailand and one river basin to be selected in Viet Nam;

(iv) Determination of magnitudes and frequency of floods in flood-prone areas and assessment of corresponding potential flood damage in the pilot areas mentioned in item (i) above;

(v) Development of flood forecasting and warning systems for dam operation in the Philippines;

/(vi)

(vi) Monitoring and reporting on the operation and performance of the flood forecasting systems selected for the TOPEX Hydrological component;

(vii) Development of a regional telecommunication system for disaster prediction and warning in Mayon Volcano area in the Philippines.

(c) Disaster prevention and preparedness

(i) Follow-up action on the joint LRCS/WMO/ESCAP missions in 1973-1976, the recommendations of the regional seminar at Tokyo in 1976, the review mission in 1976, the consultant's reports on Malaysia, the Philippines and Thailand in 1978-1979, the recommendations made by the consultant in 1981, and the recommendations of the roving mission in 1982;

(ii) Promotion of special programmes under the WD/IE component of TOPEX during the Second Operational Experiment;

(iii) Follow-up action on the Philippine project to establish a Philippine training and research centre for disaster prevention and preparedness;

(iv) Advice and assistance with training in disaster prevention and community preparedness, through consultancy services where appropriate;

(v) Improvement in the dissemination of timely warnings on typhoons, floods and storm surges, with particular attention to remote areas and to facilitate speedy relief operations with improvement of communication facilities;

(vi) Compilation of information on damage caused by typhoons and floods to be sent to TCS before the annual session. Such information should cover the disaster situation as regards loss of human life and damage to houses, public facilities, agricultural products, etc.;

(vii) Promotion of interdisciplinary co-operation and research, programmes among the meteorological, hydrological and disaster prevention and preparedness component.

(d) Training

(i) Training of personnel through group training courses in Japan and through fellowships available under the UNDP assistance, technical co-operation among developing countries, from VCP and through

/bilateral



bilateral assistance schemes. Short-term training courses and fellowships on maintenance of satellite data receiving equipment, radar and telemetering equipment might be given special consideration;

(ii) Assistance to members in exploring the possibility of providing long-term training courses in meteorology, hydrology and electronics. The VCP scheme might be further exploited for that purpose;

(iii) Training by TCS experts, assisted by counterpart staff, in meteorology and hydrology. On-the-job training by TCS experts, particularly in the operation and maintenance of radar, satellite data receiver and telecommunication equipment;

(iv) Exchange of information and identification of training facilities available among WMO members in the areas of concern and a survey of available fellowships and scholarship assistance;

(v) Participation in study tours and seminars relevant to the Committee's programme organized by members or international bodies;

(vi) Organization of training under TCDC in flood forecasting, including study tours;

(vii) Provision of short-term fellowships and organization of training in storm surge prediction;

(viii) Explore the possibility of providing facilities for training of trainers for the DPP component.

(e) Research

(i) Stimulation of research activities through advisory services, visits of study groups and exchange visits by research personnel;

(ii) Undertaking of research on typhoons, particularly during the TOPEX period, and the promotion of joint collaboration on selected topics, such as studies directed towards the development of improved storm surge prediction methods, disaster preparedness and flood forecasting;

(iii) Promotion of exchange of information on typhoons and allied research activities, including developments on related matters outside the region;

/(iv)

(iv) Initiation of provisional studies on disaster risk evaluation in typhoon-prone areas, including flood risk mapping;

(v) Encouragement of co-operation between meteorologists, hydrologists and social scientists in the study of the social and economic impact of typhoons including response to warnings, estimation of damage, etc.

118. During the consideration of the programme for 1983 attention was drawn by the representative of China to the need for the Committee to begin at once to plan its activities in the post-TOPEX period. It considered that it was necessary to develop a programme as speedily as possible. In applying the results of TOPEX for future typhoon operational and research work it was suggested that:

(i) A step by step approach should be adopted in integrating the scientific results of TOPEX into the routine operational work;

(ii) Full use should be made of TOPEX data in the activities under the Sub-Experiment; this would call for joint co-operation between members directed towards better understanding of the mechanisms of typhoon formation and development;

(iii) A medium- to long-term plan (1984-1992) should be developed for the Typhoon Committee's programme relating to typhoon operational and research work on forecasting techniques, training, etc.

119. The Committee responded with enthusiasm to this proposal and went on to consider the steps necessary to produce a medium- to long-term plan. The suggestion of China that the plan be prepared in 1983 by a small working group and the report submitted to the sixteenth session met with full approval.

120. For reasons of economy and efficiency it was decided that the working group should be small. The Co-ordinator of the TCS was requested to lead the group which would consist of himself and representatives of China, Japan, ESCAP and WMO. However, the views of all Committee members would be sought on the plan and they would be free to participate in the work of the group at their own expense. They were requested to notify the Co-ordinator of their desire to participate not later than 31 December 1982.

/121.



121. Terms of reference for the Working Group on Programme Planning were drawn up during the fifteenth session (see Appendix I). It was further decided that work should be initiated as soon as possible by the TCS, in close consultation with ESCAP and WMO. Members were requested to provide their views and any other information sought by correspondence, as expeditiously as possible.

122. The next step would be for the Working Group to hold a short meeting to prepare the medium- to long-term plan for the Committee's programme in the post-TOPEX period. It should cover all five components of the Committee's activities and, whilst this was regarded primarily as a planning exercise, it was recognized that expertise in the fields of the individual components would be required at a later stage. The meeting of the Working Group was provisionally scheduled for mid-1983 and the Committee welcomed an offer from the Co-ordinator of the TCS to host the meeting in Manila.

123. The Committee was informed that the WMO budget for 1983 contained no provision for such a meeting. However, it could be expected that the costs would be relatively small and every effort would be made to support it. It was agreed that, to the maximum extent possible, the members of the Working Group should seek national resources for attendance at the meeting. The Committee also expressed the view that the longer-term planning of its activities was of considerable importance to its objective of mitigating typhoon damage and urged its members and WMO to exert every effort to find the relatively minor resources needed for this purpose.

124. It further expressed the view that the draft report of the Working Group should be distributed to all members of the Committee in time to allow them to consider it well before its sixteenth session.

/VI.

## VI. REVIEW OF THE 1981 AND 1982 TYPHOON SEASONS

(Agenda Item 8)

125. The Committee reviewed the 1981 and 1982 typhoon seasons based on information provided by members. Among 29 typhoons which occurred in the region in 1981, 9 typhoons, namely, Typhoons Nos. 6, 7, 10, 15, 18, 20, 25, 26 and 29 seriously affected members. The Committee was informed that during 1981 the number of dead and missing persons resulting from the typhoons and floods was 73 in Japan, 1,038 in the Philippines, 224 in the Republic of Korea and 83 in Viet Nam. In 1981 and part of 1982, the number of dead and missing persons was 42 in Hong Kong, 1,598 in the Philippines and 96 in Thailand.

126. Reports prepared by members on damage and operations for disaster prevention and preparedness, as well as on typhoons and floods, were distributed during the session. Japan reported on the Nagasaki disaster caused by torrential rainfall and Typhoon No. 10, both of which caused fatalities and serious damage to the regional economy. The Philippines prepared two separate reports containing radar pictures and a review of operations for disaster prevention and preparedness as well as typhoon tracks and damage statistics.

127. The Committee agreed to include in its agenda for the sixteenth session a review of the 1982 and 1983 typhoon seasons, for which members were requested to prepare country papers. The TCS was also requested to collect relevant information.

128. The Committee noted that the information provided during the session was useful and agreed that more time should be allotted for the discussion of this subject at the sixteenth session.

/VII.



VII. CO-ORDINATION WITH OTHER ACTIVITIES OF THE  
WMO TROPICAL CYCLONE PROGRAMME  
(Agenda Item 9)

129. The Committee's discussion was based upon the information given in the Eighth Status Report on the Implementation of the WMO Tropical Cyclone Programme (TCP) (document WRD/TC.15/6), together with a verbal presentation of developments since 30 June 1982.

130. Although the item was intended mainly to provide members with an up-to-date view of the progress achieved under the increasingly wide range of activities forming the TCP, the Committee was pleased to note that the decision of Eighth Congress to upgrade the programme had led to an intensification of these activities during the WMO eighth financial period. It wished to express its satisfaction to the Secretary-General of WMO for the additional support he was providing for the TCP and urged him to continue to give high priority to this programme which was of great benefit to about 50 Members of WMO.

131. As the current session of the Typhoon Committee would be the last before Ninth Congress (May 1983) at which the programme and budget proposals for the period 1984-1987 would be considered, the Committee invited its members to give full support to the Secretary-General's proposals for the TCP during that period. It felt that there were substantial arguments in favour of further increasing the resources available under the TCP despite the "zero-growth" principle upon which the Secretary-General's proposals were based. Members attending Congress were urged to stress the long-term nature of the Tropical Cyclone Programme and the expectancy for a continuing need for support in the future. Reference was also made to the WMO Long Term Plan covering the next decade and the need for members to ensure that tropical meteorology, including the Tropical Cyclone Programme was given its proper prominence in the plan.

132. At its fourteenth session the Committee had stressed the need for the work under the general component to be pursued with dispatch. It noted with satisfaction that since that time reports or publications on Projects 1, 4, 9 and 12 had either been distributed or were being printed

for distribution shortly. In addition three TOPEX reports (Nos. 4, 5 and 6) had been published and distributed and two more could be expected in early 1983. A report on the very successful WMO Seminar on the Application of Satellite Data to Tropical Cyclone Forecasting, held in Bangkok in May/June 1982, had also been published in the TCP Series.

133. The Committee was also informed of the work being carried out under the regional component by the WMO/ESCAP Panel on Tropical Cyclones, the RA I Tropical Cyclone Committee for the South-West Indian Ocean and the RA IV Hurricane Committee. It also learned with interest that decisions taken at the eighth session of the WMO Regional Association V (South-West Pacific) (Melbourne, September 1982) would probably lead to the formation of a fifth regional cyclone body and that, if so, all the tropical cyclone areas of the world would then be covered by similar institutional arrangements. It considered that this development was evidence of the successful nature of such co-operative regional arrangements which had been initiated by the Committee itself.

134. The Chief Technical Adviser WMO/ESCAP Panel on Tropical Cyclones gave a comprehensive account of the Panel's activities during 1982, including reference to a special ship-weather reporting programme and a survey by a consultant on a proposed storm-surge modelling and prediction project for the Bay of Bengal. Several Committee members expressed their desire for closer collaboration between the Committee and the Panel in view of the close existing geographical and meteorological associations, particularly in respect of training, exchange of research information, and attendance at regional scientific conferences.

135. The Committee expressed its appreciation to WMO for the steps it had taken permitting the attendance at the Bangkok Satellite Seminar, organized under the programme of the WMO/ESCAP Panel on Tropical Cyclones, of 14 participants from 7 of its members. The training at the seminar had been of great value for the operation of the TOPEX ESCs during the First Operational Experiment. During discussions members quoted examples, such as progress in storm surge modelling, where collaboration and exchange of information between the various regional committees would be fruitful.



136. Finally, members stressed the need for a continuing linkage between the WMO Secretariat and the Typhoon Committee Secretariat in all its activities, and particularly during TOPEX. The interest of WMO's Regional Director for Asia and the Pacific was considered to be especially valuable and his continued guidance essential for the Committee's activities.

/VIII.

VIII. CONSIDERATION OF THE AGENDA FOR THE SIXTEENTH SESSION  
(Agenda Item 10)

137. The Committee requested the ESCAP and WMO secretariats, in consultation with the TCS, to prepare the detailed agenda for the sixteenth session, which should include a review of the 1982 and 1983 typhoon seasons as well as consideration of an updated long-term programme covering the period 1984-1992. It was agreed that members would inform ESCAP, WMO and the TCS at an early date of any appropriate subjects which they might wish to propose for the next session.

IX. DATE AND PLACE OF THE SIXTEENTH SESSION  
(Agenda Item 11)

138. The date and place of the sixteenth session would be decided by the ESCAP and WMO secretariats in consultation with the Chairman and TCS.

X. SCIENTIFIC LECTURES  
(Agenda Item 12)

139. As decided at its fourteenth session of the Committee, the following scientific lectures were presented:

- (1) A summary of the Northwest Pacific Typhoon Season in 1981 by Mr. Lin Kechen and Yan Guanfu, Shanghai Typhoon Institute, China  
(Presented by Mr. Song Guangyao)
- (2) A review of the TOPEX First Operational Experiment by Mr. I. Shimizu (Japan), Director of the International Experiment Centre

In addition to above, following lectures were also presented:

- (3) Cyclone Preparedness - What are We Doing About It?  
by Mr. R.L. Southern, Chief Technical Adviser, Technical Support Unit, WMO/ESCAP Panel on Tropical Cyclones



- (4) Experimental Investigations of the Typhoons in the USSR by  
Dr. R.F. Burlutsky (USSR), Main Scientific Staff,  
Hydrometeorological Centre

XI. ADOPTION OF THE REPORT  
(Agenda Item 13)

140. The Committee adopted its report on /5 November 1982.

/Appendix I

Working Group on Programme Planning

Terms of reference:

- 1) To review past and current programmes including TOPEX and prepare a medium-to long-term plan (1984-1992) covering the Committee's activities in all five components of its programme;
- 2) In carrying out 1) above the WG should:
  - a) consult all members of the Committee and obtain their views on items for inclusion in the future programme;
  - b) prepare a draft programme for consideration by TC.16;
  - c) Following consideration by TC.16, revise the draft programme as necessary and prepare a final version for execution by the Committee.



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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

TENTATIVE PROGRAMME

Tuesday, 9 November 1982

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

Wednesday, 10 November 1982

0900-1200 hours Agenda item 4 (c): ✓ Disaster prevention and preparedness component  
Agenda item 4 (d): ✓ Training  
Agenda item 4 (e): Research

1330-1630 hours Agenda item 5 (a): Report on the Second Planning Meeting for TOPEX  
Agenda item 5 (b): Report of the Management Board for TOPEX on  
its fourth and fifth sessions  
Agenda item 5 (c): Report on the TOPEX First Operational  
Experiment

Thursday, 11 November 1982

0900-1200 hours Agenda item 6: Support for the Committee's programme

~~1330-1630 hours~~ Agenda item 7: Programme for 1983  
Agenda item 8: Review of the 1981 and 1982 typhoon seasons

Friday, 12 November 1982

0900-1000 hours Agenda item 9: Co-ordination with other activities of the  
WMO tropical cyclone programme  
Agenda item 10: Consideration of the agenda for the  
sixteenth session  
Agenda item 11: Date and place of the sixteenth session

1015-1230 hours (Tripartite Review RAS/81/054 Programme Support to the  
Typhoon Committee)

1330-1630 hours Agenda item 12: Scientific lectures

/Saturday



Saturday, 13 November 1982

0900-1200 hours Drafting Committee

Monday, 15 November 1982

0900-1000 hours Agenda item 13: Adoption of the report

Closing session

## I. ORGANIZATION OF THE SESSION

1. The fifteenth session of the Typhoon Committee was held at Bangkok from 9 to 16 November 1982.

### Attendance

2. The session was attended by representatives of China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea and Thailand. Observers from the Federal Republic of Germany and the United States of America attended the session. Observers from the Office of the United Nations Disaster Relief Organization (UNDRO), the United Nations Development Programme (UNDP), the International Civil Aviation Organization (ICAO), the League of Red Cross Societies (LRCS) and the Technical Support Unit (TSU) of the WMO/ESCAP Panel on Tropical Cyclones were also present.

### Opening addresses

3. The session was opened by a representative of

A message by the Executive Secretary of ESCAP was read by the Officer-in-charge of the Natural Resources Division. A statement by the Secretary-General of WMO was read by a representative of that organization.

4. In his message, stressed that



5. The Executive Secretary of ESCAP, in his message, expressed the hope that

6. In his message, the Secretary-General of WMO stated that

Election of Officers

7. The Committee elected Mr. as  
Chairman of the Committee for the year 1982/83, Mr.  
as Vice-Chairman, and Mr. as  
Chairman of the drafting committee.



Agenda

8. 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 1982
    - a) Meteorological component
    - b) Hydrological component
    - c) Disaster prevention and preparedness component
    - d) Training
    - e) Research
  5. Typhoon Operational Experiment (TOPEX)
    - A) Report on the Second Planning Meeting
    - b) Report of the Management for TOPEX on its fourth and fifth sessions
    - c) Report on the TOPEX First Operational Experiment
  6. Support for the Committee's programme
  7. Programme for 1982
  8. Review of the 1981 and 1982 Typhoon seasons
  9. Co-ordination with other activities of the WMO Tropical Cyclone Programme
  10. Date and place of the fifteenth session
  11. Scientific lectures
  12. Adoption of the report



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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

MESSAGE FROM MR. S.A.M.S. KIBRIA, EXECUTIVE SECRETARY,  
ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Mr. Chairman, Ladies and Gentlemen,

I take great pleasure in welcoming you to the fifteenth session of the Typhoon Committee.

Your agenda this year contains many important items which will absorb your full attention during this week. One new item which I believe will be particularly useful is the review of damage from tropical cyclones during the 1981 and 1982 seasons. This exercise in reporting and reviewing the statistical picture from our constituent countries will provide us with a grim reminder of the problems facing us and the dimensions of the suffering which our mutual programme of activities has been devised to alleviate. I hope that the discussion under this item proves to be as valuable as it promises, and that subsequent meetings will continue the practice. In this manner, we may facilitate the compilation of statistics on damage, which are needed by all the institutions working towards the goal of flood loss prevention and management.

The annual cost of disaster-related damage has increased over the past two decades, according to figures from nine Asian countries made available to ESCAP. During the first half of the 1960s decade, the average annual cost recorded as a result of cyclones and flooding in those countries was approximately \$US1,600 million, measured at 1975 price levels. However, by the latter half of the 1970s decade, the average annual figure had increased to over \$US3,000 million. While part of that recorded increase reflects an improvement in statistical collection and fuller reporting, the increase is due in large part to development trends in the respective countries, where population and structural investments are concentrating in large urban centres located on rivers or in river deltas and near the sea.

/The significance



The significance for the region of damage on such a scale is that we need a comprehensive programme to solve the problems. The Committee, at its eleventh session, adopted a comprehensive programme promoting flood loss prevention and management measures, departing from an approach based on structural measures. This is a new approach which may take time for the members of the Typhoon Committee to adopt and implement fully considering the far-reaching economic and social implications of some of the non-structural measures.

An approach emphasizing prevention and management of flood loss permits us to address the multifarious problems of floods and their effects in a manner scaled to our resources. Having a regional scope, the Committee must take an approach which is conceived to tackle the common elements of the problems faced and to enhance the effectiveness of national action which subsequently deals with the problems on a case-by-case basis. In this manner, the Committee's limited resources can be applied for the optimum benefit.

