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FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

**REPORT OF THE TYPHOON COMMITTEE
ON ITS TWENTY-THIRD SESSION**

**Seoul, Republic of Korea
13 - 19 November 1990**

FOR PARTICIPANTS ONLY
ORIGINAL: ENGLISH

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

Typhoon Committee
Twenty-third session
13-19 November 1990
Seoul

REPORT OF THE TYPHOON COMMITTEE
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I. ORGANIZATION OF THE SESSION

1. The twenty-third session of the Typhoon Committee was held in Seoul, Republic of Korea, from 13 to 19 November 1990.

Attendance

2. The session was attended by the representatives of China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea, Thailand and Viet Nam. Observers from Germany, the United States of America and the Union of Soviet Socialist Republics attended the session. Observers from the Commission for Atmospheric Sciences (CAS) of the World Meteorological Organization (WMO), the United Nations Development Programme (UNDP) and the League of Red Cross and Red Crescent Societies (LRCS) were also present.

Opening address

3. The Chairman called the meeting to order and expressed the gratitude of the Committee to the Government of the Republic of Korea for the arrangements made for the session.
4. Mr. Yong-Dai Park, the Administrator of the Korea Meteorological Service, welcomed the participants. He noted that typhoon disasters could be managed by mitigating the typhoon's effects although typhoons themselves could not be controlled. He stressed that for managing typhoon disasters three factors, namely (i)

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inter-governmental co-operation, (ii) accurate and timely forecasts of the typhoon movement and intensity, and of their effect, and (iii) disaster prevention and preparedness, were important. He also stressed that these three factors should be integrated into one system in order to minimize the impact of typhoons.

5. In his message, the Executive Secretary of ESCAP expressed his appreciation to the Government of the Republic of Korea for hosting the session. He stressed that, considering the great losses due to typhoons and floods experienced by Members, it was important to further strengthen the activities of the Committee. He expressed gratitude to UNDP for its significant contributions to the Committee's work, and wished that such valuable support would be continued in the future. He informed the Committee that at its forty-sixth session, the Commission had directed that activities undertaken within the framework of the International Decade for Natural Disaster Reduction (IDNDR) be continued at a high level throughout the Decade and beyond. In this regard, he gave the assurance that ESCAP would continue to take an active role in the regional initiatives that would contribute towards achieving the goals of the Decade.

6. On behalf of the Secretary-General of WMO, Mr. Ho Tong Yuen, the WMO Secretariat representative, thanked the Government of the Republic of Korea for hosting the twenty-third session of the Typhoon Committee in Seoul and for the excellent arrangements provided. He extended a warm welcome to all participants. He emphasized the need for continued vigilance and, in particular, for the enhancement of disaster preparedness measures to mitigate the adverse impacts of typhoons that still pose a major threat to lives and property in the region. The field experiment SPECTRUM (Special Experiment Concerning Typhoon Recurvature and Unusual Movement), he added, was a further demonstration of the seriousness of Members for positive actions to minimize typhoon damages. Mr. Ho thanked UNDP for its past support to the Committee and expressed the hope that it would continue to be an external source of support to complement national resources to sustain the

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Committee's effectiveness in contributing to the objectives of the IDNDR. He also thanked ESCAP for its close collaboration and the Typhoon Committee Secretariat for its good work. He wished the session every success in its deliberations.

7. Dr. Jin-Hyun Kim, the Minister of Science and Technology, congratulated the Committee on the occasion of the successful opening of its twenty-third session. He stressed the vital importance of international and regional co-operation for the early detection of disastrous weather phenomena and for coping with the recent concern on climate change. He thanked the participants for their active endeavours in the mitigation of disasters caused by destructive typhoons. He hoped that the session would be both stimulating and productive, and wished all participants a pleasant stay in Seoul.

ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award

8. The Central Anti-Calamity Headquarters, Korean Broadcasting Systems (KBS) and Munhwa Broadcasting Corporation (MBC) in the Republic of Korea were awarded the ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award for 1990, consisting of a plaque and US \$1,200 each. The Central Anti-Calamity Headquarters developed real-time flood forecasting systems in the five major river basins of the Republic of Korea, continuously upgraded the disaster prevention plan and published various literatures on disaster preparedness for public information. Both the KBS and MBC disseminated information on, and warnings of typhoons affecting the Republic of Korea promptly and effectively in close co-operation with the Korea Meteorological Service and actively participated in the information campaign on disaster prevention.