This approach also encourages an understanding of the problems in the greater context of development. The usual reaction of Governments and donor agencies to disaster is to consider the specific needs of the moment. While the needs of the affected population during and after a disaster are a legitimate concern, the Committee's approach, oriented towards prevention, promotes long-term planning measures and the laying of groundwork which characterize development action. It thus increases people's capacity to cope with disaster and reduces the potential extent of destruction.

Turning to organizational matters, I should like to discuss the twin issues of institutional and programme support, which as everyone is aware, are among the most important issues facing a subregional body such as the Typhoon Committee.

To the credit of the constituent members of the Committee, the issue of institutional support has been mostly resolved through TCDC or technical co-operation among developing countries. The Philippine Government has generously provided host facilities for the Committee secretariat and the services of supporting staff, a meteorologist and a co-ordinator. The Government of Japan has generously provided the services of a hydrologist. At present, only the post of an electronics communication specialist still

/needs to

needs to be funded through UNDP. In fact, among the similar regional bodies established by ESCAP, with the exception of the Asian Development Bank, only the Typhoon Committee has been able to achieve such a reduction of dependency on external funding for its institutional support.

On the issue of programme support, the Committee has fared hardly less well, enjoying continued support from UNDP, UNEP, the League of Red Cross Societies and UNDRO, as well as WMO and ESCAP, and from such countries as Japan under bilateral arrangements. I have brought up this issue because I feel that I should clarify the role of ESCAP vis-à-vis the Typhoon Committee in view of the feeling among some members that ESCAP has not been providing sufficient financial support to the Committee, particularly towards the implementation of TOPEX.

I find it strange that such a feeling has cropped up since I would have thought that the role of ESCAP had been very clearly understood by those officials who were originally involved in the establishment of the Committee.

I suppose this feeling might stem from a misconception of the role of ESCAP vis-à-vis the Typhoon Committee, particularly by those who have only recently become involved in the Committee. I should like to make it clear that the role of ESCAP in the Typhoon Committee is the same as the one it plays in relation to the other regional intergovernmental bodies that it has established. As ESCAP is not a funding institution, this role is a supporting one, comprised of substantive backstopping, assistance in organizing and servicing the sessions of the institutions and assistance to them to the extent possible in seeking extrabudgetary funding for the implementation of their programmes and activities. This has been the role that ESCAP has played since the inception of the Committee.

Together with WMO, it has continued to assist the Committee in formulating its programme of work, assisting it in implementing its activities through available existing resources and seeking both institutional and programme support through UNDP and bilateral sources to implement its programme. ESCAP has never made any direct financial contribution to the Typhoon Committee aside from the support it has extended in the form of the substantive services of its staff in assisting in the implementation of some activities of the Committee concerning flood loss prevention and management and in providing facilities for the annual sessions of the Typhoon Committee.

/In this



-4-  
In this connection, I wish to point out that the extrabudgetary resources raised by ESCAP are only a fraction of its total resource requirements to carry out its regular programme mandated by the General Assembly.

Notwithstanding the above constraints, and in response to the view expressed by the Commission at its thirty-eighth session that the ESCAP secretariat should "consider allocating within the context of its mandate a portion of its resources to support priority projects of the Committee, particularly those in the hydrological and disaster prevention and preparedness components of its programme", ESCAP in June this year informed the Co-ordinator of the Typhoon Committee secretariat that it would be prepared to consider, together with all the other requirements of ESCAP and in accordance with its priority criteria, project proposals which the Committee might wish to submit to ESCAP. This gesture represents a genuine desire on the part of ESCAP to support the Committee considering, as mentioned above, the size of its own requirements compared with the available extrabudgetary resources.

I hope that the above explanation will serve to clarify ESCAP's role and dispel any mistaken notion about the support ESCAP provides to the Committee.

I wish you all success in your deliberations.

JAPAN METEOROLOGICAL AGENCY

In reply, please address  
DIRECTOR-GENERAL  
JAPAN METEOROLOGICAL AGENCY

OTE-MACHI, CHIYODA-KU, TOKYO JEX

CABLE ADDRESS  
METEOROAGENCY TOKYO

Ref. No.

JMA 82/AF/342

In Page 1. Warning radar stations, add:

5 November 1982

Japan: Hiroshima (1968), Ishigakijima (1969), Akita (1970),

Kushiro (1971), with subtotal of US\$ 1.25 million

Dr. Roman L. Kintanar

In Page 1. Co-ordinator of Typhoon Committee secretariat, add:

Typhoon Committee Secretariat

Japan: Chichijima R/W (00 and 12 GMT) (1968)

Dear Dr. Kintanar, Ishigakijima R/W (00 and 12 GMT) (1968)

With reference to your letter of 7 October 1982 concerning the list of Typhoon Committee activities, I have pleasure in sending you herewith the update of our efforts in meteorological component. namidaotojima R/W (00 and 12 GMT) (1968)

Ishigakijima R/W (00 and 12 GMT) and W (06 and 15 GMT)\*

Yours sincerely,

\* In connection with the returning of the Okinawa Islands

to Japan in 1972.

In Page 2. D. GMS satellite, correct

*E. Nishimura*  
for Jotaro Masuzawa  
Director-General

GMS launched in July 1977, operational in April 1978;

GMS-2 launched in August 1981, operational April 1982.

Enclosure

In Page 2. E. Regional telecommunication link, correct to read:

Beijing-Tokyo (TTY 75 bauds x 5) December 1977

Bangkok-Tokyo (TTY 75 bauds) March 1980

In Page 3. (a) Meteorological component, add:

13. Survey Philippines Bilateral \* Japan 1980-81

In Page 4. (d) Training, add:

4. TOPEX seminar China, Hong Kong, Korea, Multilateral \* Japan 1981  
in meteorological Malaysia, Philippines,  
component Thailand

5. TOPEX seminar China, Hong Kong, Korea, Multilateral \* Japan 1982  
in meteorological Malaysia, Philippines,  
component Thailand



# ANNEX

In Page 1. A. Storm warning radar stations, add:

Japan: Hiroshima (1968), Ishigakijima (1969), Akita (1970),

Kushiro (1971), with subtotal of US\$ 1.25 million

In Page 1. B. Radiosonde and radiowind observations, add:

Japan : Chichijima R/W (00 and 12 GMT) (1968)

Minamitorishima R/W (00 and 12 GMT) (1968)

with subtotal of US\$ 0.14 million

Minamidaitojima R/W (00 and 12 GMT) and W (06 and 15 GMT)\*

Ishigakijima R/W (00 and 12 GMT) and W (06 and 15 GMT)\*

\* In connection with the returning of the Okinawa Islands  
to Japan in 1972.

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Bangkok-Tokyo (TTY 75 bauds) March 1980

In Page 3. (a) Meteorological component, add:

13. Survey Philippines Bilateral \* Japan 1980-81

In Page 4. (d) Training, add:

4. TOPEX seminar China, Hong Kong, Korea, Multilateral \* Japan 1981  
in meteorological Malaysia, Philippines,  
component Thailand

5. TOPEX seminar China, Hong Kong, Korea, Multilateral \* Japan 1982  
in meteorological Malaysia, Philippines,  
component Thailand



*Thank you Mr. Chairman,*  
This item, corresponds to document <sup>WRD</sup> TC.15/1 which deals with the activities of the Typhoon Committee during 1982. It of course refers to the period since the last session, the 14th session held in November 1981 in Manila, so, we shall be presenting the summary of the activities in this document, since the last session up to date.

Mr. Chairman, as in the previous years, this document has got several components, namely, the meteorological component, hydrological component, disaster prevention and preparedness, training and research. Mr. Chairman, I would suggest that instead of presenting the document as a whole, it is better to deal with it component by component. As a matter of fact, I will present the meteorological component, and my colleagues, Mr. Claro Doctor, a meteorologist of TCS will present the disaster prevention and preparedness, training and research components, and Mr. Machida, Hydrologist of TCS, will present the hydrological component, when we come to these items. Therefore, Mr. Chairman, I would like to start with the beginning of the document and for my presentation I will go up to the end of meteorological component only and then will have the discussion on this item. I would suggest that we take up the next component after that. I hope this procedure is agreed to, as we have done in the past.

Mr. Chairman, on page 1 of document TC.15/1, there are a few general information.

Paragraph 2 reported that the Typhoon Committee received UNDP assistance in the amount of approximately one million US Dollars for the various activities for the years 1982 to 1984. As a matter of fact, the Typhoon Committee has much relied on this assistance, aside from the assistance received through bilateral sources to execute various important programme of work of the Committee.

Paragraph 3 reported that the second Planning Meeting for TOPEX was held from 18-<sup>to</sup>22 February in Tokyo and paragraph 4 refers to the fourth and fifth session of the Management Board for



TOPEX, which were held in November 1981 and February 1982 in Manila and Tokyo, respectively.

Since these items are to be dealt separately in the Document WRD/TC.15/3<sup>2 and 3</sup> under the agenda item 5<sup>a and b</sup>, I do not need to make any reference to these paragraphs at this stage.

Paragraph 5, 6 and 7 referred to the Roving Mission and consultant's services provided by the Government of Japan, WMO and LRCS from the end of 1981 through 1982, which those experts have done a great deal <sup>(of contributions)</sup> in assisting members in respects to the three components of TOPEX programme.

Paragraph 8 and 9 reported that members of the Typhoon Committee have made every efforts to mobilize the resources and manpower required for the First Operational Experiment and in the result, as a matter of fact, the First Operational Experiment was completed successfully during 1 August to 15 October this year. The details of the experiment will be discussed <sup>モビライズ</sup> in Document WRD/TC.15/1 under the agenda item 5.

So with this brief remarks, Mr. Chairman, I will pass on to the Meteorological component on page 3 of the document. First of all Mr. Chairman, there are two paragraphs, those of paragraphs 12 and 13 which give some information related to meteorological satellite.

As you are aware, a new Geostationally Meteorological Satellite (GMS-2)<sup>in short</sup> was successfully launched by Japan in the later part of 1981. Since then the GMS-2 continued to provide useful information to the Typhoon Committee region and hourly satellite picture transmission were made available by JMA during the Typhoon Tracking Experiment period of the First Operational Experiment in 1982.

The Philippine has installed a new GMS high resolution picture receiving system and put into operation in May this year. At present, most members of the Typhoon Committee are now able to intercept satisfactorily either GMS or TIROS-N satellite pictures. However, some members have been experiencing



difficulties in obtaining replacement parts from abroad for repair <sup>or</sup> either because of high cost or the need for a long period of time to obtain such replacement parts from abroad for repair. To overcome these problems, members were advised to stock sufficient spare parts to maintain their equipment without long interruptions.

Mr. Chairman, paragraphs 14 to 19 on page 4 of this document reported the latest developments related to the implementation of radars and upper-air observations.

Some new radars were installed in the Philippines and Thailand and most of these new radar stations have provided useful information during the First Operational Experiment in 1982. A total number of radar stations committed by members to participate in TOPEX special observations is of 40 stations and 55 for upper-air stations.

In compliance with the requirements of the TOPEX intensified upper-air observations<sup>ス</sup>, a number of hydrogen gas cylinders<sup>シリンダー</sup>, gauges, hydrogen generators and radiosonde transmitters have been provided to the Philippines, the Republic of Korea and Thailand, either through WMO, VCP, by China, USA and also from UNDP funds.

During the period of the First Operational Experiment this year, there were about 357 additional radar, 564 upper-air, 108 GMS satellite and 2500 surface observations were made by members and those data were received by IEC in Tokyo and it was considered very essential elements for the execution of TOPEX.

Next, we come to the meteorological telecommunication aspect which were referred to in paragraph 20 to 24 of this document. <sup>(on page 5)</sup>

First of all, you may be aware that a test exercise on data exchange between IEC Tokyo and all <sup>ES</sup> IEC's located at respective members was conducted on 12 May 1982, in accordance with the recommendation made by the fifth session of the Management Board for TOPEX. The object of the test was to check the efficiency of transmission of TOPEX messages on existing GTS



links between the IEC and ESC's and to ensure prompt and reliable data exchange. The result of the test were considered satisfactory.

Some of SSB transceivers, teleprinters or spare parts for telecommunication equipment have been provided to a number of members either through UNDP fund or WMO VCP assistance, in order to improve national data collection and transmission, especially to meet the TOPEX requirements.

However, based on monitoring of data flow between RTH Tokyo to members, it was found that some members, namely, China, Hong Kong, the Philippines and the Republic of Korea have been experiencing delay in receiving data from RTH Tokyo. It is therefore considered necessary to improve these circuits.

In this connection, China has planned to establish an automated computer switching system at Guangzhou to improve data exchange between Beijing and Hong Kong, and some members have already brought the matter up with RTH Tokyo where improvement plans were under consideration.

In so far as to improve national data collection in the Philippines, the Government of Japan assisted PAGASA in conducting a survey of the existing telecommunication facilities and also drew up a tentative plan of establishing UHF-VHF-SW (SSB) combined telecommunication network for ensuring efficient data collection. These plans were submitted by the Japanese survey mission to the Government of the Philippines for consideration and implementation.

#### Ocean Weather Ships and Buoys

Mr. Chairman, in paragraph 25, on page 5, it refers to the operation of ocean weather ships and buoys contributed by the Government of Japan. According to the latest information given by JMA that the ocean weather ship "Tango" was already replaced by a new ocean buoy No. 8 located at 29°N and 135°E since 31 March 1982. Since then, this new buoy station has been



used to collect and report weather data throughout the year, except for the maintenance of equipment from March to April each year. The research vessel Keifu-Maru and Ocean buoys No. 3,4,6, and 7 have been carrying out similar observations as those have been done in previous year.

#### Exchange of Radar Fixes (para. 26)

Next Mr. Chairman, we will come to the exchange of radar fixes. At its Fourteenth session, the Committee urged, members to ensure regular and prompt exchange of radar fix messages. Based on a survey of radar fix message exchanges<sup>2</sup> made by the Hong Kong Royal Observatory, the attention of members was drawn to the need to ensure more regular and prompt exchange of radar fix messages through the GTS, and also suggested that typhoon eye fix reports should be included in RTH radio broadcasts for the benefit of those members which have not yet established point-to-point GTS circuits. In response to this suggestion, Japan has included radar fix reports in the Tokyo RTH radio broadcast this year.

#### Meteorological Reconnaissance Flights<sup>7-2</sup>

Mr. Chairman, paragraph <sup>27</sup>35, on page 6, deals with meteorological reconnaissance flights by the United States aircrafts. Reconnaissance flights continued to provide valuable information as in the previous years for typhoon warning purposes, and I believe as was mentioned at the Fourteenth session it is expected that the United States would continue its programme of typhoon reconnaissance flights in the years ahead. Such a statement was made at the Fourteenth session and "I believe that" this will be reconfirmed at this session for the reconnaissance flights to be continued in the years ahead. will



Finally we come to the item of action proposed. In this connection, the Committee is invited to consider two aspects:

The first one is to consider revising the list of priorities which is being distributed by Mr. Doctor to all of you. I have just called your reference now and we will look at that priority list and we shall try to bring it up to date. We can introduce any correction or additions to be incorporated in the report of the 15th session. We have to amend this list, we have to delete items already implemented, and we will add items if anyone wishes to suggest any new item for the priority list especially in connection.

The second is to consider the recommendations for further measures to expedite implementation of the required meteorological observing and telecommunication facilities, especially those urgently needed for TOPEX.

Mr. Chairman, I think that concludes the presentation of the meteorological Component. Thank you.



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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

NOTES FOR THE INFORMATION OF PARTICIPANTS

1. The fifteenth session of the Typhoon Committee will be held at Bangkok from 9 to 15 November 1982.

Immigration requirements

2. Participants are required to possess a valid passport and an entry visa for Thailand, obtainable at any Thai diplomatic or consular mission. Participants from countries where there is no Thai Embassy or Consulate may enter Thailand without a visa only if prior notification is forwarded to ESCAP, at least seven days in advance of the arrival date, giving full details of participant, namely: name, address, position, nationality, passport number, flight number and flight date and arrival time in Thailand. Upon receipt of this information, ESCAP will notify the Ministry of Foreign Affairs, which in turn will advise the Immigration Division to issue the appropriate stay permit upon arrival at Bangkok Airport.

Health requirements

3. Participants are not required to obtain any certificate of vaccination. They are, however, advised to consult travel agents in their own countries at least two weeks in advance of their departure, in order to obtain up-to-date information on health requirements.

Foreign exchange

4. Participants may bring with them pounds sterling or United States dollar travellers' cheques or bank drafts, which can be exchanged for Thai currency at the prevailing bank rates. The exchange rates, which fluctuate from time to time, are approximately as follows:

\$US	1.00	=	Baht	22.90
£	1.00	=	Baht	41.89



Exchange facilities are available at the hotels as well as the United Nations Branch of the Siam Commercial Bank Ltd., which is open from 0830 to 1530 hours from Monday through Friday, except on official holidays, and is located on the third floor of the Service Building.

#### Weather

5. The climate of Bangkok during November is humid and warm. The daily mean maximum temperature is 32°C (89°F) while the daily mean minimum temperature is 21.5°C (71°F). The mean monthly rainfall is 65 mm (2.6 in) and the average number of rainy days is 7. Light tropical clothing will be appropriate. The conference hall where the meetings are to be held is air-conditioned.

#### Communications

6. Mail intended for participants should be addressed as follows:

c/o Mr. A. S. Manalac  
Officer-in-Charge  
Natural Resources Division  
Economic and Social Commission for Asia  
and the Pacific (ESCAP)  
United Nations Building  
Rajadamnern Avenue  
Bangkok 10200, Thailand

Cable address: ESCAP BANGKOK

#### Hotel accommodation

7. To facilitate reservation of hotel accommodation, participants are requested to complete and submit the attached attendance information form at an early date, or otherwise to furnish the following particulars by cable at least seven days in advance to Mr. S. F. Tsao, Chief, Conference and General Services Section, Division of Administration, ESCAP, United Nations Building, Rajadamnern Avenue, Bangkok 10200, Thailand.

Cable address: ESCAP BANGKOK

- (a) Date and time of arrival
- (b) Airline and flight number
- (c) Hotel accommodation requirements

8. Accommodation will be reserved at the request of participants at the Thai, Majestic and R.S. Hotels, which are located close to ESCAP.

9. Special room rates are available to participants as follows:

HOTEL	ROOM	RATES PER DAY	
Thai	Single	Baht	420.00 (net)
	Double	Baht	520.00 (net)
Majestic	Single	Baht	420.00 (net)
	Double	Baht	520.00 (net)
R.S.	Single	Baht	484.00 (net)
	Double	Baht	616.00 (net)

All rooms have air-conditioning. Charges for all meals, including breakfast, will be extra. Meals are subject to a 10 per cent service charge. Hotel room rates are subject to alteration without prior notice.

#### Transport

10. All participants are requested to arrange their own transportation upon arrival at Bangkok International Airport. Limousines and bus services are available at the airport at moderate rates.

11. Owing to budgetary limitations, it will not be possible for ESCAP to provide transportation for participants between the hotels and ESCAP. Participants will therefore have to make their own arrangements for attending meetings and social functions. Some hotels are within walking distance of the ESCAP building, and taxis are generally readily available. As meters are not used by taxis, it is necessary to agree on the fare beforehand.

#### Schedule of meetings

12. The opening meeting will be held at 1000 hours on Tuesday, 9 November 1982 (0900-0945: Registration), in one of the conference rooms in the Secretariat or the Service Building, where all subsequent sessions will also be held.



13. Subject to confirmation by the participants, the daily schedule, except for the opening meeting, will be as follows:

Monday to Friday	0900 to 1200 hours 1330 to 1600 hours
Saturday	0900 to 1230 hours

#### Registration

14. A registration desk will be located outside the conference room. Participants are requested to be in the lobby outside the conference room between 0900 and 0945 hours on the opening day, in order to allow time for registration. Participants who have failed to register on the opening day of the session should please request a registration form to ensure that their names will appear in the list of participants.

#### Badges

15. Participants are requested to wear the identification badges they receive upon registration at all meetings and official functions.

#### Officers concerned with the session

16. The substantive division concerned with the session is the Natural Resources Division, of which Mr. A. S. Manalac is the Officer-in-Charge. His office is on the fifth floor of the United Nations Building.

17. The Division of Administration, of which Mr. C. Roy Smith is the Chief, is responsible for the physical arrangements for the session.

#### Working hours of the ESCAP secretariat

18. The working hours of the ESCAP secretariat are from 0730 to 1545 hours with a break of 45 minutes for lunch, Monday through Friday. Staff servicing the session will, however, be available during meeting hours.

#### Documents

19. Documents for the session are normally sent to the seats of Government at least six weeks before the session. In addition, documents are sent directly to participants if their names are submitted to the

ESCAP secretariat at least three weeks before the start of the session. In view of the limited number of copies available, it will be appreciated if participants bring with them the sets supplied in advance.

#### Working language

20. The working languages of the session will be English and French.

#### Microphones

21. Sound equipment is provided in the conference room. All microphones on the tables are controlled by the operator at the control desk. Before speaking, participants are requested to push the button on their microphone stand; a red signal will then show.

#### Refreshments and lunch

22. Tea, coffee, soft drinks and other light refreshments will be available at reasonable prices in the lounge. Lunch at reasonable prices will be available in the Cafeteria on the fourth floor of the Service Building.

#### First-aid facilities

23. The ESCAP first-aid room is located in Room S-5051 on the fourth floor of the Service Building. The nurse, Mrs. Mayuree Bhanganada, can be contacted by telephone No. 2829191, extension 1352.

#### Postal facilities

24. A post office is located on the ground floor of Sala Santitham. Its working hours are from 0800 to 1800 hours (without lunch break) from Monday to Friday and from 0800 to 1300 hours on Saturday and Sunday and on official holidays.

#### Library facilities

25. The facilities of the ESCAP Library are available to participants. Publications can be consulted in the library but may not be taken out. The Library is located on the first floor of the Service Building. The Chief Librarian, Mr. Allan F. Windsor, can be reached by telephone No. 2829161, extension 1332.



Return bookings

26. Participants are advised to ensure that their return booking is confirmed soon after their arrival in Bangkok. For this purpose, they should contact the ESCAP Travel Services on the fourteenth floor of the United Nations Building.

/ATTENDANCE

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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

PROVISIONAL AGENDA

1. Opening of the session
2. Election of officers
3. Adoption of the agenda
4. The Committee's activities during 1982
  - (a) Meteorological component (TANG)
  - (b) Hydrological component (MACHIDA)
  - (c) Disaster prevention and preparedness component (DOCTOR)
  - (d) Training ( " )
  - (e) Research ( " )
5. Typhoon Operational Experiment (TOPEX) (WMO)
  - (a) Report on the Second Planning Meeting for TOPEX (Arafles?)
  - (b) Report of the Management Board for TOPEX on its fourth and fifth sessions (Shinji?) } WMO
  - (c) Report on the TOPEX First Operational Experiment (SHIMIZU) (reporting by WMO)
6. Support for the Committee's programme (WMO/ESCAP) (SASAKAWA)  
Drafting by ESCAP.
7. Programme for 1983 (TANG)
8. Review of the 1981 and 1982 typhoon seasons Introduced by TCS and suggest  
Time constrained for reporting (DOCTOR) (Machida) Chairman to give floor for make
9. Co-ordination with other activities of the WMO tropical cyclone programme (WMO) to present
10. Consideration of the agenda for the sixteenth session WMO/ESCAP
11. Date and place of the sixteenth session
12. Scientific lectures China, Japan, USSR
13. Adoption of the report



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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

ANNOTATED PROVISIONAL AGENDA

1. Opening of the session

The fifteenth session of the Typhoon Committee will begin at Bangkok on 9 November 1982.

2. Election of officers

Rule 6 of the rules of procedures of the Typhoon Committee states: "The Committee shall, at its first meeting of the year, elect from among its representatives a chairman and a vice-chairman, who shall hold office until their successors are elected. They shall be eligible for re-election".

3. Adoption of the agenda

The provisional agenda has been prepared by ESCAP and WMO in close consultation with the Typhoon Committee secretariat (TCS). Representatives of participating Governments may propose additions or changes to the agenda if they so desire.

4. The Committee's activities during 1982

A review of the activities of the Committee since the fourteenth session will be made under this item (WRD/TC.15/1). The review will cover each of the five components of the programme, namely: (a) meteorological, (b) hydrological, (c) disaster prevention and preparedness, (d) training and (e) research. The Committee is invited to assess the progress made since its fourteenth session, comment on the activities undertaken in 1982 and offer suggestions for accelerating those not completed. The members may also wish to report on the establishment in their countries in 1982 of any relevant facilities not covered by the report.



6. Support for the Committee's programme

Document WRD/TC.15/4 will review the resources currently available from all sources to support the Committee's activities, including TOPEX. On the basis of its foreseen needs, the Committee may wish to express its views on the extent to which these needs are expected to be met by the available resources and to propose measures to meet any shortfalls.

7. Programme for 1983

The Committee will make a selection of specific items of work on which it wishes to concentrate, with the assistance of TCS, during 1983. For this purpose, it may wish to take account of the short- and long-term programmes of work recommended by the Typhoon Committee review mission and endorsed at the eleventh session. Proposals for the items to be included in the programme will be made in document WRD/TC.15/5.

8. Review of the 1981 and 1982 typhoon seasons

At its fourteenth session, the Committee decided to include in its agenda for the fifteenth session a review of the 1981 and 1982 typhoon seasons, for which members were requested to prepare country papers containing information on typhoons and corresponding damage up to August 1982. The Committee may wish to express its views on the reports, which will be submitted by the members at the fifteenth session.

9. Co-ordination with other activities of the WMO tropical cyclone programme

Developments under the WMO tropical cyclone programme (TCP) will be reported to the Committee under this item. A status report on the implementation of TCP is issued each year and the report up to 30 June 1982 will form the basis of the document submitted to the Committee at its fifteenth session (WRD/TC.15/6) giving information on the general and regional activities under the programme. The Committee may wish to review the effectiveness of the present arrangements for the co-ordination of such activities and the exchange of information thereon.

10. Consideration of the agenda for the sixteenth session

To conform to the ESCAP conference requirements as laid down by the Advisory Committee of Permanent Representatives and Other Representatives Designated by Members of the Commission, the Committee is requested to draw up a provisional version of the agenda it would wish to consider at its sixteenth session, it being understood that additions or changes may be made to that agenda at any time.



11. Date and place of the sixteenth session

Rule 1 of the Committee's rules of procedure states: "The Committee shall hold at least one session annually. The venues and dates of its sessions shall be decided by the Committee". Members may wish to make offers to host the sixteenth session.

12. Scientific lectures

In accordance with the wishes expressed by the Committee, a programme of scientific lectures will be arranged during the fifteenth session. Details will be announced later.

13. Adoption of the report

The Committee's report on its fifteenth session should be adopted at the final meeting.

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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

THE COMMITTEE'S ACTIVITIES DURING 1982

(Item 4 of the provisional agenda)

Note by the Typhoon Committee secretariat



## General

1. At its thirty-eighth session (Bangkok, March to April 1982) the Economic and Social Commission for Asia and the Pacific (ESCAP) noted with satisfaction the activities of the Typhoon Committee, including TOPEX. Appreciation was expressed for the support extended by UNDP, UNEP, WMO and members of the Committee itself to these activities. The Commission urged UNDP and UNEP to continue their support, especially for TOPEX, in the years ahead. ESCAP was also requested to consider allocating within the context of its mandate a portion of its resources to support priority projects of the Committee.

2. The current UNDP support for the regional typhoon programme of US \$1,001,400 for the three years 1982 to 1984 includes provision for the following items:

- (a) Twelve man-months of consultant services;
- (b) The continuation of the services of the expert in telecommunication and electronics for 1982;
- (c) Short-term fellowships and seminars; and
- (d) Telecommunication and electronic equipment, spare parts, radar test equipment and consumables for upper-air observations for TOPEX.

3. The Second Planning Meeting (PM-II) for TOPEX was held from 18 to 22 February 1982 at the JMA headquarters in Tokyo. The report of the meeting will be discussed (Document WRD/TC/15/2) under item 5(a) of the provisional agenda.

4. The fourth and fifth sessions of the Management Board for TOPEX were held from 17 to 19 November 1981 (Manila) and from 23 to 24 February 1982 (Tokyo) respectively. Reports on these meetings will be discussed (Document WRD/TC/15/3) under item 5(b) of the provisional agenda.



5. A TOPEX Roving Mission, organized by the Government of Japan, comprising three teams covering, respectively, the meteorological, hydrological and warning dissemination and information exchange components of TOPEX, visited selected members of the Committee in late 1981 and early 1982. The mission reviewed and discussed technical aspects of the three components based on the experience gained during the Pre-Experiment.

6. In response to the request of the Typhoon Committee, WMO assigned Mr. Peter Rogers, Special Projects Officer, to visit members of the Typhoon Committee during January to March and in May 1982. He assisted members to resolve various difficulties experienced during the TOPEX Pre-Experiment and helped in the detailed planning of the TOPEX First Operational Experiment to be carried out in 1982. His mission was highly appreciated by the members visited.

7. LRCS, in co-operation with WMO and UNDRO, provided a consultant on disaster prevention and preparedness and the TOPEX WD/IE component for two three-month missions during 1981. The second mission was completed in December 1981 and the final report presented to PM-II and MB-V. A number of valuable suggestions were put forward by the Consultant for the improvement of this component.

8. In compliance with the suggestion of MB-IV, the TCS Telecommunication and Electronics Expert attended the RA-II/RA-V Implementation Co-ordination Meeting on the GTS held from 30 November to 4 December 1981 at Singapore. During the meeting the difficulties experienced by members during the TOPEX Pre-Experiment were examined and proposals made for improvement of existing facilities and for the procedures to be followed during TOPEX. These proposals were endorsed by PM-II and MB-V.

9. Members of the Typhoon Committee have made considerable efforts to mobilize the resources and manpower required for the First Operational Experiment from 1 August to 15 October 1982. China, Hong Kong, Malaysia, Philippines, the Republic of Korea, Thailand and Viet Nam have nominated scientists to be seconded to the IEC, Tokyo, and ESC's have been established by these members.

10. In accordance with the decision of the fourteenth session of the Typhoon Committee to strengthen co-ordination with other regional cyclone bodies, the TCS was represented at the ninth session of the WMO/ESCAP Panel on Tropical Cyclones held from 11 to 17 May 1982 at Madras in India.

11. Other missions made by TCS staff during 1982 included:

Telecom & Electronics : Thailand (May to June), China (July),  
Expert Republic of Korea (July), Japan (July),  
Malaysia (August), India (May).

Hydrologist : China (July), Republic of Korea (July),  
Japan (July), Malaysia (August),  
Thailand (September).

Meteorologist : China (July), Republic of Korea (July),  
Japan (July), Malaysia (August)

#### A. METEOROLOGICAL COMPONENT

##### Meteorological satellites

12. A new Geostational Meteorological Satellite (GMS-2) was successfully launched by Japan in August and became operational in December 1981. GMS-1 is now stationed at 160°E longitude to serve as a standby while GMS-2 took over the position at 140°E longitude over the equator. Special efforts were made to transmit hourly pictures during the TTE periods of the First Operational Experiment.

13. In the Philippines, the installation of a GMS HR satellite picture receiving system was completed and put into operation in May 1982. Most members are now able to intercept satisfactorily either GMS or TIROS-N satellites. However, some experienced difficulties in obtaining replacement parts from abroad for repairs. Such problems may increase when equipment warranty periods have ended. To overcome these problems, members were advised to stock sufficient spare parts to maintain the equipment without long interruptions.



### Radar and upper-air observations

14. In the Philippines, the radars at Mactan, Basco and Daet were modified with WSR-77 kits which are provided with DVIP and colour display units. The radar at Virac was completely replaced with a new WSR-77 model. At present, seven radars are operational and three more are to be installed in the near future. Spare parts needed for the 5.6-cm TOSHIBA radar at Aparri were provided under the UNDP fund supporting the Typhoon Committee.

15. The 10-cm radar at Chumphon (Thailand) was out of action due to shortage of Thyratron tubes. Procurement of replacement tubes was made under the UNDP fund so that the radar was expected to be operational again in the second half of 1982. It has been proposed to install a new 5.6-cm radar at Haad Yai in place of Chumphon for participation in TOPEX.

16. Hong Kong has replaced its old Plessey type 10-cm radar with a new 10-cm VITRO model MR-786-2 equipped with CAPPI and DVIP colour display units.

17. The number of radar stations committed by members to participate in TOPEX special observations is as follows: China 5, Hong Kong 1, Japan 1, Korea 1, Malaysia 6, the Philippines 5, and Thailand 2.

18. In compliance with the requirements of the TOPEX intensified upper-air observations, a number of hydrogen gas cylinders, gauges, hydrogen generators and radiosonde transmitters have been provided to Philippines, the Republic of Korea and Thailand, either through the WMO VCP by China or from UNDP funds.

19. The number of upper-air observation stations that carried out intensified observations during the First Operational Experiment was: China 18, Hong Kong 1, Japan 9 (including one research vessel, Keifu-Maru), Malaysia 7, Philippines 6, Republic of Korea 1, Thailand 4 and Viet Nam 3.

### Meteorological telecommunications

20. A test exercise on data exchange between the IEC and ESC's was conducted on 12 May 1982. The results of the test were satisfactory. The object of the test was to check the efficiency of transmissions on existing GTS links between the IEC and ESC's and to ensure prompt and reliable data exchange. *ASK JMA as to improve next plan*

21. SSB transceivers, teleprinters or spare parts for telecommunication equipment has been provided to a number of members, either through UNDP or WMO VCP, to ensure reliable data collection and transmission to meet the TOPEX requirements. *letter*

22. The establishment of an automated computer switching system at Guangzhou (China) was planned to improve data exchange between Beijing and Hong Kong.

23. To improve data collection in the Philippines, the Government of Japan made a survey of the existing facilities. Plans for a combined UHF-VHF-SW (SSB) telecommunication network were submitted to the Government of the Philippines for its consideration.

24. TCS continued to receive quarterly statistics of national data collection and transmission from the members of the Typhoon Committee in order to review the efficiency of its operation. The statistics were analyzed and summarized results circulated to members.

### Ocean weather ships and buoys

25. The Japanese ocean weather ship "Tango" (29°N, 135°E) operated from May to October 1982 making surface observations (3 hourly) and radiosonde and pilot balloon observations at 00 and 12 GMT. The research vessel "Keifu-Maru" also made surface observations (3 hourly), echosonde or rawinsonde observations at 00 and 12 GMT, echorawin or rawin observations at 06 and 18 GMT, radar observations at 00 and 08 GMT and BT observations once a day in the period from August to October 1982. Keifu-Maru also participated in the intensified upper-air observations during the TOPEX TTE periods. Japan also continued to operate ocean buoys Nos. 3, 4, 6 and 7 at their usual locations.



## Exchange of radar fixes

26. Based on a survey of radar fix message exchanges made by the Hong Kong Royal Observatory, the attention of members was drawn to the need to ensure the regular and prompt exchange of radar fix messages through the GTS; it was also suggested that typhoon eye fix reports should be included in RTH radio broadcasts for the benefit of those members which have not yet established point-to-point GTS circuits. Japan has agreed to include radar fix reports in the Tokyo RTH radio broadcast.

## Meteorological reconnaissance flights

27. Reconnaissance flights by United States aircraft continued to provide valuable information for typhoon warning and tracking purposes. At its fourteenth session, the Committee welcomed the information that the United States of America was likely to continue its programme of typhoon reconnaissance in the years ahead.

## Action proposed

28. The Committee is invited to:

- (a) revise its list of priorities;
- (b) recommend further measures to expedite implementation of the required meteorological observing and telecommunication facilities, especially those urgently needed for TOPEX.

## B. HYDROLOGICAL COMPONENT

### General activities

29. Based on the programme for 1982 as agreed during the 14th session, the following activities were done by members. Continued efforts have been made to improve flood forecasting and warning systems in the major river basins in China, Malaysia, the Philippines and the Republic of Korea. Further progress has been made in the Philippines where the systems in the Agno and Cagayan river basins, in addition to the one in the Bicol river basin became operational before the rainy season (May 1982). Study for establishing flood forecasting and warning systems for dam operation has been considered in the Philippines. Little information was available on studies for Comprehensive

flood loss prevention and management, as well as for determination of magnitude and frequency of floods, in the pilot areas although these were conducted in disaster stricken areas by some members. Under the hydrological component of TOPEX, monitoring reports on the operation and performance of the flood forecasting systems during flood events in 1981 as well as reports on forecast accuracy were prepared by some members for evaluation.

### JAPAN

30. The radar raingauge systems established in 1981 in the Yodo river basin, as well as those in the Tone and Chikugo river basins, operated satisfactorily during 1982. Three additional systems in Kiso, the Yoshino river basin and Southern Kyushu are under installation.

### MALAYSIA

31. The establishment of a flood forecasting system in the Sadong river basin in Sarawak, for which a technical feasibility study was conducted in 1979 with the assistance of the Japanese Government, has been planned.

32. A field survey for improvement of the existing flood forecasting systems in the major river basins in peninsular Malaysia was also conducted in 1981 and the results are being studied.