Election of Officers

9. The Committee unanimously elected Mr. Yong-Dai Park (Republic of Korea) Chairman and Mr. Luo Jibin (China) Vice-chairman of the Committee for its twenty-third session and the following inter-sessional period. Mr. Lim Joo Tick (Malaysia) was elected Chairman of the Drafting Committee for the session.

/Agenda

Agenda

10. 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 1990:
 - (a) Meteorological component;
 - (b) Hydrological component;
 - (c) Disaster prevention and preparedness component;
 - (d) Training component;
 - (e) Research component
5. Review of the 1989 and 1990 typhoon seasons/annual publications
6. Co-ordination with other activities of the WMO Tropical Cyclone Programme
7. Programme for 1991 and beyond:
 - (a) Report of the SPECTRUM Steering Group Meeting on the 1990 Field Experiment held at Manila;
 - (b) Initial reports on the SPECTRUM Field Experiment;
 - (c) Project document on "Reduction of natural disasters related to typhoons" for the next UNDP programming cycle, 1992-1996;
 - (d) The Typhoon Committee's role in the context of the IDNDR
8. Support required for the Committee's programme
9. Agenda for the twenty-fourth session
10. Date and place of the twenty-fourth session
11. Scientific lectures
12. Adoption of the report

II. THE COMMITTEE'S ACTIVITIES DURING 1990

(Item 4 of the agenda)

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11. The Committee reviewed and evaluated in detail its activities during 1990. The Committee was pleased that Members continued to undertake, with the assistance of WMO, ESCAP and TCS, activities called for by its Regional Co-operation Programme.

A. Meteorological component

(Item 4 (a) of the agenda)

12. The Committee approved the amendments submitted by the rapporteur, Mr. H. Ohnishi, for updating the Typhoon Committee Operational Manual (TOM)- Meteorological component and expressed its appreciation for his excellent work and willingness of Japan to continue providing services of the rapporteur. The amendments as approved are reflected in Appendix I.

13. The Committee learned that SPECTRUM was instrumental to some extent in the acquisition of new facilities, upgrading of existing ones and relocation of stations for more comprehensive and adequate coverage.

14. China installed its latest radar system, model 714, in two coastal stations and converted some older ones into modern systems with digital data processing and short distance echo transmission capabilities. Japan also equipped 17 of its 20 radars with REDIS (Radar Echo Digitalizing and Dissemination System). In early 1991, two others would be similarly equipped.

15. In the Philippines, only the radar at Tanay was operational after the July 16 earthquake and the recent spate of tropical cyclones had damaged the other units in the network.

16. Korea would install two additional doppler type digital radars by the end of 1990 bringing the total to three. Two more similar radars would be set up in 1991 in time for the typhoon season, completing a planned network of five radar stations.

17. In Thailand, a new S-band doppler radar at Phuket became operational in early 1990. A second new S-band doppler radar was under installation at Bangkok International Airport, while a third new S-band doppler radar for Surat Thani was under procurement, and these radars would be operational by 1991 and 1992,

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respectively. A new C-band radar at UNOCAL oil rig platform in the Gulf of Thailand is also under installation and would be operational by the end of 1990, whereas another new C-band radar for Sakon Nakhon was under procurement and would be operational by 1992. Data from the operational radar stations in the network was encoded using the modified FM 20-VIII RAOB code on an experimental basis.

18. Viet Nam had installed a 10-cm radar in Haiphong, and another was planned for installation at Danang in 1991.

19. The Committee was informed that upper-air observations were carried out satisfactorily in general in spite of some difficulties encountered by some Members.

20. An automatic wind-measuring equipment was installed at Zuoshan, China in 1990.

21. The installation of an automated upper-air observation system at Minamidaitojima in 1990 brought the number of systems in the Japanese upper-air network to five. One more would be added in March 1991.

22. Malaysia acquired two fully automatic upper-air receiving systems to replace existing ones at Petaling Jaya and Kuantan.