### PHILIPPINES

33. In addition to the flood forecasting and warning system completed in the Bicol river basin in 1981, the establishment of similar systems in the Agno and Cagayan river basins was subsequently completed and they became operational in the rainy season of 1982. These three systems are operated together at the Flood Forecasting Center in Metro Manila with each system having its own sub-center located in the Bicol, Agno and Cagayan river basins respectively.

34. The rehabilitation of the existing flood forecasting and warning systems in the Pampanga river basin was completed by PAGASA with the assistance of the Japanese Government. The system was established in 1973 as a pilot project of the Typhoon Committee. The TCS assisted PAGASA in carrying out the rehabilitation of the facilities and in the proper operation and the application of maintenance methods for the system.



35. With a view to reducing the damage caused by water released from existing dams in the Philippines, Government agencies began a detailed survey for establishing flood forecasting and warning systems for dam operation. These systems, if the survey suggests them to be feasible, are expected to be completed in 1985.

#### REPUBLIC OF KOREA

36. The computer installed in 1974 for flood forecasting in the Han river basin was replaced in February 1982. A number of additional rainfall stations are planned to be established, with a view to more accurate flood forecasting in the Han river basin, in connection with the operation of the Chugjo multi-purpose dam which is now under construction in the South Han river basin.

#### Flood loss prevention and management

37. It has been observed in urban areas in Japan that loss of life and property caused by floods has increased due to rapid urbanization in the low lands. Therefore efforts have been made to promote comprehensive flood loss prevention and management, as well as conventional measures to reduce flood damage in urban areas.

38. The Sixth Five Year Plan (1982-1987) for flood control costing about 1,210 billion yen was launched. The plan aims to reduce flood damage by applying comprehensive flood loss prevention and management measures in urban areas as well as by constructing ordinary flood control facilities in major river basins. It also includes erosion control in mountainous areas and measures for environmental conservation and recreation.

39. In the Philippines, following the flash floods and mud flows caused by heavy rainfall during a tropical storm in June-July 1981, which rushed down the gullies on Mt. Mayon's slope leaving 200 dead, 30 injured and destroying more than 800 houses, the Government decided to review the Master Plan for the Mayon Volcano Sabo and Flood Control prepared in 1979-1980. In conjunction with the review, a new study for comprehensive

flood loss prevention and management was being carried out by a team of Japanese experts at the request of the Philippine Government. The study covers risk-analysis, establishment of a telecommunication link for disaster prediction and warning, and measures for disaster preparedness and prevention such as resettlement and emergency evacuation. The risk analysis was carried out with the aid of topographical maps (1 to 25,000) and aerial photographs taken before and after the flood.

#### Action proposed

40. The Typhoon Committee is invited to:
- (a) consider further steps for the establishment of pilot flood forecasting systems in the Lao People's Democratic Republic and Viet Nam and for the proposed extension of flood forecasting systems to Sabah and Sarawak in Malaysia;
  - (b) consider steps to be taken for the investigation and survey of the pilot river basins selected for comprehensive flood loss prevention and management; and
  - (c) consider steps to be taken for photographing flood situations and marking flood levels as important information which could serve as a basis for the preparation of flood risk maps, etc.

#### C. DISASTER PREVENTION AND PREPAREDNESS (DPP)

##### General activities

41. In co-operation with WMO and UNDR0, LRCS provided a senior officer to carry out a consultancy mission for two 3-month periods in 1981. The consultant completed his second 3-month consultancy mission in December 1981. A roving mission on warning dissemination and information exchange provided by the Government of Japan, visited Malaysia, the Philippines and Thailand in early 1982. The recommendations



of the consultant, as well as those of the roving mission, were discussed at PM-II and MB-V.

42. PM-II agreed that a simple standard format for damage assessment should be adopted for the region. A simple but effective "notice board" used in the Kelantan river basin in Malaysia might be considered for use by members.

43. Japan reported that it was ready to carry out, during the TOPEX First Operational Experiment a series of activities in accordance with the guidelines formulated by the consultant. Japan was also considering a "Disaster Prevention Week" to foster greater awareness in disaster prevention which would include a disaster prevention fair and disaster prevention drills.

44. A Manual on "How to Assess Damage and Impact", published by the Office of the Civil Defense of the Philippines in 1982, has been circulated to agencies involved in disaster prevention and preparedness, with special emphasis on the WD/IE component of TOPEX. The forms to be used for surveys have been revised and will be distributed in six regions of the country affected by typhoons, particularly in pilot communities designated in each of the six regions.

#### Action proposed

45. The Committee is invited to:

- (a) note the above information;
- (b) record its gratitude to LRCS, WMO and UNDP and the Government of Japan for providing valuable consultant services and the Roving Mission in the field of DPP; and
- (c) consider the further action necessary to ensure effective work in the field of disaster prevention and preparedness with reference to recommendations made by consultants in the past.

#### D. TRAINING

##### General activities

46. A training course on tropical meteorology and hurricane forecasting was conducted at the University of Miami from March to May 1982. Participants from several members attended the course with support from VCP. A Seminar on the Application of Satellite Data to Tropical Cyclone Forecasting, as part of the programme of the WMO/ESCAP Panel on Tropical Cyclones, was held in Bangkok from 24 May to 4 June 1982. Seven members of the Typhoon Committee sent participants to the seminar.

47. Two workshops on regional development and application of HOMS in Asia and the South-West Pacific were held in Manila and Bangkok in November 1981. They were attended by hydrological officers from Bangladesh, Burma, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Viet Nam, the Asian Institute of Technology, the Mekong Secretariat and the Typhoon Committee Secretariat. After being briefed on the concept and current state of development of HOMS, the participants introduced reports providing background information on the situation regarding operational hydrology in their respective countries, with particular reference to hydrological technology available and requirements for additional technology which might be provided through HOMS. The workshops then drafted outlines of a number of sub-projects for development, adaptation, testing and pilot application of HOMS components in the region.

48. In support of TOPEX, Japan conducted a seminar on the Hydrology and Warning Dissemination and Information Exchange (WD/IE) Component from 1 July to 7 August 1982 in Tokyo. Focal Points or participants nominated by the Focal Points attended the seminar.

49. The TCS Telecommunications and Electronics Expert conducted training courses on the theory and practical use of test equipment for repair and trouble shooting of IC digital circuitry and microprocessors in the Philippines (April), Thailand (June), China (July), Republic of Korea



(July) and Malaysia (August) for the benefit of maintenance personnel and technicians. The TCS Hydrologist gave courses on hydrology, with special emphasis on urban hydrology and flood fighting, in China (July), Republic of Korea (July) and in Malaysia (August).

50. Group training courses were held in Japan for the benefit of members of the Committee on the following subjects:

- (a) river engineering (July and November);
- (b) flood loss prevention and management (July to September);
- (c) technology for disaster prevention (September to December); and
- (d) maintenance of weather radar (October 1982 to February 1983).

51. A Seminar on Flood Vulnerability Analysis was planned to be held in Bangkok from 7 to 13 September 1982. The seminar will discuss important measures that can be used as a non-structural approach to flood loss prevention and management for technical personnel actually involved in the formulation and planning of flood loss mitigation measures.

52. A Regional Scientific Conference on Tropical Meteorology was scheduled to be conducted under the auspices of WMO, the Meteorological Society of Japan, and the American Meteorological Society, from 18 to 22 October 1982, at Tsukuba, Japan. At the fourteenth session of the Typhoon Committee, China indicated its willingness to host a seminar on Typhoon Forecasting. The seminar will be held at Hangzhou, China from 25 to 27 October 1982.

#### Action proposed

53. The Committee is invited to:

- (a) record its appreciation to China for hosting the typhoon seminar for members of the Typhoon Committee;
- (b) record its gratitude for the assistance provided by the Government of Japan in organizing training courses for members of the Committee; and

- (c) advise members to take full advantage of the various training facilities offered by members, UNDP, and through the WMO/VCP.

#### E. RESEARCH

##### General activities

54. Members have been requested to furnish TCS with lists of publications on research of interest to the Committee, as well as a list of on-going research activities. The lists are consolidated by TCS and circulated to members. Members wishing to have copies of publications may obtain them from the member directly or through TCS.

55. <sup>patung to the</sup> In the Philippines, an inter-agency project "Ecological Protection of Ports and Coastal Projects Through Storm Surge Prediction" is being undertaken by PAGASA as the lead agency, and the Ministry of Public Works and Highways (MPWH) and the Bureau of Coast and Geodetic Survey (BCGS) as co-operating agencies, with a view to developing storm surge forecasting techniques and other measures to protect ports, coastal projects and communities from storm surges.

56. The TOPEX Sub-Committee on the Sub-Experiment was established during MB-III. As recommended by PM-II to MB-V, the terms of reference of the Sub-Committee have been slightly modified as follows:

- (i) to formulate plans for studies to be undertaken within the Sub-Experiment with objectives as follows:
  - (a) investigation on the mechanisms of generation and development of typhoons;
  - (b) improvement of techniques for typhoon tracking, intensity identification and prediction;
  - (c) improvement of techniques for storm surge prediction;



- (d) investigations of induced effects of typhoons on the general circulation and weather patterns in Asia/Pacific area;
  - (e) development of techniques for quantitative precipitation forecasting using data gathered during the TOPEX years.
- (ii) to submit the draft plans for specific studies to the Management Board for approval; and
- (iii) to review and evaluate the results of studies.

Action proposed

57. The Committee is invited to:

- (a) note the above information; and
- (b) consider further action necessary to ensure effective collaboration in typhoon and associated flood research and to exchange the results amongst members.

*may member can give additional input.*

FOR PARTICIPANTS ONLY

WRD/TC.15/2

20 September 1982

ORIGINAL: ENGLISH

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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

TYPHOON OPERATIONAL EXPERIMENT (TOPEX)

REPORT ON THE SECOND PLANNING  
MEETING FOR TOPEX

(Item 5 (a) of the provisional agenda)

Note by the WMO secretariat

Introduction

1. In accordance with the timetable agreed at the First Planning Meeting for TOPEX, the Second Planning Meeting (PM-II) was held at the Japan Meteorological Agency in Tokyo from 18 to 22 February 1982. It was attended by representatives of seven of the 10 members of the Typhoon Committee and by observers from UNDP, UNDRO and LRCS.
2. The primary purpose of PM-II was to continue the detailed planning of TOPEX with the emphasis on the arrangements for the First Operational Experiment scheduled for 1 August to 15 October 1982. The full report of the meeting has been published by WMO as TOPEX Report No.5 under the Tropical Cyclone Programme series. The complete report, which participants at TC.15 may wish to bring with them, is not therefore being reproduced as a document for the session. A summary of the principal decisions of PM-II is, however, given in the present document. In this summary, which follows the order in which the items were considered by PM-II, cross references are given to the appropriate paragraphs of the full report.



### Review of the Pre-Experiment and other activities (Paras. 9-10)

3. The planning leading up to the Pre-Experiment in 1981, and its results, were reviewed briefly. PM-II noted that the IEC had been re-opened in late 1981 to permit discussions on future co-ordination between the IEC and ESCs. The resulting recommendations were referred for discussion under the appropriate agenda items.

### Decisions made by TC.14 and MB-IV (Paras. 11-14)

4. PM-II decided, for simplification of its work, to consider all the recommendations of TC.14, MB-IV and the co-ordination discussions under the three items dealing respectively with the further planning of the Meteorological, Hydrological and WD/IE Components.

5. It was pleased to learn that Japan would again, through JICA, provide support for six scientists to be seconded to the IEC for the First Operational Experiment (FOE). The support would extend from 22 July to 17 October. In addition, JICA would also fund five participants at the seminar on the Hydrological and WD/IE components to be held in Tokyo for five weeks in July/August 1982. The Director of the IEC agreed that each member might send a second scientist for the FOE period if support was available from other sources.

### Review of the TOPEX Roving Mission (Paras. 15-18)

6. PM-II reviewed the activities of the TOPEX Roving Mission fielded by Japan which had visited six members to assist in preparations for one or more of the three components. A total of 18 experts had participated in the mission. The meeting considered that the mission had been very useful in promoting a better understanding of TOPEX and in clarifying the position in the countries visited. It expressed its warm appreciation to Japan.

### Further Planning of the Meteorological Component (Paras. 19-43)

7. When discussing the observational aspects of the Core Experiment PM-V agreed to a series of proposals put forward by Japan. These provide

for an increase from two to four in the number of selected typhoons with intensified observations; a maximum of five days for each TTE period; mandatory 6-hourly upper-air observations at all committed stations within 500 km of the centre, and recommended 6-hourly observations at other committed stations; hourly GMS observations on one-day during each TTE period; and for other observations to be in accordance with the decisions of PM-I.

8. The telecommunication problems revealed by the Pre-Experiment were considered on the basis of recommendations made at the RA-II/RA-V Implementation Co-ordination Meeting (December 1981) and proposals made by Japan. A number of principles were agreed for the procedures to be used during the FOE. These procedures will be in compliance with the Manual on the GTS. Together with the agreed TOPEX message formats, they have since been incorporated in the TOPEX Operational Manual (TOM). Dates were also agreed for a test of the circuit over which TOPEX messages are to be exchanged and a schedule for the transmission of messages and data from the IEC to the ESCs was drawn up.

9. On the data processing and archival aspects of TOPEX, PM-II considered and agreed to a plan put forward by Japan specifying the data which will be available in each of the data sets for the Pre-Experiment and the First and Second Operational Experiments. The desire of other WMO Members and scientific institutes to acquire TOPEX data sets for research was recognized.

10. PM-II agreed that objective forecasts obtained by means of the Moveable Nested Grid model during TTE periods will be transmitted by the IEC to ESCS over the GTS. It also agreed that a list of all the committed observational stations for the FOE should be included in the TOM.

11. The proposals made by Japan for support to the IEC from ESC Tokyo were welcomed by PM-II, including the provision for a liaison officer. The many recommendations made following the Pre-Experiment were considered in detail and appropriate action taken (see Appendix D of report of PM-II).

TOPEX



12. Consideration of the work being performed by the Sub-Committee on the Sub-Experiment led PM-II to propose that completed studies be forwarded by late 1984 for collection and publication by WMO. It was further suggested that studies of quantitative precipitation forecasting should be carried out by the Sub-Committee to strengthen the linkage between the Meteorological and Hydrological Components.

Review and further planning of the Hydrological Component (Paras. 44-59)

13. Although there were no major floods in any of the designated river basins during the 1981 Pre-Experiment, a number of the systems were operated to monitor the performance of these flood forecasting systems. The TOPEX water year runs from 1 April to 31 March and monitoring reports on the 1981/82 year were to be submitted by mid-1982. No difficulties were reported with the use of the standard monitoring format and it was considered that it included all the information that was necessary for the monitoring of the systems. It was therefore agreed that the same format should be used in 1982-83. It was decided that in future, the systems should be activated even for minor floods and that the monitoring should also be carried out in river basins not yet designated. A flexible procedure of this type would guarantee the largest possible input for the later evaluation of TOPEX.

14. It was recalled that the comparison of models within TOPEX was the responsibility of members and should be based on the annual reports submitted for those forecasting systems having the capability of using more than one model. PM-II encouraged members to install additional models for this purpose and to include details of their performance in the annual monitoring and forecast accuracy reports.

15. The meeting noted that Japan was compiling information received from members on flood risk analysis into a brief report. Detailed discussions of the data requirements and analytical techniques to be used were expected to be held at the TOPEX seminar in July/August 1982.

Further planning of the Warning Dissemination and Information Exchange Component (WD/IE) (Paras. 60-67)

16. PM-II considered the further planning of the WD/IE Component on the basis of the report of the consultant who had spent six months in the area, case studies performed by members, and the roving mission provided by Japan. The considerable increase in the momentum of the activities under WD/IE led to a large number of proposals for the programme during the First Operational Experiment. These proposals were combined into a series of recommendations on a country by country basis (see Appendix E to PM-II report). Emphasis was placed upon a number of topics including the linkage of remote disaster-prone areas with improved communications, the training of trainers in disaster prevention and preparedness, closer co-operation among national agencies in effecting a more efficient counter-disaster programme, and a more aggressive campaign to promote understanding of TOPEX.

17. Japan announced that, to foster greater public awareness and response, it is considering a "Disaster Prevention Week" under which a series of events such as disaster prevention fairs and drills would be carried out.

18. PM-II recommended that floods and flooding situations be photographed to serve as the basis for the preparation of flood risk maps. The meeting also agreed that a simple standard format for damage assessment should be adopted for use in the region.

Co-ordination of the three TOPEX components (Paras. 68-70)

19. Attention was also given by PM-II to the arrangements for the co-ordination of the three TOPEX components at both regional and national levels. There was general agreement that the existing arrangements, though varied at the national level, were operating satisfactorily.

20. The continued production by WMO of meeting and technical reports in the TOPEX series was seen by PM-II as essential to the success of TOPEX and WMO was requested to continue these publications.

Date and place of Third Planning Meeting (Paras. 71-72)

21. PM-II decided, at the invitation of Japan, that the Third Planning



Meeting for TOPEX would be held in Tokyo in February 1983. Its principal purpose would be to review the results of the FOE and to prepare for the Second Experiment. A tentative invitation for the Evaluation Meeting on TOPEX to be held in Tokyo in March 1984 was also accepted with appreciation.

Action proposed

*contains action proposal.*

22. The Typhoon Committee is invited to:

- (a) Examine this summary of the main decisions of PM-II, in conjunction as may be required with the full report of the meeting;
- (b) Express its views on the decisions made, taking into account the further planning of TOPEX and, especially, the results of the First Operational Experiment and the arrangements for the Second Operational Experiment;
- (c) Refer to the Management Board for consideration at its sixth session those questions on which further early action is required.

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FOR PARTICIPANTS ONLY  
WRD/TC.15/3

20 September 1982

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ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC  
AND

WORLD METEOROLOGICAL ORGANIZATION

Typhoon Committee  
Fifteenth session  
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Bangkok

TYPHOON OPERATIONAL EXPERIMENT (TOPEX)

REPORT OF THE MANAGEMENT BOARD FOR TOPEX ON  
ITS FOURTH AND FIFTH SESSIONS

(Item 5 (b) of the provisional agenda)

Note by the WMO secretariat

Introduction

1. The terms of reference assigned by the Typhoon Committee to the Management Board for TOPEX require it to report on progress to the Committee's annual session. Since the fourteenth session the Board has met twice, holding its fourth session in Manila from 17 to 19 November 1981 and its fifth session in Tokyo on 23-24 February 1982. The members of the Committee will already be familiar with the results of the Board's work in the period up to and including the Pre-Experiment. At its fourth and fifth sessions it has concentrated on the action needed to improve the systems as a result of the lessons learned during the Pre-Experiment and the further planning of the TOPEX activities during the First Operational Experiment (FOE) from 1 August to 15 October 1982. This document contains a brief review of the main decisions taken by the Board at the above two sessions.



Decisions of the Board at its fourth session

2. MB-IV was held immediately after the fourteenth session of the Committee. Its main pre-occupation was to review the results of the Pre-Experiment, mainly on the basis of the report of the IEC activities submitted by its Director and on a summary of the work performed at the ESCs prepared by the Chairman of the Board. These reports contained a large number of recommendations which the Board accepted in principle, whilst considering that they should be given more detailed discussion at the Second Planning Meeting for TOPEX (see document WRD/TC.15/2).
3. However, the Board made the firm decision that the FOE should be held from 1 August to 15 October 1982, the precise dates for the Second Operational Experiment being decided later in the light of experience during the FOE. It further requested Japan to consider increasing the number of typhoons selected with intensified observations from two to four and decided that it would not be necessary for the IEC to consult ESCs before selecting a particular typhoon.
4. In the light of problems revealed during the Pre-Experiment the Board made a series of recommendations for immediate remedial measures designed to improve the telecommunication system for TOPEX. These included provision for a test exercise in exchanging messages between the IEC and the ESCs, as well as instructions to ESCs intended to ensure better handling of TOPEX messages and data at the local level.
5. The need for the scientists seconded to the IEC to be highly experienced forecasters and for them to be fully familiar with the procedures in the TOPEX Operational Manual (TOM) was emphasized.
6. The programme followed by the participants at the seminar organized in Tokyo on the Hydrological and the Warning Dissemination and Information Exchange Components was reported to the Board. Most members had not had significant flood events calling for the operation of their flood forecasting and warning systems in the designated river basins. Activities in other areas were described.

7. A number of case studies or reports on activities under the WD/IE Component were submitted to the session. The Board noted that there had been a marked improvement in the work being carried out under the third component but that there was still a need for the promotion of TOPEX among all agencies involved, and especially with those national authorities responsible for budgetary allocations. Proposals for improvements were made in a number of areas of WD/IE. Concern was expressed over the need to give TOPEX wider publicity and the Board requested members to give careful consideration to the steps they could take through the press, radio and television to promote better understanding of the Experiment.

8. MB-IV endorsed the proposals for studies under the Sub-Experiment of the Meteorological Component of TOPEX put forward by the Chairman of the Sub-Committee. The importance of TOPEX data was stressed; it was agreed that a good archiving format would facilitate research and that complete data sets for particular typhoons should be compiled. It was considered premature for the Sub-Committee to meet, the first need being to make some progress by correspondence.

Decisions of the Board at its fifth session

9. MB-V was held immediately after the Second Planning Meeting (PM-II) for TOPEX. Mr. I. Shimizu (Japan) and Mr. Fang Qi (China) were re-elected as chairman and vice-chairman respectively until the first meeting in 1983, in accordance with the Board's Rules of Procedure.
10. The Board examined the recommendations made by PM-II, and particularly those referred specifically to it. It noted the strenuous efforts being made by members to fulfil national commitments to TOPEX and stressed the need for the continuation of these efforts. The current position with regard to external sources of assistance was reviewed. The aid obtained by WMO through UNDP and VCP was noted with appreciation. Thanks were expressed to China for the VCP assistance it was providing to the Philippines and Thailand. WMO was urged to try to meet any requests for upper-air expendables for the increase in intensified observations agreed by PM-II for the FOE. Reference was made to the TC.14 request to ESCAP to support TOPEX activities.



11. MB-V considered that the guidelines proposed by Japan for the evaluation of the Meteorological Component of TOPEX constituted a satisfactory general procedure for this purpose (see Appendix C to report of MB-V). It recognized that there might be a need to modify or add to them in the light of experience during the FOE. The Board requested WMO as co-ordinator for the Hydrological Component and UNDRO/LRCS as co-ordinators for the WD/IE Component to formulate similar guidelines for submission to MB-VI.

12. The terms of reference of the Sub-Committee on the Sub-Experiment were amended, primarily to make provision for studies of quantitative precipitation forecasting (see Appendix D to report of MB-V). Japan agreed to distribute to all participating members a new Chapter 7 for the TOM containing the telecommunication procedures for TOPEX agreed at PM-II. The report of PM-II was formally endorsed by the Board.

13. The Board discussed arrangements for the preparation of the reports of the IEC and ESCs. It agreed that the guidelines for the format of these reports adopted at MB-II remained valid but time constraints precluded following the same procedures as after the Pre-Experiment. It decided that preparation of the reports should begin well before the end of the FOE and that each member of the Board should bring 25 copies of his ESC report directly to MB-VI.

14. In view of the need for guidance in making assessments of typhoon damage and the PM-II proposal for the adoption of a simple standard format for the region, the Board requested UNDRO and LRCS to co-operate in the preparation of such a format and to make proposals to its sixth session. The Board reminded participating members to provide WMO with information on their TOPEX activities for inclusion in TOPEX Newsletters.

15. The Board agreed that its sixth session should be held in Bangkok from 16 to 18 November 1982.

*is listed*  
Action proposed

*on page 5. Thank*

16. The Committee is invited to:

- (a) endorse the reports of the Management Board for TOPEX on its fourth and fifth sessions;
  - (b) note the progress achieved in the further planning of TOPEX;
  - (c) make proposals for the questions to which special attention should be given prior to the Third Planning Meeting for TOPEX;
  - (d) consider and amend as necessary the provisional agenda for PM-III.
-



WRD/TC.15/4  
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AND  
WORLD METEOROLOGICAL ORGANIZATION

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

SUPPORT FOR THE COMMITTEE'S PROGRAMME

(Item 6 of the provisional agenda)

Note by the ESCAP and WMO secretariats

Introduction

1. The Typhoon Committee receives support from a variety of different sources. These sources are: UNDP, various developed countries which provide assistance either bilaterally or through ESCAP and the WMO Voluntary Co-operation Programme (VCP), and TCDC arrangements between the members of the Committee themselves.
2. At each of its annual sessions the Committee reviews its need for assistance in the light of the particular programme activities it is carrying out and, to the extent possible, determines the possible sources and level of support required to implement its programme. This document provides information on the present position with regard to the support available from different sources to meet some of the foreseen requirements of the Committee.
3. The primary concern of the Committee is to implement its short- and long-term programmes of work as approved at its eleventh session. In this context, strong support would be required to implement the programme of work of the Committee for 1983, a principal item of which is the implementation of TOPEX. Support would also be required for the Typhoon Committee

/secretariat



secretariat (TCS), which is the executive arm of the Committee. In addition, the Committee requires support in the convening of its annual sessions.

4. This document will discuss first TCS, then the Committee's programme activities, including TOPEX, and finally its annual sessions.

#### Typhoon Committee secretariat

5. The present staffing of TCS consists of:

- (a) A co-ordinator, provided by the Philippines;
- (b) A meteorologist, provided by the Philippines;
- (c) A hydrologist, provided by Japan;
- (d) A telecommunication/electronics expert, provided by UNDP.

6. In June 1981 all members of the Committee were asked to give urgent and serious thought to the provision of a co-ordinator for TCS taking into account the views of the Philippines, which had been providing a co-ordinator for three years. At the fourteenth session of the Committee, the Philippines agreed to provide a co-ordinator for a further period, again as an interim arrangement. The possibilities in this regard are the following:

- (a) One of the other members offers to provide a co-ordinator;
- (b) The Philippines will continue to provide a co-ordinator as an interim arrangement until such time as another member could be prepared to assume this responsibility.

The Committee may therefore wish to review the present situation and express its views on the arrangements for the future.

7. As stated in paragraph 5 above, the posts of meteorologist and hydrologist are filled through the assignment of counterpart staff by the Philippines and Japan respectively. In the case of the hydrologist, whose assignment expired in February 1982, Japan, at the request of ESCAP, extended his assignment for one more year. As these posts will continue to be needed for TCS, the options open to the Committee after 1982 are the following:

- (a) The Philippines will continue to provide the meteorologist;
- (b) Japan will continue to provide the hydrologist.

The Committee may wish to express its views concerning future arrangements.

8. The post giving rise to great concern is that of the telecommunication/electronics expert. In its new programme for support to the Typhoon Committee from 1982 to 1984, UNDP provides for his continuation only throughout the year 1982. The Committee is well aware of the importance of this post and the useful services of the incumbent. His provision of on-the-spot technical advice to members on the installation, operation and maintenance of the telecommunication and electronic equipment is essential to the operation and improvement of the typhoon forecasting and warning systems. The matter has been discussed by WMO with UNDP, and it seems likely that the expert's services can be extended through 1983, although confirmation is still awaited at the time of writing this document. This will ensure proper support during the second operational experiment. The situation for 1984 will have to be reviewed later and the possibility of one of the members providing an expert under TCDC arrangements similar to the other posts in TCS should be considered.

9. While the Committee considers that a full-time expert in disaster prevention and preparedness is not required, part-time consultant services in this field appear to be necessary to ensure the proper implementation of this component of the Committee's programme. UNDR0 and LRCS had in previous years provided assistance in this regard and this option for support in this field continues to be open to the Committee.

#### Programme activities, including TOPEX

##### (a) UNDP

10. A new project RAS/81/054, "Programme support to the Typhoon Committee" covering the period 1982-1984 providing support for the Committee's activities, including TOPEX, has been approved by UNDP. Of the total amount of \$US1,001,400 provided for the three-year period, approximately \$US600,000 has been allocated to equipment and \$US160,000 to training. Expert consultant services and miscellaneous costs absorb most of the remainder of the available funds.

##### (b) WMO Voluntary Co-operation Programme

11. VCP has for many years provided a source of assistance for members of the Typhoon Committee. The advent of TOPEX has revealed additional requirements for equipment which must be met if the members of the Committee are to carry out fully their national responsibilities under the



experiment. A number of projects have already been implemented under VCP and others have been circulated to WMO members for their consideration. In this connection, it may be noted that the Chinese contribution through VCP to the Philippines and Thailand may be valued at \$US85,000. In addition \$60,000 was made available from VCP cash for TOPEX.

(c) WMO Special Temporary Voluntary Fund for TOPEX

12. Following a request made by the Management Board for TOPEX at its first session (June 1980), a Special Temporary Voluntary Fund for TOPEX was established in February 1981 by the Secretary-General of WMO. Malaysia and Thailand each contributed \$US1,000. The Government of Haiti also contributed \$US1,000 to the Fund. Information on further contributions received, if any, will be reported at the fifteenth session.

(d) ESCAP extrabudgetary resources

13. At its fourteenth session, the Committee was requested to make strong representations with ESCAP for the allocation within the context of its mandates of a portion of its resources to support priority projects of the Committee. In response to this request, which was reaffirmed by the Commission at its thirty-eighth session, the ESCAP secretariat, in June 1982, informed the TCS co-ordinator that it would be prepared to consider, together with all other ESCAP requirements for extrabudgetary support, requests for support for any activities within the framework of the Typhoon Committee's programme of work on the basis of the priority criteria established by ESCAP. Developments on this matter will be reported at the fifteenth session.

(e) UNEP

14. *secure support through WMO*  
UNEP provided funds to support the reopening of IEC from 30 November to 3 December 1981 for the meeting of ESC Directors. Efforts to secure further support for TOPEX from UNEP have been unsuccessful.

(f) TCDC

15. TCDC could be an important source of support for exchange of experts, provision of equipment, training and research. For instance, China provided hydrogen cylinders, generators and pressure gauges to the Philippines and Thailand. Japan provided assistance in mounting roving missions to the member countries on the three components of TOPEX in late 1981 and early

/1982

*Endover*

1982 and in organizing a five-week seminar covering the hydrological and WD/IE components of TOPEX in July 1982. Japan also made funds available to support the secondment of six scientists to IEC for the First Operational Experiment of TOPEX.

Annual sessions

16. Since its inception, the annual sessions of the Committee have been convened by the Executive Secretary of ESCAP, in consultation with the Secretary-General of WMO and the Chairman of the Committee. ESCAP, in co-operation with the Secretary-General of WMO, has also provided the necessary servicing of the Committee's meetings. For this purpose, and together with the technical support extended to the Committee by ESCAP in the organization of workshops and seminars in the field of flood loss prevention and management, ESCAP has allotted from its regular budget about \$US40,000 annually covering the cost of the services of Professional staff, documentation services, simultaneous interpretation and other related administrative services. Whenever the sessions are held away from Bangkok, ESCAP incurs an additional expense of \$US15,000. Unless there is a change in current arrangements for convening and servicing the Committee's annual sessions, ESCAP will continue to bear this annual expense.

17. Similarly, WMO incurs expenses in the organization and servicing of these annual sessions through the provision of the services of Professional staff and for translation (from English into French) of the documents for the session and the final report.

18. It should also be noted that the increased tempo of Typhoon Committee activities as a result of TOPEX has led WMO to provide substantial additional support from its regular budget. The preparations for TOPEX, which began in 1979, have called for a number of planning meetings and for the holding of sessions of the Management Board for TOPEX twice a year. For all these meetings, WMO has not only provided the usual services of Professional staff and documentation, but has also met the travel and/or per diem costs of a representative of each member of the Typhoon Committee participating in TOPEX. For the 1981 Pre-Experiment WMO funded the travel and subsistence costs of two of the scientists seconded to IEC. Three scientists are attending IEC during the First Operational Experiment at WMO expense. In 1982 alone, these and related TOPEX costs met from the WMO

/regular



regular budget will total approximately \$US45,000. In addition, specifically to assist members in their TOPEX preparations, a secretariat officer spent six months in the area at an estimated cost of about \$US50,000.

Action proposed

19. The Typhoon Committee is invited to:

(a) Review the staffing of TCS and to:

- (i) Consider future arrangements for filling the post of the TCS co-ordinator;
- (ii) Seek confirmation that the posts of the meteorologist and hydrologist will continue to be filled by counterpart staff;
- (iii) Consider ways in which the functions of the telecommunication/electronics expert may be met from 1984 onward;
- (iv) Examine the need for further consultant services in disaster prevention and preparedness, or in other specialized fields related to its programme and how the need should be met;

(b) Review the various sources of support for the Committee's programme as to adequacy;

(c) Review current arrangements and support for the Committee's annual sessions.

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

Typhoon Committee  
Fifteenth session  
9-15 November 1982  
Bangkok

CO-ORDINATION WITH OTHER ACTIVITIES OF THE  
WMO TROPICAL CYCLONE PROGRAMME

(Item 9 of the provisional agenda)

Note by the WMO secretariat

Introduction

1. The purpose of this document is to inform the Committee of the various activities related to its own work which are being carried out under the WMO Tropical Cyclone Programme (TCP), of which this work forms part. The annex to the document consists of the eighth status report on the implementation of the TCP which provides a summary of the developments that have taken place in the year up to 30 June 1982. Later information covering the period between the issue of the status report and the fifteenth session of the Committee will be presented by the representative of the WMO Secretariat at the session.

Action proposed

2. The Committee is invited to:

- a) note and comment on the information provided in the annex to this document and on any later developments reported to the session;
- b) review the measures taken to ensure effective co-ordination of the Committee's activities with those performed under the TCP as a whole;



Eighth Status Report on the Implementation of the

WMO Tropical Cyclone Programme

(30 June 1982)

Introduction

1. Resolution 2733 (XXV) of the United Nations General Assembly expressed concern at the loss of human life and material damage caused by tropical cyclones and other natural disasters and requested international action for the mitigation of the harmful effects of such disasters. In response to this resolution, the Sixth World Meteorological Congress, in 1971, initiated the WMO Tropical Cyclone Project.
2. The United Nations General Assembly has maintained a close interest in the project and in 1977 adopted a further resolution (A/RES/32/196) calling on WMO to intensify its efforts in this field. Eighth Congress reviewed the progress made up to 1979 and decided that the project should be upgraded to be the WMO Tropical Cyclone Programme (TCP) from 1980 onwards. It unanimously agreed that it was essential to strengthen and intensify the programme in the years ahead and that WMO should co-ordinate these activities.
3. The ultimate objective of the TCP is to establish national and regionally co-ordinated systems to ensure that the loss of life and damage caused by tropical cyclones are reduced to a minimum. To attain this objective, the programme aims at strengthening the capabilities of Members affected by tropical cyclones to:
  - (a) detect, track and forecast the approach and landfall of tropical cyclones;
  - (b) provide forecasts or timely assessments of heavy rainfall and forecasts of strong winds resulting from tropical cyclones;
  - (c) apply the most appropriate techniques of quantitative storm-surge prediction;
  - (d) forecast the flooding arising from a tropical cyclone strike;
  - (e) provide the basic data on risk of loss by winds, storm surges and floods to meet the needs for development planning and other purposes;
  - (f) organize and execute the essential disaster prevention and preparedness measures;
4. It is expected that the following benefits will increasingly be derived from the further implementation and development of the TCP:
  - (a) improved capability to issue accurate and timely warnings of tropical cyclones and their effects, particularly those caused by strong winds, storm surges and floods;
  - (b) co-ordinated planning and execution of disaster prevention and preparedness measures;



- (c) reduction of the loss of human lives;
- (d) mitigation of the dramatic impact of tropical cyclones upon the populations and economies of the countries affected.

5. A plan of action for the TCP was first adopted by the Executive Committee in 1972. A revised plan of action, prepared at the request of Eighth Congress (1979), was formally adopted during the current reporting period and distributed to all Members as a publication within the TCP series. This revised plan of action, which was endorsed by the thirty-fourth session of the Executive Committee (June 1982), is based on the following main principles:

- (a) close international co-operation is a prerequisite for the attainment of the objective of the TCP (see paragraph 3 above);
- (b) there is a need for fully integrated and co-ordinated systems with forecasts and warnings playing increasingly important roles;
- (c) full advantage must be taken of relevant developments in technology and advances in the sciences with special emphasis on technical co-operation and in the training of personnel and transfer of technology to the developing countries;
- (d) greater consideration should be given to the evaluation of the risk of disaster from tropical cyclones as a basis for medium and long-term planning of land use, local development and an effective response to forecasts and warnings;
- (e) forecasts and warnings must be improved to meet more effectively the requirements of the users;
- (f) through regional and sub-regional arrangements, guidance emanating from forecasting of meteorological parameters in the planetary and large-scales of motion should be increasingly made available to countries affected by tropical cyclones for real-time operational purposes;
- (g) improvements are needed in national capabilities for local forecasting and warning, which rely essentially on analysis and forecasting of meso-scale and small-scale meteorological phenomena;
- (h) activities in flood forecasting should take advantage of the many recent developments in the technology of the collection and processing of hydrological data, including the modelling of the rainfall-runoff process;
- (i) the development of activities at the interface with the user to increase the impact of warnings, taking into account their humanitarian and economic aspects, should be pursued, and, to this end, guidance should be provided to countries concerned.