23. The Philippines received the first of two Vaisala Digi-Cora Rawinsonde systems from the Government of Finland through the Voluntary Co-operation Programme (VCP) of WMO. It was installed at Legaspi and, as a result of special efforts to this end, became operational in time for SPECTRUM. This brought to five the number of upper-air stations available for the experiment.

24. Installation of Automatic Weather Observing Systems (AWOSs) at Surat Thani Airport and at Phitsanulok Airport in Thailand was completed. The former became operational since August 1990, while the latter was under testing. A third new AWOS installed at Khon Kaen Airport would become operational by April 1991. Thailand was procuring four additional new high resolution NOAA and GMS satellite receiving systems for installation at its regional centers. Installation of these equipment would be completed by late 1991.

25. Viet Nam put into operation 10 new French wind recorders, TAVID-87, at coastal stations.

26. The Committee agreed that the GMS system was the backbone of satellite-based data for forecasting and warning services. Most Members had already acquired the ground receiving equipment. Some Members also acquired NOAA polar orbiting satellite reception stations.

27. In late 1989, Japan successfully launched GMS-4 which replaced GMS-3. The latter was moved to 120 °E to serve as a backup system.

28. China successfully launched its second experimental polar-orbiting meteorological satellite on 3 September 1990. Satellite orbit prediction message data would be available on GTS.

29. The Philippines was able to put back its GMS ground receiving equipment into operation in May 1990.

30. Korea's Meteorological Satellite Data Analysis System (MESDAS) has been providing various information from both GMS and NOAA satellites since June 1989, and its dual capability was further enhanced by adding more softwares this year to provide TOVS temperature data and cloud motion vectors.

31. Thailand developed a similar dual capability in its satellite data system and expanded its network to regional meteorological centers in the country.

32. Viet Nam requested Japan to continue LR-FAX transmission because of its inability to upgrade its three stations due to technical reasons.

33. Members continued their efforts to upgrade their telecommunication facilities. The Hong Kong-Beijing circuit was upgraded to 9600 bps. Hong Kong introduced the use of NAVTEX to broadcast marine forecasts and tropical cyclone warnings to the ships plying nearby waters.

34. The regional telecommunication circuit, Bangkok-Yangon, was upgraded from HF radio to satellite link 50 bauds on 1 October 1990. Thailand was seeking ways and means of establishing a 50 bauds satellite link between Bangkok and Hanoi. Malaysia

obtained assistance from WMO in procuring processing software for upgrading the Kuala Lumpur-Singapore circuit to 4800 bps thus paving the way for a complete upgrading of the Kuala Lumpur-Singapore-Jakarta-Melbourne regional circuits.

35. The implementation phase of the Meteorological Telecommunication System Development Project in the Philippines, with assistance from the Government of Japan, commenced with the construction of the data information center which was expected to be completed by 1991.

36. Korea started to integrate several independent networks into one system called the Combined Meteorological Information System (COMIS) which would allow data and imagery to be exchanged between the headquarters and the various forecast offices. The system also distributes its products to the Anti-calamity Headquarters, Ministry of Construction and the Broadcasting Systems.

37. The computerized message switching system of Viet Nam, provided under a UNDP/WMO project, continued to work satisfactorily. Ten new HF SSB transceivers were put into operation to upgrade national data collection.

38. The Committee was pleased with the use by Members of prognostic products of the global numerical model arising from the acquisition of better computer facilities and speedier telecommunication systems.

39. In Hong Kong, a high speed computer workstation dedicated to numerical modelling was ordered, and installation of the workstation would be carried out in early 1991.

40. Japan modified the typhoon spectral model with regard to the cumulus parameterization scheme.

41. In the Philippines, output of the Global Spectral Model had replaced the use of ECMWF products.

42. Two numerical weather prediction models have been in operation since 1989 at the Korea Meteorological Service. A newly developed oceanic numerical model for wave forecasts using the results of the Mesoscale Model would become operational soon.

43. In Thailand, the installation of NWP software was completed.

B. Hydrological component

(Item 4(b) of the agenda)

44. The Committee noted with appreciation that sustained efforts had been made towards establishing and/or improving the flood forecasting and warning systems in the major river basins of the Members.