6. The TCP is organized around three main elements:

- (a) Meteorological, based on the World Weather Watch, which is concerned with the provision of the basic meteorological data required for tropical cyclone forecasting and the application of the appropriate techniques to ensure timely and accurate forecasts;
- (b) Hydrological, based on the Operational Hydrology Programme, which is concerned with the basic hydrological data required for flood forecasting and the application of the appropriate techniques to ensure timely and accurate forecasts;
- (c) Prevention and Preparedness, which is concerned with all other structural and non-structural measures required to ensure the maximum safety of human life and the reduction of damage to a minimum. In this connexion, WHO's role of assisting Members to ensure the co-ordination measures to protect life and property will be performed in close co-operation with UNDRO, LRCS and other appropriate bodies with special expertise in these fields.

To achieve the objectives of the programme, attention is given not only to operational aspects but also to research and to education and training.

7. It is found convenient to regard the TCP as being composed of two components, a general component dealing with those activities of application to all Members affected by tropical cyclones and a regional component devoted to the programmes of regional tropical cyclone bodies. The information on activities and developments during the period of the report is presented below under two main headings, the general component and regional component. Additionally information of a more general nature, information on the action taken jointly with other international organizations and on the programme envisaged for 1982-1983 is also given. The status of implementation of the various projects under the general component, in summary form, is shown in an appendix to this report.

#### General component

8. The aim of the general component is to convey information and provide guidance to Members, mainly through the publication of manuals and reports, to enable increased application of scientific knowledge and technological developments to the introduction or improvement of the components of the warning and disaster preparedness and prevention systems. It encompasses the broader aspects of training for the TCP.

9. The principal steps taken within the general component during the period of the report have been the continuation of activities under a number of sub-projects. A summary of the status of implementation of each of the 15 projects, formerly referred to as sub-projects, is given in the appendix. It shows that prior to July 1981, reports had been prepared and distributed under projects Nos. 2, 5, 6, 7, 8 and 10 and that project No. 11 had been successfully accomplished. The report entitled "Automatic Weather Stations for Tropical Cyclone Areas" which had been prepared under project No. 3 and published, within the TCP series, was distributed to all Members during the current reporting period. Further action on these projects, such as the updating of publications when significant new information becomes available, will be taken when appropriate.



10. A report prepared under project No. 1 - 'Special tropical cyclone observing network' is expected to be distributed during 1982.

11. Project No. 4 - 'Radar' aims at providing guidance information to assist Members in selecting and installing storm warning radar equipment and in making the best use of it in tropical cyclone tracking, forecasting and warning. An expert from USA, in consultation with experts designated by Australia, France, Japan and the WMO Commission for Instruments and Methods of Observation (CIMO), completed preparation of and submitted for publication a report entitled "Weather radars for monitoring tropical cyclones".

12. A revised draft of the report on project No. 9 - 'Tropical Cyclone Warning Systems' has been received from the project team leader and is in the final stages of review prior to publication.

13. A review of the draft report on project No. 12 - 'Human response to tropical cyclone warnings and their content', was followed by revision of the text and the incorporation of new material. The revised text is expected to be available in the WMO Secretariat shortly after mid-1982 and to be submitted for publication before the end of the year.

14. During the year substantial progress was made towards the implementation of project No. 13 - 'Regional aspects of storm surge prediction (Caribbean, Central America and Eastern Pacific)'. A team of experts carried out a survey in September to October 1981 on the status of storm surge prediction in the region. As a follow up to the survey, an informal planning meeting held in Kingston, Jamaica in December 1981 developed a draft action programme including recommendations for the measures needed to improve the storm surge prediction systems in the area, which was endorsed by the Hurricane Committee at its fifth session (Nassau, Bahamas, 1982).

15. Project No. 14 - 'Public information and education' is a joint WMO/UNDRO/LRCS project. A preliminary plan has been formulated and consideration is being given to the arrangements, including the possibilities of funding, for the implementation of this project.

16. Project No. 15 - Typhoon Operational Experiment (TOPEX) forms part of the programme of activities of the ESCAP/WMO Typhoon Committee. TOPEX Reports Nos. 4 and 5 were prepared, published in the TCP series and distributed during the period covered by this report. The full list of completed TOPEX Reports is given in the Appendix. Additionally, TOPEX Report No. 6 on the Evaluation of the Pre-Experiment, which took place in July to August 1981, has been completed and submitted for publication. Further information on TOPEX is given in paragraphs 19 to 23.

#### Regional Component

17. The regional component of the TCP is concerned mainly with the development of co-ordinated regional systems to combat loss of life and damage resulting from tropical cyclones. Its main thrust therefore is for the efficient operation of tropical cyclone early warning systems, including warnings of associated phenomena such as storm surges and floods and of the relevant disaster prevention and preparedness organization.

18. Under the regional component, work is carried out through two intergovernmental groups: the ESCAP/WMO Typhoon Committee and the WMO/ESCAP Panel on Tropical Cyclones and two groups established by regional associations: the RA I Tropical Cyclone Committee for the South-West Indian Ocean and the RA IV Hurricane Committee. Close liaison has been maintained between the four regional cyclone bodies.

#### ESCAP/WMO Typhoon Committee

19. The year under review has seen a concentration of the Typhoon Committee's activities on the Typhoon Operational Experiment (TOPEX). A three-week Pre-Experiment was held in July/August 1981 as a test of the operational system in preparation for the later phases of the Experiment. The Pre-Experiment was a valuable exercise, revealing a number of shortcomings in the system.

20. Much of the intervening period has therefore been devoted to overcoming these defects so that the system may operate at top efficiency as the First Operational Experiment (FOE) approaches. With the help of funds provided by UNDP and through the WMO Voluntary Co-operation Programme (VCP), equipment, spares and consumables have been purchased. Tests have been carried out to verify the effectiveness of the telecommunication systems so that the flow of administrative messages and data during the operational periods between centres in eight countries may be unimpeded. Close contact in these preparations with participating members of the Committee has been maintained through visits of experts from the Typhoon Committee Secretariat (TCS) and the provision by WMO of a Secretariat officer in the area to assist members.

21. In parallel with these activities the further planning of TOPEX has progressed through periodic meetings of the Management Board for TOPEX and the Second Planning Meeting held in early 1982. Important decisions taken at the Planning Meeting included an increase in the number of selected typhoons with intensified observations during the FOE from two to four; six-hourly upper-air observations will be mandatory at all committed stations within 500 km of the centre of the selected typhoon and recommended at other committed stations; hourly GMS observations will be made on one of the maximum of five days allotted to each Typhoon Tracking Experiment period.

22. These preparations reach their climax on 1 August 1982 when the First Operational Experiment begins. The International Experiment Centre (IEC) in Tokyo will then be manned during a period of two and a half months by scientists seconded by participating members. The IEC will be the nerve centre for the operations during the FOE, maintaining close contact with the Experiment Sub-Centres (ESCs) and guiding the activities throughout the experimental period. All the facilities of the IEC are generously being provided by the Government of Japan which is also, through the Japan International Co-operation Agency (JICA), funding the expenses of six of the seconded scientists. Others present will have their attendance costs provided by WMO.

23. Whilst the IEC guides the meteorological aspects of TOPEX, a series of other activities will be pursued under the Hydrological and Warning Dissemination/Information Exchange (WD/IE) Components. Though mainly carried out at a national level, some international events are also planned such as the seminar in Tokyo on these two components which is to take place over a five-week period in July/August 1982.

24. At its fourteenth session (Manila, November 1981) the Typhoon Committee's discussions ranged over its total programme, not only TOPEX. A new list of priorities for the establishment of observing and telecommunication facilities was drawn up, as well as a programme of the work items to which special attention should be given in 1982. The programme covers all five components of the Committee's activities, namely, meteorological, hydrological, disaster prevention and preparedness, training and research.



25. The Technical Support Unit (TSU) to the Panel was transferred from New Delhi to Colombo in October 1981 in accordance with the earlier decision of the Panel and the offer of host facilities made by the Government of Sri Lanka. At about the same time the vacant post of Telecommunications/Electronics Expert was filled by the recruitment of a specialist from the United States. Thus the TSU, in its new location, has been operating at full strength over the past nine months, with the added support of a consultant in hydrology for a limited period.

26. At its ninth session (Madras, May 1982) the Panel confirmed its intention of assuming responsibility for the co-ordination of its activities when UNDP support for the Chief Technical Adviser is withdrawn at the end of 1982. Thus, whilst the Panel is in Colombo, the Permanent Representative with WMO of the host country will become the Regional Co-ordinator, an arrangement similar to that already adopted by the Typhoon Committee for its Secretariat in Manila. The Panel proposed to UNDP that the technical staff of the TSU be replaced by consultants who will provide technical advisory services in direct support of specific programmes.

27. In the use of the UNDP funds of approximately US \$960,000 for 1982-1984 the Panel set priorities for spares and consumables under the equipment allocation and for short-term fellowships under training.

28. Considerable progress was announced at the session in the development of the cyclone operational plan for the area. Regular satellite and storm advisory bulletins will be issued by RMC, New Delhi. They will incorporate assessments from imagery received from the newly-launched Indian multi-purpose geostationary satellite INSAT-1A. Regional radar surveillance has been improved by the installation of a new 10 cm cyclone watch radar at Masulipatnam on the Andhra Pradesh coast and the re-commissioning of the radar at Kyaukpadaung on the Arakan coast of Burma. Another 10 cm radar will be installed at Trincomalee in Sri Lanka in 1982 and plans are proceeding for another at Port Blair in the Andaman Islands.

29. Two new upper-wind stations have been installed at Rangoon and Tavoy in Burma and upgraded radiosonde equipment will soon be in operation at Chittagong in Bangladesh. In an attempt to improve the collection of ship data the Panel decided to nominate a special ship weather reporting period from October to December 1982. This is intended to maximise the collection of ship data during the period of highest frequency of tropical cyclones in the region. Other data-gathering activities being pursued by the Panel include plans for a coastal network of high gust recording anemometers and for the installation of tide gauges in the Bay of Bengal.

30. As the result of the visits made by the consultant, the ninth session of the Panel was able to adopt a new Hydrological Component for inclusion in its Technical Plan.

31. There has been a considerable upsurge in the level of the Panel's work in disaster prevention and preparedness, with the help of UNDRP and LRCS and concerted national efforts. Innovative work in India includes the development of a computer model to simulate all phases of a cyclone disaster to assist in training decision-makers and for relief resources assessments. Widespread progress has been made in the shelter construction programme in Tamil Nadu and Andhra Pradesh where more than 400 of the planned 1500 shelters have been completed. Each accommodates 500 people and serves as a community health and education centre during non-cyclone periods.

32. Almost immediately following its ninth session, a WMO Seminar on the Application of Satellite Data to Tropical Cyclone Forecasting was held in Bangkok as

part of the Panel's programme. A total of 21 participants from 12 Members of WMO attended, including seven members of the Typhoon Committee. Consultants from Australia and the United States carried out a very successful programme of lectures and practical exercises, using visible, infra-red and enhanced satellite imagery.

#### RA I Tropical Cyclone Committee for the South-West Indian Ocean

33. The Members participating in the work of the Committee are: Comoros, France (Reunion), Madagascar, Malawi, Mauritius, Mozambique, Seychelles and United Republic of Tanzania.

34. The groundwork having been carried out since the previous session by a study group set up for the purpose, the fifth session of the Committee (Mahé, Seychelles, September 1981), as a major achievement formulated and agreed upon a Tropical Cyclone Operational Plan for the South-West Indian Ocean. The purpose of the operational plan is to ensure the most effective co-operation between all the members of the Committee in the provision of meteorological information, forecasts and warnings of all tropical cyclones affecting the area. The draft plan, therefore, defines the forecasting and warning responsibilities of co-operating Members. It also sets out the existing arrangements in the Region for provision of observational data and exchange of information, and contains information on practices and procedures of regional significance. Thus, the operational plan is designed to serve not only as a record of agreed international arrangements, but also as a valuable source of information for the operational services.

35. In developing the draft operational plan, the Committee agreed on terminology for use in the region, including the classification of tropical cyclones in relation to their intensity and on the use of alternating male and female names for identifying them.

36. The Committee recommended that the Regional Association I formally adopt the draft plan, at its next session, and invited Members concerned to implement its provisions pending the formal adoption.

37. The Committee expressed the view that a joint UNDRP/WMO/LRCS mission on disaster preparedness, which had visited Member countries in 1980/1981 had served as a means of heightening awareness of the value of effective disaster prevention and preparedness arrangements and exchanging information and experiences in the region. It gave its full support to the proposal in the report of the mission that a training seminar in disaster prevention and preparedness be organized in the region and endorsed a preliminary plan for the seminar.

38. Attention was also given to the need for training of personnel with the tasks of preparing and issuing tropical cyclone warnings. The Committee agreed on the need for practical training in the utilization of satellite data, radar meteorology and other more general aspects of tropical cyclone monitoring and forecasting as priority requirements.

39. The Committee's fifth session also reviewed its technical plan which sets out the programme of foreseen activities in the fields of meteorology, hydrology and disaster prevention and preparedness, aimed at the development and improvement of the warning systems and measures to mitigate the harmful effects of tropical cyclones. The Committee recognized with satisfaction the efforts of its Members to implement its technical plan and to obtain the financial support which is an essential requirement for this purpose. It strongly endorsed a regional technical assistance project request which had been submitted to UNDP. The Committee recorded its appreciation for the substantial support provided by Members through the WMO VCP for implementation of its



technical plan. Subsequently, in June 1982, the Executive Committee urged Members to continue and wherever possible increase such support.

#### RA IV Hurricane Committee

40. Nearly all of the 22 Members of RA IV are affected by tropical cyclones, called hurricanes in that Region, and actively participate in the work of the RA IV Hurricane Committee.

41. Following a review of the 1981 hurricane season, the Committee's fifth session (Nassau, Bahamas 1982) concluded that the RA IV Hurricane Operational Plan continues to work well and proposed only minor adjustments to it. The session agreed on meanings for additional terms to be used in the region and on further strengthening of the regionally co-ordinated warning systems through arrangements for back-up support in cases of disruptions caused by hurricanes. Attention was given to other operational items such as use of a new supplementary vortex data message code, various observing and telecommunication matters and the content of warning messages.

42. A critical review was carried out of the meteorological, hydrological and disaster prevention and preparedness segments of the Committee's Technical Plan as well as on-going activities in training and research as the basis for updating the plan. The Committee recorded its appreciation for the training carried out, particular mention being made of the course on tropical meteorology and hurricane forecasting held in Miami from 1 March to 7 May 1982, and agreed upon priority requirements for group training in the years ahead. These included further courses in hurricane forecasting and workshops on relevant aspects of radar observations, storm surge, short-range hurricane forecasting and advances in tropical meteorology.

43. The Committee placed emphasis on the transfer of technology and the development of operational hurricane prediction and warning systems particularly for storm surges, quantitative storm rainfall estimation and hurricane threat probabilities.

44. An action programme to improve the storm surge prediction systems in the area (see paragraph 14 above) through the production of surge atlases derived from numerical models - that is, the comparatively simple SPLASH and more sophisticated SLOSH models - was endorsed. The atlases, relating to specific areas, will help meteorologists to forecast, with an adequate degree of accuracy, the surge height and to define the coastal areas to be evacuated. Additionally they will provide valuable guidance to planners in dealing with topics such as land use, new developments and disaster preparedness and prevention.

45. The session considered the need for and feasibility of establishing a TCP project on estimation of tropical cyclone rainfall estimation using remote sensing techniques. It also discussed possible establishment of pilot projects for testing in the region of presently available satellite and radar techniques, with sufficiently dense raingauge networks to provide data to serve as ground truth. The Committee appointed a study group to give further attention to this subject.

46. Interest was expressed in the possible application operationally of probabilities of hurricane threat. The Committee proposed that such probabilities be computed for coastal areas of countries in the region during 1982 as inputs to a closer examination of this matter.

47. The RA IV Hurricane Committee has repeatedly emphasized the need for assistance to some Members as an essential requirement for implementation of important segments of the meteorological component of its Technical Plan as well as for strengthening of the Operational Plan. Requests have been addressed to various sources,

including UNDP, and the Executive Committee in June 1982 urged Members to give further and, wherever possible, increased support to these activities through WMO VCP or bilateral arrangements.

#### Co-operation with other organizations

48. In accordance with the wishes of Eighth Congress, close co-operation with other international organizations active in disaster prevention and preparedness has continued. Thus there has been close consultation with ESCAP, UNDP, UNDRO, UNEP and LRCS on a variety of matters of common concern. The main items include ESCAP's co-sponsorship of the Typhoon Committee and the Panel on Tropical Cyclones, UNDP's invaluable support, through regional projects, for the programmes of those two bodies, UNDRO and LRCS involvement in the WD/IE Component of TOPEX and in the joint mission on disaster preparedness for the RA I Tropical Cyclone Committee as well as in TCP project No. 14 and UNEP support for the Pre-Experiment of TOPEX. Special mention should be made of the UNDRO and LRCS role in relation to provision of consultant services for TOPEX. Additional UNDRO and LRCS activities of specific interest to the TCP include the holding of an International Workshop on Disaster Preparedness and Relief in Pakistan during April 1982, the establishment of a Pan-Caribbean Disaster Preparedness and Prevention Project within Region IV and their involvement in planning a joint mission on disaster preparedness for Panel members.

#### Programme for 1982-1983

49. The TCP covers a wide range of activities which are of a continuing and long-term nature. Preceding sections of this report contain an overview of several of the ongoing activities and, in some instances, indications have been given of the plans for the period ahead. The main parts of the 1982-1983 programme are set out below in summary form:

##### General component

- (a) arranging for and taking initial action to implement the revised plan of action for the TCP;
- (b) as appropriate, preparation, editing, publication and distribution of reports under TCP projects Nos. 1, 4, 9, 12 and 15 (see Appendix, section B);
- (c) implementation of items, particularly towards attainment of the short-term objectives, of the action programme for TCP project No. 13 on storm surge prediction;
- (d) making arrangements for the execution of TCP project No. 14 on public information and education;
- (e) execution of TOPEX through operations at the IEC and ESCs and other national activities, with further planning, management and co-ordination being effected mainly through the third Planning Meeting for TOPEX and meetings of the TOPEX Management Board and the Typhoon Committee itself;



- (f) initiating action on further proposals, relating to the general component, made by the regional tropical cyclone bodies, included developments aimed at tropical cyclone rainfall estimation on an operational basis.

# Regional component

50. Under the regional component, the programme will be chiefly concerned with the activities undertaken by the regional tropical cyclone bodies and the implementation of the decisions they make. A provisional schedule, for the period 1 July 1982 to 30 June 1983, of meetings of regional bodies, meetings related to TOPEX and also of WMO regional training activities is given below:

- Seminar on typhoon forecasting (Hangzhou, China, 25-27 October 1982);
- ESCAP/WMO Typhoon Committee, fifteenth session (Bangkok, Thailand, 9-15 November 1982);
- Management Board for TOPEX, sixth session (Bangkok, Thailand, 16-18 November 1982);
- Third Planning Meeting for TOPEX (Tokyo, Japan, February 1983);
- Management Board for TOPEX, seventh session (tentatively Tokyo, Japan, February 1983);
- WMO/ESCAP Panel on Tropical Cyclones, tenth session (tentatively Bangladesh, March 1983);
- WMO/ESCAP Panel on Tropical Cyclones seminar on the Application of Radar Data to Tropical Cyclone Forecasting (date and place to be decided);
- RA IV Hurricane Committee, sixth session (date and place to be decided).

## APPENDIX

### WMO TROPICAL CYCLONE PROGRAMME - GENERAL COMPONENT

#### Status of Implementation on 30 June 1982

#### A. Projects (formerly called sub-projects) completed, or under which reports have been issued

<u>Project number and title</u>	<u>Title of report and date of issue</u>	<u>Remarks</u>
No. 2 - Observations from mobile ships	"Observations from mobile ships" distributed on 16 March 1977	
No. 3 - Automatic weather stations	"Automatic weather stations for tropical cyclone areas" (WMO-No. 570) published in June 1981 and distributed in July 1981	
No. 5 - Geostationary satellites	"The use of Satellite Imagery in Tropical Cyclone Analysis" (WMO Technical Note No. 153) published in November 1977	
No. 6 - Forecasting tropical cyclone intensity and movement	"Operational Techniques for Forecasting Tropical Cyclone Intensity and Movement" (WMO-No. 528) published in August 1979	
No. 7 - Storm surge prediction	"Present techniques of tropical storm surge prediction" (WMO-No. 500) issued in March 1978	
No. 8 - Risk evaluation techniques	"The quantitative evaluation of the risk of disaster from tropical cyclones - report of a WMO/UNEP project on the meteorological and hydrological aspects" (WMO-No. 455) published at the end of 1976	
No.10 - Community preparedness and disaster prevention	"Guidelines for Disaster Prevention and Preparedness in Tropical Cyclone Areas" (WMO) published in English in June 1977 and in French and Spanish during the first half of 1978.	Requests for copies may be addressed to WMO, ESCAP or LRCS Secretariats.



<u>Project number and title</u>	<u>Title of report and date of issue</u>	<u>Remarks</u>
No. 11 - Flood forecasting and warning	----	A joint ESCAP/WMO mission visited the Tropical Cyclone Panel member countries to assess facilities available and evaluate the improvements required. Significant progress has been made in improving hydro-logical facilities in the Typhoon Committee area. A roving seminar was organized to train local personnel in the analysis and prediction of intense precipitation and floods in Asia and S.W. Pacific.
No. 15 - Typhoon Operational Experiment (TOPEX)	(See list below*)	(See section B of this Appendix).
*TOPEX Report No. 1	- First Planning Meeting (WMO-No. 565), published in 1980.	
TOPEX Report No. 2	- TOPEX Operational Manual, published in 1980, revised in 1981.	
TOPEX Report No. 3	- TOPEX - a general description (WMO-No. 573) published in 1981.	
TOPEX Report No. 4	- Information on objective methods of typhoon track prediction being used operationally at experiment sub-centres, TOPEX Core Experiment, published in May 1982.	
TOPEX Report No. 5	- Second Planning Meeting, published in June 1982.	

B. Other sub-projects

<u>Project number, title and objectives</u>	<u>Mode of implementation</u>	<u>Status</u>
No. 1 - <u>Special tropical cyclone observing network</u> (anemometer and barometer networks)  Objectives: To produce a report on the desirability and feasibility of establishing a relatively dense network of wind and pressure observing stations	Australia, with the collaboration of Japan, India and the Typhoon Committee Secretariat (TCS)  Mr. P.J. Shaw (Australia) Leader, Dr. M. Komabayashi (Japan) Shri V. Balasubramaniam (India) Dr. S.N. Sen (TCS)	Draft report completed and received in the WMO Secretariat and expected to be distributed shortly.
No. 4 - <u>Radar</u>  Development of guides which will assist Members in selecting storm warning radar equipment, installing it in the best practical location and making the best use of it in tropical cyclone tracking, forecasting and warning.	USA with the collabora- tion of Australia, France, Japan and CIMO  Mr. D. Holmes (USA) Leader, Dr. P. Barclay (Australia) Mr. M. Malick (France) Mr. J. Aoyagi (Japan) Dr. N. Kodaira (CIMO)	Report entitled: "Weather radars for monitoring tropical cyclones" has been submitted for publication.
No. 9 - <u>Tropical cyclone warning systems</u>  Objectives: The production of guidelines describing the main principles and practical considerations to be followed in setting up a tropical cyclone warning system	India, in collaboration with Australia, France (La Réunion), Japan and USA  Experts nominated: Shri V. Balasubramaniam (India) Leader, Dr. R. Tatehira (Japan) Mr. F. Herry (Australia)	A revised text has been completed and will be submitted for publication after editing.



<u>Project number, title and objectives</u>	<u>Mode of implementation</u>	<u>Status</u>
<p>No. 12 - <u>Human response to tropical cyclone warnings and their content</u></p> <p>Objectives: To prepare a publication for use in countries exposed to tropical cyclones providing information and guidance on the most effective wording for use in tropical cyclone warnings.</p>	<p>USA with the collaboration of Australia, India, Philippines and UNDRO</p> <p>Mr. Richard I. Coleman (USA) Leader, Mr. R.L. Southern (Australia) Mr. B. Rajagopal (India) Mr. A.K. Sen Sarma (India) Mr. L.A. Amadore (Philippines)</p>	<p>A revised text has been submitted and will be published shortly.</p>
<p>No. 13 - <u>Regional aspects of storm surge prediction (Caribbean, Central America and Eastern Pacific)</u></p> <p>Main objectives:</p> <p>a) to carry out studies needed for the establishment of an adequate tide gauge network;</p> <p>b) compilation of data on past storm surges in the area;</p> <p>c) recommendations for the techniques to be used for storm surge forecasting;</p> <p>d) consideration of the need for modelling studies aimed at improving these techniques.</p>	<p>Members represented on the RA IV Hurricane Committee with assistance from the WMO Secretariat and consultant services</p>	<p>A draft action programme prepared by an experts' meeting has been endorsed by the RA IV Hurricane Committee.</p>

<u>Project number, title and objectives</u>	<u>Mode of implementation</u>	<u>Status</u>
<p>No. 14 - <u>Public information and education</u></p> <p>Objectives: To prepare a sample kit of public information material and guidance material to assist Members in the improvement of their public education programmes.</p>	<p>Joint WMO/UNDRO/LRCS project.</p>	<p>In the planning phase.</p>
<p>No. 15 - <u>Typhoon Operational Experiment (TOPEX)</u></p> <p>Objectives: To reduce the risk of loss of life and damage from typhoon wind, flood and storm surge by improving the forecasting and warning capabilities of Members of the Typhoon Committee through the conduct of an operational test of the various systems used for typhoon analysis, forecasting and warning as well as for flood forecasting during all stages of typhoons in the area.</p>	<p>Project of the ESCAP/WMO Typhoon Committee.</p>	<p>Planning and execution proceeding. (Reports which have been issued are listed in section A of this Appendix).</p>



27 September 1982

ORIGINAL: ENGLISH

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Seminar on Flood Vulnerability Analysis

7-13 September 1982

Bangkok

REPORT OF THE SEMINAR ON FLOOD VULNERABILITY ANALYSIS

I. ORGANIZATION OF THE SEMINAR

1. The Seminar on Flood Vulnerability Analysis was held at Bangkok from 7 to 13 September 1982.

Attendance

2. The Seminar was attended by participants from Bangladesh, Burma, China, Malaysia, Pakistan, the Republic of Korea, Sri Lanka, Thailand and Viet Nam.

3. Representatives of the Office of the United Nations Disaster Relief Co-ordinator (UNDRO), the World Meteorological Organization (WMO), the Typhoon Committee secretariat and the Technical Support Unit of the WMO/ESCAP Panel on Tropical Cyclones also attended.

Officers of the Seminar

4. The Director of the Seminar was Dr. W.E. Watt, Professor, Department of Civil Engineering, Ellis Hall, Queen's University, Kingston, Canada.

Opening of the Seminar

5. The Deputy Executive Secretary of ESCAP opened the Seminar by reading out a message from the Executive Secretary. In his message, the Executive Secretary pointed out that since it was impossible to avoid all risk and the resources available for mitigation of the effects of disaster were limited, the size and types of projects should be based on the level of risk involved and, for that reason, vulnerability or risk analysis had slowly gained the attention of planners in various fields. It was only through an integrated and comprehensive approach employing both structural and non-structural measures that countries could achieve the maximum benefits from their investments in flood loss prevention and

/management



management. In that regard, he stressed the importance of determining an acceptable safety level on which to base a comprehensive plan through flood vulnerability analysis.

#### Seminar programme

6. The seminar programme covered the following topics:
1. Introduction to flood risk analysis
  2. The need for flood vulnerability analysis
  3. Recent experience in the United States, Canada and the ESCAP region
  4. The role of operational hydrology
  5. Urbanization and flooding
  6. Socio-economic considerations on flood damage reduction
  7. Economic analysis: flood loss simulation
  8. Flood hazard mapping
  9. Uncertainty considerations of the analysis
  10. Applicability and limitations

#### Working methods

7. The Seminar opened with an overview of flood vulnerability analysis by presentations comprising an introduction to flood risk analysis by the representative of UNDRO, the need for flood vulnerability analysis, experience in the United States and the ESCAP region by Dr. Harold C. Cochrane (Associate Professor, Department of Economics, Colorado State University, Fort Collins, Colorado, United States of America), recent experience in Canada by Dr. W.E. Watt and the role of operational hydrology by the representative of WMO.

8. The various topics were presented in a series of lectures by Dr. W. Edgar Watt and Dr. Harold C. Cochrane, both of whom were consultants to ESCAP. The lectures were followed by discussions. During the Seminar, a computer program on the evaluation of the economic impacts of flooding was demonstrated, utilizing a micro-computer. Mr. O. Machida showed a film entitled "Invitation to floods: urban sprawl", which concerned a case study in a small urbanized river basin where rapid economic development had increased both actual and potential flood damage.

/II.

## II. OVERVIEW

### Introduction to flood risk analysis

9. The participants noted the following points in the introduction to flood vulnerability analysis:

(a) Flood risk analysis (or flood vulnerability analysis) was a process of identifying the flood hazard and evaluating its potential impact on human activities in the areas subject to inundations. That process consisted of the following operations: (i) assessment of hazard; (ii) assessment of probable damage from a hazard of given magnitude; and (iii) determination of risk;

(b) Flood hazard had been defined by areal extent (or areas subject to flooding), magnitude of a flood and frequency of occurrence. Hazard assessment resulted in the preparation of flood hazard maps, which should portray the distribution of hazard by type (water course, zone of erosion or sedimentation, stagnating water), by intensity (depth of flooding water, velocity of a flow) and frequency of occurrence (in terms of the return period). Usually flood hazard maps should be prepared for floods of 10-, 20-, 50- and 100-year return periods;

(c) Probable damage from a flood of a given magnitude was a function of flood hazard, flood plain occupancy (population, buildings, economic activities, infrastructure etc., which were termed "elements at risk") and vulnerability (susceptibility) of the above elements, namely, the degree of loss to given elements at risk in relation to the magnitude of a flood. The expected damage could be calculated as a sum of damage to different elements. The damage to an element at risk was determined as the product of its value and vulnerability. The vulnerability of elements was normally determined through a post-disaster survey. Probable damage could also be assessed by other methods such as depth-damage function and flood damage coefficient;

(d) When probable damage from a given flood had been calculated, flood risk could be determined as a product of the expected damage and the probability of occurrence of such a flood. Flood risk was expected damage (in monetary terms) from a given flood within one year. To be more representative, an average annual disaster risk from floods of various magnitudes (10-, 20-, 50- and 100-year floods) should be calculated as a

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weighted sum of the flood risks from the above floods. Average annual flood risk was the average probable value of flood damage for each year. As such, it was widely used for flood plain regulation, land-use planning and cost-benefit analysis of flood protection solutions.

#### The need for flood vulnerability analysis

10. The topic of flood vulnerability analysis was important for two reasons. First, Governments needed to know the importance of the flood problem relative to other pressing social issues. Given the limited resources available to countries in the ESCAP region, it was prudent that they be devoted to flood protection of development projects that might create jobs or alleviate housing shortages and accompanying sanitary problems inherent to crowded urban areas. The benefits of devoting scarce resources to the solution of flood damage reduction must therefore be balanced against the achievement of other goals. In short, a case must be made for giving priority to the flood problem on the Government's agenda. Flood vulnerability analysis was one tool to achieve that. It was equally important to utilize flood vulnerability analysis to estimate the benefit of alternative damage-mitigating schemes.

#### Recent experience in the United States

11. The participants were informed that the Corps of Engineers had played a predominant role in mitigating flood losses during the period 1930-1965. The projects undertaken by the Corps were almost entirely large engineering works, most specifically channel improvements and large flood control reservoirs. Most early designs had served a single purpose, namely, flood control. Often the benefits were overstated and the costs underestimated. The nature of production in the United States had led to a mobile labour force, one more ignorant of natural hazards. It was felt by some that that as much as any other factor had resulted in escalating flood losses despite the Corps' efforts.

12. The liberal disaster relief policies implemented as a result of the 1964 Alaskan earthquake had set a precedent for flood loss compensation. By the 1972 Rapid City flood, the Government had been covering more than half the entire cost of flooding. The primary source of relief took the form of heavily subsidized disaster loans.

13. Initial efforts to institute a purely voluntary flood insurance programme had failed miserably. Concern that flood losses were continuing to mount and that the Government was being forced to "bail out" growing numbers of flood victims had led to a restructuring of the flood insurance programme. Commercial banks and other federally regulated lending institutions were required to inform prospective home buyers about the property's location vis-a-vis the flood plain. If within the 100-year limit, they were required to purchase insurance (at a subsidized rate). If the property consisted of raw land, then the buyer could erect a home only if insurance was purchased at an actuarial rate. Local planning and zoning boards were designated as enforcers of those regulations. That placed flood plain management squarely on the shoulders of those boards since subsidized insurance would be continued only so long as the boards actively enforced their own regulations.

14. If the subsidy was not incentive enough, the federal Government denied any federal aid to communities which failed to participate in the insurance programme. As a result of those changes, insurance sales had grown dramatically during the 1970s. Currently, 1.8 million policies were in force, with a coverage of \$98 billion.

15. Large federal budget deficits combined with environmental concerns had led to a diminished emphasis on large federally subsidized structures. The most striking change occurring in flood regimen during recent years had been the alteration of the flood hydrograph in urban areas as a result of upstream land use. Less widespread but probably significant was the reduction in channel carrying capacity as a consequence of the diminution in peaks by storage works.

#### Recent Experience in Canada

16. The participants learned that Canada had recently adopted a co-ordinated and comprehensive approach to reducing flood damage. The National Flood Damage Reduction Programme employed strategies to inhibit new flood plain development based on the identification of hazard through mapping while at the same time it incorporated other programmes such as flood forecasting/warning, protective works, acquisition and relocation to minimize damage to existing flood plain development.



17. The cornerstone of the programme was a series of flood hazard maps, a map for every flood-prone urban or urbanizing area in the country. Once an area had been mapped and the flood hazard area designated jointly by the federal and provincial Governments, the information on flood hazard was communicated to the public, industry and government agencies and all investment of public funds for flood-vulnerable undertakings in the flood-hazard area must cease. Those undertakings included direct development such as government buildings and indirect development through industrial incentive programmes, mortgages etc. To restrict private development, the flood-hazard information must be incorporated into official plans and by municipal laws and provincial regulations.

18. Structural works were tied to land-use management. Where unwise flood plain development had taken place and there was pressure for structural works, the area must be mapped to determine the flood risk and a flood plain management study must be undertaken. That study, with economic, social and engineering elements, must include the assessment of a wide range of alternatives to reduce the flood risk and must include an evaluation of the environmental impact of those alternatives. Finally, before financial support was provided for structural works, restrictions on land use in the flood-hazard area must be in place.

#### Recent experience in the ESCAP region

19. The participants all indicated that flood problems occupied national attention in each of their respective countries. In some instances, it was felt that the population at risk had adapted to the situation and in others much could be done to diminish the risk of catastrophic loss of life, especially along coastal zones subject to storm surge. It was pointed out by some participants that a form of flood vulnerability analysis had been undertaken in sizing dykes and flood control reservoirs. It was also suggested that a more quantitative approach might have to be implemented in order to compete for scarce international aid and development loans.

#### The role of operational hydrology

20. A fundamental role of operational hydrology in flood-vulnerability analysis was to supply information on the hazard of floods of various magnitudes occurring at any given location during any specified

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period of time. The main characteristics of a flood which were of importance in vulnerability analysis were: the maximum stage, the maximum velocity of flow, the length of time that the water level remained above any elevation, the quality of water (including sediment and debris load) and the complete flood hydrograph.

21. For the purpose of flood-vulnerability analysis, the single most important characteristic of a flood was its peak stage. When records of stage were available for the locality in question, they could be analysed directly to yield stage-frequency relationships which would indicate the probability of the flood levels reaching any given elevation. In most instances, probable water elevations must be derived from estimates of peak discharge for floods as derived from regional flood frequency analyses or from the analysis of rainfall data in conjunction with the derivation and use of rainfall-runoff relationships. In that connection, the participants were informed that a number of WMO publications dealt with the techniques used for determining the relevant flood characteristics.

22. Flood forecasting in real time, an important input into the operation of flood protection networks, was another important subject of operational hydrology. Flood-vulnerability analysis was of value in identifying those areas for which flood forecasts should be issued and the associated flood hazard maps could be used to interpret such forecasts in real time.

23. Thus, a case was made not only for the importance of vulnerability analysis in the over-all flood loss mitigation effort, but for the need for hydrological data as a basis for the analysis. It was the provision of such data and their preliminary analysis, together with the development of hydrological forecasts, which was the role of operational hydrology. The relevant activities were carried out, at the national level, by hydrological services.

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### III. SUMMARY OF THE LECTURES AND DISCUSSIONS

24. The subjects covered by the lectures and discussions are briefly summarized below.

#### A. SOCIO-ECONOMIC CONSIDERATIONS

##### 1. Balanced approach

25. Both flood risk and the cost of mitigating that risk were integral parts of the so-called "balanced approach", which was based on the principles of cost-benefit analysis. The benefit of undertaking protective action was the average annual reduction in flood losses. The optimum scale of a project was determined by contrasting the additional benefit received for each additional dollar spent. A balance was achieved at the point where they were equal. The resultant solution yielded a minimum sum of flood losses and cost of protection.