45. The Committee was pleased to note that ESCAP, in co-operation with WMO and TCS, organized the Third Expert Group Meeting on Comprehensive Flood Loss Prevention and Management at Bangkok from 23 to 27 July 1990. It was the last meeting of the project on Preparation of a Manual and Guidelines for and Dissemination of the Techniques of Comprehensive Flood Loss Prevention and Management Applicable to Typhoon Committee Members implemented under RAS/86/175. The meeting finalized the Manual and Guidelines and discussed the programme of the roving seminars for dissemination. The meeting also considered a proposed project of the hydrological component of the Typhoon Committee, namely, Preparation of Manual and Guidelines for Integrated River System Development and Management with reference to Comprehensive Flood Loss Prevention and Management.

46. The Committee was informed that ESCAP, in co-operation with TCS, implemented and concluded a project on Urban Flood Loss Prevention and Mitigation in the ESCAP Region-Phase I, with financial support from the Government of Japan. In this connection, as its last planned activity, an Expert Group Meeting was held at Bangkok from 16 to 20 April 1990. The meeting reviewed and analyzed urban flood problems and counter-measures in the Member countries/areas and discussed the requirement of follow-up activities. The proceedings of the Expert Group Meeting and the reports of the advisory missions to Member countries/areas were under printing.

47. The Committee expressed appreciation to the Japanese Government for supporting the TCS initiate translation into English of Japanese references concerning comprehensive flood loss prevention and mitigation for dissemination to

Members.

48. In regard to its programme activities on the description and monitoring of flood forecasting systems, the Committee recalled that some problems had arisen on the application of monitoring procedures and that WMO had developed a new procedure entitled "Management Overview of Flood Forecasting Systems" (MOFFS) for reviewing and monitoring of these systems. At its twenty-second session the Committee had identified MOFFS as a new project for the hydrological component. Since then the Panel on Tropical Cyclones, the RA-IV Hurricane Committee and the RA-V Tropical Cyclone Committee had each met and recommended this system for use by its respective Members. The Committee recalled that MOFFS had been designed to enable the facilities and procedures of annual performance of many flood forecasting systems to be described and monitored using a three-point scoring system. It agreed that the use of the same monitoring system by the different cyclone bodies would greatly facilitate the exchange of experiences on flood forecasting among the various regions. The Committee therefore formally decided to recommend MOFFS for use by its Members, and that it be included specifically in its Regional Co-operation Programme Implementation Plan. It requested WMO to urge all its Members concerned to designate river basins /river reaches whose flood forecasting systems could be monitored using the MOFFS rating system and to apply MOFFS accordingly.

49. The Committee was pleased to note that the Working Groups on Hydrology of WMO Regional Associations II (Asia) and V (South-West Pacific) were both undertaking important tasks of considerable interest to the regions. Special attention was being given to the problems of hydrological networks, data collection and transmission of hydrological data, hydrological forecasting and modelling and the development and promotion of regional aspects of WMO's Hydrological Operational Multipurpose Subprogramme (HOMS). Six Members of the Committee (China, Japan, Malaysia, Philippines, Thailand and Viet Nam) had experts appointed as rapporteurs on these working groups to undertake specific tasks either individually or jointly. At the

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kind invitation of China, the fourth session of the WMO RA-II Working Group on Hydrology was held in Beijing from 18 to 22 October 1990.

50. The Committee was also pleased to note that WMO implemented technical co-operation projects for Members of the Typhoon Committee that involved the assessment of flood risk and the installation or upgrading of flood forecasting systems. A draft project document had been circulated for a regional project, to be funded by UNDP, entitled "Manpower development and technology transfer in water resources assessment and development for Asia and the South-West Pacific". The project, which would consolidate and enhance the capacities of National Hydrological Services to assess water resources and to provide vital hydrological data for development projects, was supported by the Committee.

51. Malaysia expressed its appreciation to ESCAP for dispatching a flood loss prevention expert to Malaysia from 14 to 25 August 1990 for the purpose of establishing a real-time flood forecasting model to be applied in Batu Pahat River basin, a fast developing basin seriously affected by tidal action.

52. The Committee was pleased to learn of the completion of the Bangkok Metropolitan Flood Control Centre on 7 August 1990 which covered an area of about 600km² in eastern Bangkok. In the implementation of this project, financial support from the Government of Japan was also received. This Centre would effectively monitor the operation of many pumping stations, control gates, drainage and flood protection facilities on a real-time basis.

53. The Committee was informed that TCS organized the pre-session meeting of the hydrological component in co-operation with ESCAP and WMO on 12 November 1990. The meeting discussed research activities, technical co-operation among Members and future activities under the hydrological component. A brief report of the meeting was presented to the session, and its recommendations were considered under the appropriate agenda items.

C. Disaster Prevention and Preparedness Component

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(Item 4(c) of the agenda)

54. The Committee thanked WMO for arranging a Mission in August to September 1990 on disaster prevention and preparedness to Members in accordance with the work plan of WMO/UNDP revised project and in response to the request of its twenty-second session. The mission team, Col. V. R. Pagulayan Jr. (Philippines), the part-time expert on DPP in the TCS and Mr. K. Takase (Japan), a meteorologist in the Japan Meteorological Agency visited three Members in the first phase of the mission and Col. Pagulayan visited four other Members in the second phase. The Committee was informed by Col. Pagulayan of the outcome of the mission. In accordance with their terms of reference, the mission team report was being submitted to WMO. The Committee recorded its deep appreciation to the two experts of the mission team for the excellent job done and felt that this activity would prove to be a significant step in its efforts to further develop and accelerate progress in the DPP component of its programme. The Committee requested WMO to finalize mission report(s), consulting with Members concerned following its usual practice and to submit reports to Members visited and to the next session of the Typhoon Committee.

55. The International Development Centre of Japan (IDCJ), a private and non-profit organization, sent a team of three members in August 1990 to several institutions/organizations in Asian countries to collect information on policies on disaster mitigation and activities of the Typhoon Committee. However, the principal task of the Centre as commissioned by the Ministry of Foreign Affairs of Japan was to get views and/or suggestions on Japan's aid policy on disaster mitigation.

56. In Malaysia, various measures to minimize or reduce loss of life and damage to property were reviewed annually by the National Disaster Committee and Ministry of Social Welfare Services to strengthen them prior to the advent of the monsoon season. These measures were on disaster prevention and other mitigation activities and rehabilitation programmes. Such activities included the creation of public alertness during the monsoon season, training of officers to make them more capable in managing

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disasters, utilization of voluntary organizations, provision of cash aid and relocation of disaster victims.

57. Korea undertook disaster prevention and preparedness activities on a continuing level to protect life and property. Annually, before the month of May, various measures were undertaken. The repair of facilities and management of danger areas that were potential sources of disasters, clearing of rivers from obstructions, assignment of watch teams on rivers and embankments, conducting public education through T.V. and radio programmes, etc. were among the activities carried out.

58. In accordance with the IDNDR national programme, the Korea Meteorological Service (KMS) organized 3 working groups: research, international cooperation, and public information service groups. The research group initiated domestic and international researches on severe weather and forecasting systems. The international cooperation group would promote international activities, and explore measures of bilateral or multilateral cooperation. The public information service group would publish brochures and booklets on disaster preparedness.

59. The Royal Observatory Hongkong, in order to promote the 1990s as the IDNDR, produced a calendar depicting the theme of the Decade. The information provided by the Dial-A-Weather System was also being provided to the public through telex, facsimile and telephone. Pamphlets and booklets on tropical cyclones, landslides, floods and thunderstorms and their warning systems were distributed to the public free of charge. Also special pamphlets for the marine community were issued to ship owners. The Royal Observatory maintained close consultation with transport operators and emergency bodies to ensure the safe conduct of workers from their places of work to their homes. Other activities included the annual meet-the-press session to promote DPP awareness, the weekly T.V. weather programmes and tour of the Observatory by school students.

60. The Meteorological Department of Thailand reported on the conduct of seminars for the different levels of the civil defense authorities and volunteers for civil

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defense programmes and the establishment of two operation centres in southern Thailand after the serious flooding in November 1989 to manage DPP activities during floodings. A national committee composed of members from various ministries was established in January 1990 to undertake activities on DPP in pursuit of IDNDR. Awareness of the impact of tropical cyclone on the national economy and on society increased considerably among the public and top level management. The Local Administration Department in cooperation with the Asian Disaster Preparedness Centre (ADPC) prepared three draft proposals on flood protection and relief management for technical and financial assistance from donor countries. Three test exercises on DPP related to IDNDR activities were conducted in disaster-prone areas in Thailand during the month of August 1990.