26. The framework for achieving a balanced approach was extended to assess several related issues: the optimum time to invest, the optimum mix of adjustments and an optimum flood plain mapping strategy. Cost-benefit procedures were utilized to determine how losses and costs would be altered as a result of postponing the implementation of protective measures. It was concluded that such a procedure would be valuable in regions where the scarcity of resources required a time-phased approach. The optimum mix of measures was shown to be dependent upon the interaction of alternatives. It was pointed out that measuring the benefits of each laternative could overstate their value unless the effect of interdependence was recognized. In a related way, the value of flood plain mapping was dependent upon costs and losses. Improved map accuracy would lead to better management decisions, which in turn should result in a lower total cost of managing flood problems.

27. The balanced approach had proved to be useful in clarifying several points that were conventionally misunderstood. The fact that losses existed should not necessarily lead to the conclusion that protective action was warranted. The costs might simply outweigh the reduction in loss that might result from its implementation. Similarly, growth in loss did not necessarily mean that previous strategies had failed. Loss would grow as an economy expanded. Losses would also grow as economic activities in the flood plain were shifted (e.g., from agricultural to urban use). Policy makers should be alarmed, however, whenever such shifts occurred unwisely and individuals expanded the use of flood-prone areas out of ignorance.

28. One major stumbling block to achieving a balanced approach was the lack of loss data. A pilot study conducted in Chiang Mai and Thailand's Central Plain had yielded encouraging results. However, there was currently no systematic way of tabulating losses and making data available to researchers. Several low-cost procedures were discussed. For example, military flight training exercises could be altered slightly to obtain mapping and/or loss data at little incremental cost.

##### 2. Major issues in pursuing a balanced approach

29. The major issues in pursuing a balanced approach revolved around two themes -- objectives and inappropriate techniques.

30. Many planners paid an inordinate amount of attention to loss mitigation, a principle which ran counter to the balanced approach. They also appeared to be preoccupied with the design flood, the 100-year return interval in the United States, to cite one example.

31. All too often the interest rate used in project selection was lower than the Government's borrowing rate. It had been argued that such an adjustment was necessary to accommodate such factors as regional unemployment. It was not recommended that the discount rate be arbitrarily lowered to account for such special considerations. Instead, the "true" cost of undertaking a project should be carefully assessed and lowered accordingly.

32. Similarly, the role of inflation in project selection was not well understood. It had been demonstrated that it was proper either to include or to exclude inflation in all economic factors. The cost-benefit criteria would be unaffected. However, if inflation was included in some factors and excluded in others the assessment would be in error.

33. The foregoing remarks did not apply to real growth in flood-prone properties. A procedure had been developed to capture the effects of such growth and to determine how it influenced the timing of protective actions.

34. Lastly, flood plain management options were often narrowly defined to include engineering works only. Land-use management was often dismissed because of the difficulty in measuring its cost. There were well-defined procedures for establishing such costs and it might prove to be the case that land-use changes might be the most cost-effective and safest means of coping with the flood problem.



### 3. The role of flood-hazard mapping

35. The implementation of flood-vulnerability analysis was dependent upon both hydrologic and demographic information. It was emphasized that adequate planning could be carried out with less than perfect maps. Mapping accuracy should be tied to anticipated losses and the alternative protective schemes available to those living along a river's banks. It could be argued that geomorphological maps would suffice in upland rural areas and that detailed maps should be produced for coastal zones subject to storm surge. In the former instance, losses were likely to be low and the population well adapted to the hazard. In the latter, loss of life could be (and had been) catastrophic and low-cost options (e.g., shelters) were available. It was agreed that limited mapping resources should be allocated in such a fashion that the most vulnerable areas would be treated first.

#### B. ECONOMIC ANALYSIS

##### 1. Flood loss simulation program

36. The application of a computer program for flood loss simulation was demonstrated to the participants. The program computed the benefits derived from alternative flood plain management strategies. Following the United States Water Resources Council's (WRC) guide-lines, those benefits were based on the extent to which each strategy reduced flood damage. The procedure for estimating those potential losses was the model's core.

37. Annual flood damages for events of varying return interval were obtained by multiplying the depth of flooding, the percentage of a structure's value destroyed and the total value at risk. The expected loss was directly computed by integrating the area under the loss curve. Indirect losses, namely, production delays and homeowner inconvenience, were assumed to be a percentage of the direct losses, as were destruction of contents and the damage sustained by public facilities.

38. The computer routine developed to solve the problem required the user to enter data for each of the elements described below. While the computation of losses was relatively straightforward, several important ingredients had been added to the program, which were explained. Growth in properties at risk should be of concern to governmental agencies monitoring the flood plain. The losses borne by the community would be geographically distributed. Some locations would sustain substantial damage, while others would

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only be minimally affected. Emphasis should be given to those locations which were likely to be significantly affected. Anticipating that, the routine had been designed to disaggregate total losses into small geographical units so that each impact could be detected. Detailed descriptions of those specialized components of the model were discussed and procedures for operating the program were presented.

##### 2. Data requirements

39. The flood loss model, which was the program's foundation, was driven by a set of assumptions reflecting characteristics of both the event and the population at risk. In some instances, the term "assumption" was misleading since several of the factors shown could be estimated with some precision or were dictated by WRC's procedures. The cost of funds, for example, was tied to the Government's borrowing rate. The Government would know the amount of insurance coverage, if any, currently in force; hence, that ingredient too could not truly be considered an assumption. However, in either instance some judgement was required.

40. Other "assumptions" required by the model were somewhat less certain. A planning horizon of 50 years was not uncommon. The criticality of that assumption diminished when interest rates were high. The label "assumption" applied most pointedly to the depth damage curves and indirect loss factors.

41. In contrast, techniques were available which yielded reasonably accurate frequency discharge curves and flood depths. Engineering consultants and hydrologists involved in mapping studies would utilize a range of tools such as those described below.

42. Characteristics of the population at risk, the type and extent of capital subject to flood loss and their likely rate of change over the foreseeable future could be obtained through aerial photographs and field surveys. Estimating the growth rate was, of course, the most difficult aspect of the problem. Growth was governed by the amount of raw land which was developable and the real rate of appreciation experienced by those who owned developed property. Both of those factors were linked to the over-all economic viability of a region's economy, something that might be difficult to forecast.

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### 3. Case study

43. An Apple II-Plus micro-computer was used to demonstrate the loss simulation program. Data for a sample flood plain was stored on a floppy disk. The participants were shown how new data files could be created and old ones edited and rewritten onto the disk. Several sample runs were made to illustrate the principles in the lecture. The sample case was changed to reflect 25-year and 100-year channel improvements. The resultant costs and benefits were noted and related to the optimum scale of protection. Lastly, the optimum timing graphics package was exercised. A discussion ensued regarding possible extensions and limitations of such a tool in the ESCAP region. It was noted that micro-computers were revolutionizing hydrotechnical studies. However, it was pointed out that technical support, in the form of both hardware and software, was lagging. One of the most important limitations faced by the region was lack of loss data. In addition, neither computer software nor hardware maintenance had kept pace with the growing use of microcomputers. On the positive side, micro-computers would enable the region systematically to collect the hydrologic information and loss data to implement vulnerability studies. It was noted that those devices would lead to the development of more compact and accessible hydrotechnical programmes. Evacuation, planning and relief and rehabilitation training exercises might be enhanced through the use of such equipment.

#### C. FLOOD-HAZARD MAPPING

##### 1. Uses of flood-hazard maps

44. In terms of effective reduction of flood damage, there was a broad spectrum of uses for flood-hazard maps. At the very least, such maps were a means of informing the general public of areas where there was a flood hazard. In areas with infrequent flooding, many people either had forgotten or had never known where flooding occurred. At the other end of the spectrum, flood-hazard maps formed the basis for implementing land-use restrictions and were incorporated into zoning by laws etc. Between those two extremes there was a variety of other uses. Emergency planners could use those maps to define escape routes to be used when the inevitable flood event occurred. Also, those maps were a prerequisite for any study to evaluate the economic viability of any proposed structural works to reduce flood damage. As in Canada and the United States, the maps could be used by government agencies and

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departments to prevent flood-vulnerable developments, either direct or indirect, by government agencies. Finally, the maps could be used as part of a flood insurance programme as in the United States.

##### 2. Alternative mapping techniques

45. There was a wide range of alternative mapping techniques. An appropriate mapping technique would depend upon the intended use of the map and the economic implications of such mapping.

(a) Class A maps - Exact flood data based on hydraulic calculations are common in Canada and the United States. Those maps, which were published on a specified scale and with a specified contour interval, showed, at a minimum, the flood-hazard area, which was defined as the area inundated by the design flood event, often the 1 per cent or so-called 100-year flood. In some cases, class A maps also showed the flood lines corresponding to other return periods (e.g., the 20-year flood). Frequently, a hydraulically designed floodway was also shown on the map.

(b) Class B maps - Interpreted flood data based on known highwater marks were occasionally used in North America. Those maps might or might not have a specified scale and contour interval because often the map had been produced for another purpose. They showed the flood-hazard area, which was defined as the area inundated by some recorded flood, often the flood of record.

(c) Class C maps - Interpreted flood data based on nonhydraulic calculations included actual aerial photos taken during times of flooding, maps of highwater marks located by talking to oldtimers who had lived in an area for many years, maps based on aerial photo interpretation of topography and soils maps.

##### 3. Preparation of flood-hazard maps

###### (a) Acceptable level of flood risk

46. That depended on the use to be made of the maps. If the maps were going to be used primarily for information and planning purposes, then a number of flood lines corresponding to several specified return periods (e.g. 25, 100, 500 years) should be identified on the map. However, if the maps were going to be embodied in official plans, zoning by laws and other

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restructive devices on land use, then practical considerations would probably dictate the delineation of preferably one but not more than two lines and much more deliberation was required to determine the acceptable risk. Obviously, there were political constraints, and land-use restrictions would be successful only if those could be accommodated. However, one would hope that a primary input into the decision-making process would be location-specific or regionalized economic analyses. Those would show which levels of protection were economically efficient given various levels of future development and different weights for intangibles, externalities etc.

(b) Methodology

47. Apart from the processes of planning, printing and distribution, the actual process of map preparation could be divided into two general categories of work: surveying and mapping work, and hydrotechnical studies. The degree of effort and cost of those two categories would depend upon the criteria and the extent of available mapping.

48. For class A maps a scale or a range of scales would be specified (e.g. 1:10,000). If topographic maps on that scale did not exist for the area in question, then new maps must be prepared. Occasionally, existing aerial photography might be acceptable but often a mapping project must include the whole range of aerial photography and targeting, vertical ground control, horizontal ground control, aerial triangulation and numerical adjustment, mapping, cartography and printing. For such projects, the cost of the surveying and mapping work was at least 50 per cent of the total cost. Following the hydrotechnical studies to determine the elevations defining the flood-risk areas and the floodway, the limits of the flood-hazard area(s) and the floodway were transferred to the topographic map. The hydrotechnical studies required for class A maps were not inexpensive and could require extensive data.

49. The specifications for class B maps were much more flexible and quite often an existing map would be acceptable. The flood-hazard area was located on existing maps either by interpolation on the map if it showed topographic detail and/or using information provided by field surveys. The hydrotechnical studies required for class B maps were of moderate cost and normally did not require extensive data.

50. The specifications for class C maps were very general. Such maps included actual aerial photos taken during times of flooding, maps of highwater marks located by talking to oldtimers who had lived in an area for many years, maps based on aerial photo interpretation of topography and soils maps. No hydrotechnical studies were required for class C maps.

4. Systematic hydrotechnical studies

51. Planning the hydrotechnical studies was carried out once the flood-prone locations within a region had been tentatively identified. At the commencement of a flood-hazard mapping programme the hydrotechnical engineer should decide what hydrologic and hydraulic techniques were to be applied for evaluating flood levels at the numerous locations within the study area.

(a) Classification of hydraulic systems

52. This aspect involved classifying the individual hydraulic systems in terms of the factors that controlled flood levels. Available mapping, water level, discharge data supplemented by data gleaned from field trips and interviews with local inhabitants would in most cases provide adequate information to undertake such a classification.

53. The first category was the one-dimensional river reach. Storage within the reach was generally small compared with the flood volume and during the passage of a flood, quasi steady-state flow conditions prevailed. Such systems had well-defined and unique stage discharge relations and standard backwater computations could be employed. The only required hydrologic input was a flood peak.

54. The second general category, lakes and reservoirs, included all those systems in which storage played a significant part. Flood levels at the point of interest were a function of not only the flood peak, but also the flood volume and the storage state of the lake or reservoir systems prior to the arrival of the flood. Such systems required some sort of storage routing technique incorporating friction, continuity and occasionally even dynamic effects. The hydrologic input must take the form of a complete design hydrograph or a continuous trace of hydrologic inputs spanning, say, 30 to 50 years.

55. Special cases arose when the area of interest was at the mouth of a river entering the ocean or a large lake. Ocean tides and storm surges in the large body of water might control the flood levels, particularly if the river gradient was flat. In that case, statistical analyses of the lake or ocean water levels must be undertaken to assist in determining the required flood levels.



56. A major problem was the effect of debris blockages on flood levels. In areas where there was a known potential for blockage, some attempt should be made to determine the likely extent and nature of a severe blockage and to calculate flood levels associated with that blockage and a given flood event.

57. In some systems the geometry might be changing owing to natural degradation or aggregation or man-induced changes (dredging, filling etc.). Under those conditions, measured water levels had little or no value in assessing design flood levels and hydraulic procedures must be applied to calculate the response of the current or some proposed future developed level of the system to the hydrologic input.

58. In addition to the possibility of a non-stationary hydraulic system, the hydrologic system might be non-stationary owing to either natural or man-made effects. Common natural effects were urbanization in the case of small basins and deforestation in the case of large basins.

#### (b) Hydrologic analyses

59. The over-all hydrotechnical studies required two categories of hydrologic analysis: flood frequency analysis and hydrologic event modelling. Unless flow or water level records were very long, both single-site and regional frequency analyses should be employed. The techniques were well established and there were a few very good references. Event models were required whenever storage and/or control was involved or when the streamflow or water level data must be simulated from inputs such as rainfall and wind (e.g., rainfall floods on small and/or urbanizing basins, storm surge). The techniques of hydrologic event models were well known and documented basin event models such as HEC-1, HYMO and TR 20 were available.

### D. FLOOD VULNERABILITY ANALYSIS

#### 1. Uncertainty considerations

60. Each of the steps in the production of a flood-hazard map had associated with it a certain degree of uncertainty. It was convenient to classify those sources of uncertainty as: (a) hydrologic; (b) hydraulic; and (c) mapping, referring respectively to the determination of the design discharge, the determination of corresponding water levels and the determination of the actual line on a map where those water levels intersected the land surface. Obviously, within each of those three categories there were a number of

61. Hydrologic uncertainty could be divided conveniently into the uncertainty in determining the T-year flood (i.e., the statistical uncertainty) and the uncertainty in applying a deterministic model to a specified input (i.e., the modelling uncertainty). Statistical uncertainty varied inversely as the square root of the period of record. Recent studies indicated that for the 100-year flood and 25 years of record, the error varied from 10 to 20 per cent. For an ungauged site, errors were generally about 25 or 30 per cent.

62. Hydraulic uncertainty resulted from inaccurate representation of the flow mechanisms by the analytical technique applied, from inaccurate representation of the systems geometry in the model being applied and from uncertainty in the parameters.

63. Mapping uncertainty manifested itself in two ways. First, river cross-sections and longitudinal slopes were required for the hydraulic analyses. Those could be obtained from field surveys, air photos or topographic maps in decreasing order of precision. For example, if the cross-sections were taken from topographic maps, considerable hydraulic uncertainty might result. In addition, after the water levels corresponding to the design flood had been determined, they must be indicated on a contour map and that also resulted in uncertainty.

#### 2. Applicability and limitations

64. In its most general form, flood-vulnerability analysis was applicable to all the countries in the ESCAP region. In other words, they would all benefit by knowing the depths and inundation areas anticipated for a spectrum of flood events. It was unlikely, however, that all countries would utilize cost-benefit procedures which were based on flood-hazard mapping. That was due in part to political factors and in part to the fact that loss of life was more important than efficiency computations. It might turn out that flood-vulnerability studies would prove to be most valuable for countries that were competing for scarce international aid. There were several pitfalls that could diminish the value of such studies. Most important, there might be difficulties encountered in implementing the results.

### IV. CONCLUSIONS AND RECOMMENDATIONS

65. It was the consensus that the Seminar had been useful. The participants considered that the lectures given by the consultants and the representatives of WMO and UNDRO had been highly informative. The techniques of flood-vulnerability



analysis and their application to the formulation of a comprehensive plan for flood loss prevention and management had been illustrated by sufficient examples. Computer programs on the evaluation of the impact of flooding had also been demonstrated. The participants agreed that flood-vulnerability analysis would provide basic economic and technical information for the formulation of both structural and non-structural flood-protection measures.

#### Recommendations

66. The following recommendations were unanimously agreed on by the participants:

(1) Noting the tight competition for resources among various projects and the limitations of structural measures for flood mitigation, it was recommended that countries employ a comprehensive approach in the formulation of flood loss prevention and management plans.

(2) It was pointed out that the combination and co-ordination of conventional structural measures and non-structural measures were key factors in the comprehensive approach to flood loss mitigation. It was therefore recommended that countries consider the application of flood-vulnerability analysis to achieve the best combination and co-ordination of various components in a flood mitigation plan.

(3) While recognizing the value of the techniques and methods applied in the developed countries, it was pointed out that appropriate changes or modifications might be necessary owing to special conditions in developing countries in the region. It was therefore recommended that countries initiate studies to determine the modifications required to be made in those techniques and methods.

(4) It was recommended that countries apply simple methods, as an interim measure, by which the historical recorded floods could be interpreted on flood-hazard maps. In that regard, it was also recommended that countries initiate the collection of data on both hydro-meteorological and socio-economic effects of past floods.

(5) It was recommended that countries take the necessary steps to improve or revise their flood damage survey and data compiling systems to enable the adoption of those advanced techniques.

(6) Noting the rapid urbanization and the increasing flood hazard in and around urban areas, the Seminar recommended that such areas should be given priority in the promotion of flood-vulnerability analysis though not at the cost of agricultural areas.

(7) As the principles and techniques of flood vulnerability analysis were not well known in the ESCAP region, where good examples of their application could not be found, it was strongly recommended that international organizations concerned establish a pilot project to prepare flood-hazard maps in a selected river basin in the region seriously and adversely affected by floods which could be used as a case study for training in the field.

#### V. ADOPTION OF THE REPORT

67. The report of the Seminar was adopted at the closing session on 13 September 1982, during which the participants expressed their thanks to ESCAP, UNDRO, WMO and the lecturers for their respective roles in the Seminar. Appreciation was also expressed to UNDP for providing funds for the Seminar and to the Mekong secretariat for making a micro-computer available.

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