61. China established a National Disaster Reduction Commission in April 1989 chaired by the Vice-Premier with members coming from the different Ministries of the government including the State Meteorological Administration (SMA). In line with this, SMA set up its own IDNDR Committee tasked to deal with disasters caused by meteorological hazards such as typhoons under the aegis of the national committee on IDNDR. The Deputy Administrator of SMA served as the chairman of this subsidiary committee. Plans were afoot to set up a data bank on tropical cyclone disasters. The National Meteorological Center and the provincial meteorological bureaus were involved in the collection of historical data on disasters.

62. The China Disaster Prevention Association, a non-governmental organization, held a symposium in October 1990 on Developing Strategy for Disaster Reduction over Coastal Areas. The Association was preparing again to host another international symposium on disaster reduction. China also established in 1990 nine warning networks including 17 transmitting stations and 2135 receiving stations for water retention basins in the Yangtze, Yellow, Huaihe and Haihe rivers.

63. In the Philippines, one of the programmes being implemented by PAGASA on dissemination of public information for natural hazards was granted several

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extensions by the United States Agency for International Development (USAID) due to its impressive accomplishments. Recently, an additional grant was given to fund the study on the improvement of the contents of PAGASA's warning bulletin. A new format for warning was formulated and was used in the 1990 typhoon season. Further improvement on the format might be made depending on the results obtained from more studies and surveys being conducted on its effectiveness.

64. The Philippines issued presidential proclamations embodying the aims and purposes of IDNDR to ensure yearly celebration with maximum public participation and awareness through an intensive information campaign using print and broadcast media. These issuances were Proclamation No. 553 declaring April 22 as Earth Day as part of the World Earth Day Celebration to restore the liveability of the environment and protect against environmental degradation; Proclamation No. 237, declaring the month of June every year as Environment month as a contribution to World Environment Day (June 5), and Proclamation No. 296, declaring the first week of July every year as National Disasters Consciousness Week. The celebration in July 1990 underscored the nationwide observance of the latter event with the awarding of plaques of recognition and appreciation to outstanding disaster coordinating councils and non-governmental organizations for promoting volunteerism and exemplary community services.

65. The Philippines also was able to avail of the support of the Italian government in the conduct of Disaster Preparedness and Community Development in the Bicol region this year. In addition, a UNDP-funded Disaster Management Workshop for DPP regional personnel was conducted and later echoed in two regions to upgrade the skills of local executives and officials. The Core Shelter programme under the Department of Social Welfare and Development was able to build 9,986 core houses, designed to withstand typhoons, for disaster victims.

66. Viet Nam established its National Committee for IDNDR with an approved action programme for implementation. The UNDP/WMO national project on disaster prevention

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and rehabilitation was being implemented in Binh Tri Thien province (1989-1991). This project was composed of three subprojects concerning telecommunication, rehabilitation and Typhoon Flood Warning. The successful implementation of the project would enhance the disaster prevention and preparedness in the region. The government also proclaimed 22 May as National Tradition Day to promote natural disaster prevention and preparedness activities in the whole country.

Activities of TC in relation to IDNDR

67. The Members organized and continued to organize national committees to respond positively to and implement activities for carrying out the aims and objectives of the IDNDR. Some of these activities included the use of visual aids to depict the theme of the Decade, the issuances of government proclamations encouraging celebrations to highlight public participation and raising of community awareness on the impact of natural disasters and the preparation of plans to be undertaken with the support of international organizations such as UNDRO, WMO, ESCAP, UNDP, LRCS, AIT and others (see, for example, paras. 58-61, 64 and 66 above).

68. The Committee was informed that ESCAP had established a multi-divisional multi-sectoral Task Force for IDNDR as a response to the General Assembly resolution that, among other things, urged the regional commissions to play an active role in the Decade activities, as natural disasters often transcend national boundaries. Owing to their multi-sectoral structures and convenient locations regional commissions were well-suited for disaster reduction activities in their respective regions. ESCAP, since its establishment over forty years ago, had already been assisting its members in their efforts for natural disaster reduction, and at its forty-fifth session in 1989 the Commission passed a resolution on fulfilling the requirements of IDNDR. Consequently, ESCAP concentrated its efforts on reduction of effects of tropical cyclones, floods, storm surges, droughts as well as volcanic and seismic disasters in Asia and the Pacific.

69. The Committee was pleased to note that ESCAP had initiated a project on

/Assessment

Assessment of Current Preparedness Programmes, Forecasting Systems and Operational Methods for Water-related Natural Disaster Reduction in the ESCAP Region in co-operation with UNDRO, WMO, UNESCO and TCS. This project was supported by the Japanese Government, and the work involved would cover various aspects of the hydrological and DPP components of the work of the Committee.

70. WMO's responsibility within the UN System related to activities on meteorology, climatology and operational hydrology. Providing a leading role within the context of IDNDR, WMO's main concern was the mitigation of disasters caused by tropical cyclones, floods, droughts, tornadoes, severe thunderstorms and other severe weather phenomena such as storm surges, major snow storms, extremely high or low temperatures, landslides and avalanches. In addition, WMO also contributed to the mitigation of other types of disasters such as insect plagues and forest fires, through its involvement in the meteorological and hydrological aspects of the disasters, and to dissemination of tsunami warning and seismological data through its Global Telecommunication System.

71. The real important and immediate problem, addressed by WMO in the context of IDNDR and directed to developing countries, was the application of existing proven technologies and procedures. Adequate scientific bases and an array of tried and tested methodologies, technologies and equipments were available to fulfill most of the needs. In addition, further scientific advances and new or improved techniques were extremely valuable, and more studies, particularly research on meteorology, should be promoted. Specifically, therefore, WMO's main thrust was on :

(a) Filling the gaps in the implementation of the observing networks, telecommunications and data processing facilities defined under the World Weather Watch Plan, as required for establishing or upgrading warning systems,

(b) Promoting, initiating or accelerating action on improved response to warnings to ensure that they are effectively used,

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- (c) Risk assessment, particularly as needed for disaster prevention measures,
- (d) Public information education and awareness.

Two great impediments to the improvements at national level in the short-term period in many developing countries were :

- (a) Lack of knowledge and expertise in the technology,
- (b) Lack of funds to install, operate and maintain systems using existing technology and procedures.

These impediments could be overcome through technical co-operation, activities emphasizing technology transfer and/or institution building, provision of equipment and facilities and human resources development. WMO was involved in such activities.

72. In addition to the long-term activities undertaken as part of WMO's major programmes, plans were developed for three projects geared towards the attainment of the goals of IDNDR. These projects are very cost-effective and would have a significant impact at both international and national levels. These include projects on:

- (a) Comprehensive Risk Assessment,
- (b) System for Technology Exchange for Natural Disaster (STEND).

73. It can be summarized that the strengthening of the Disaster Prevention and Preparedness components was a major thrust in 1990 among the TC Members by including disaster related activities in their priority funded list. The level of awareness on disasters was intensified through public education and information tapping the print and broadcast media to focus the impact on the grassroots level. Concerted efforts, community-oriented activities and volunteerism were major issues underscored in seminars and training courses conducted for the Members' staff, local government units and non-governmental organizations. Continuing activities and proposals on disaster preparedness were formalized and included as major inputs in support of IDNDR.

D. Training component

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(Item 4(d) of the agenda)

74. Members continued to take every opportunity to improve their human resources through the facilities available from both inside and outside the region. They also took full advantage of the various training events such as symposia, workshops and training courses.

75. The Asian Disaster Preparedness Centre at Bangkok had just conducted the first of a series of interdisciplinary workshops on Improving Cyclone Warning Response and Mitigation (ICWRM) in the Asia-Pacific Region. This was supported by a generous grant from the European Economic Community. ICWRM-2 would be held in Manila in January 1991.

76. Representatives from four Members attended the training course, provided by USA in co-operation with WMO, on Tropical Meteorology and Tropical Cyclone Forecasting (Florida, USA, February to May 1990) with the financial support from WMO.

77. Japan conducted, through JMA, training courses on the following with representatives from six Members attending :

- Forecast service,
- Automation of meteorological observations,
- Numerical weather prediction,
- Meteorological instruments,
- Meteorological telecommunications,
- Quantitative forecasting,
- Marine meteorology,
- Numerical modelling,
- Research and forecast services for tropical cyclones.

JMA also provided expert services to five Members on:

- Meteorological telecommunications,
- Meteorological instruments,
- Meteorological training,

/Mission

Mission for Typhoon Committee,

Postgraduate courses in Hydrology.

The representative of Japan informed the Committee that JMA is ready to send its forecasters or other experts to the Members, if the Committee will organize on-the-job training events for familiarization with the RSMC Tokyo-Typhoon Center products.

78. With support from the Japan Foundation for Ship Advancement (JAFSA), JMA hosted an International Conference on Marine Meteorological Information Services. Furthermore, the Japan International Cooperation Agency (JICA) conducted a seminar on Administration for Disaster Prevention and a training course entitled Information Processing Personnel (Database System Design (A)). The TCS Meteorologist was provided training on Hydrology and Typhoon Disaster Prevention by JICA.

79. Some Members participated in the WMO training workshops on (i) the use of Satellite Meteorology conducted by China and (ii) Telecommunications and Meteorological Instruments conducted by India. Some Members participated in the WMO Training Workshop on Diagnosis and Prediction of Monthly and Seasonal Variations held in Nanjing, China. A Training Workshop on Measuring Sea Surface Wind and Wave with model 714 Radar would be held before the end of the year.

80. Several staff members of the Royal Observatory Hongkong completed the Scientific Officer Course at the British Meteorological Office College, a Diploma Course on Management of Information Systems at the University of London, and a course on meteorology at Florida State University. In turn, the Observatory accepted overseas trainees to its Applied Meteorology Course for Forecasters which was completed in June 1990. It also announced that a Course on Meteorology of Southeast Asia for Class II meteorological personnel would be held in February-March 1991, and a few places would be available to Members.

81. An officer of the Malaysian Meteorological Service (MMS) was given training in Objective Analysis at the Australian Meteorological Bureau with partial financial

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support from the host government. Two other officers were attending, since February 1990, a ten-month Postgraduate Meteorologist Course also in Australia. MMS conducted an attachment training course on radar observation and calibration, and a study tour of computer facilities for Thai meteorological personnel.

82. Several PAGASA staff members participated in the following courses:

- (a) Workshop on Improving Tropical Cyclone Warning Response, ADPC Bangkok
- (b) Diploma Course in Remote Sensing and Image Processing, UK
- (c) Advanced Course in Instrumentation, India
- (d) Software Development in Meteorology, Singapore
- (e) Diploma Course in Electronics for Meteorological Engineer, UK (on-going)
- (f) Inter-university Postgraduate Program in Hydrology, Belgium
- (g) International Postgraduate Hydrology Course, Ireland
- (h) Overseas on-the-job Training on Flood Forecasting and Warning System for Dam Operations (Telecommunications), Japan
- (i) Disaster Management Course, ADPC (British Council).

83. Some staff members from Korea attended the training courses in Development of Nowcasting System and in Numerical Weather Prediction, at the Florida State University, USA. On the other hand, it provided training courses to Thailand in Flood Forecasting and Warning System for the Han River Basin and to Viet Nam in the Use of Radar Data in Operational Forecasting of Heavy Rainfall.

84. Thailand participated in training courses in General Meteorology (India), River and Dam Engineering (Japan), WMO Regional Workshop on Tropical Cyclone and Storm Surge Forecasting (Sri Lanka), Technology for Disaster Prevention (Japan), and Basic Aeronautical Meteorology (Pakistan).

85. Viet Nam staff attended the WMO International Workshop on Meteorological Services (Switzerland) and Application of Satellite Data in Tropical Cyclone Forecasting (Thailand).

86. The observer from the USSR reiterated the availability of various training

/courses

courses under the WMO Voluntary Cooperation Programme. It announced the organization of 3-week courses on Hydrological Forecasts of Floods to be held in Moscow and Leningrad in April 1991, specially addressed to Class I and II hydrologists of southeast Asia.

E. Research Component

(Item 4 (e) of the agenda)

87. Research continued to assume an integral part of all components of the Members' activities.

88. Members participating in SPECTRUM took extra efforts to ensure the success of the experiment. Malaysia made a request for enhanced 3-hourly ship observations from ships recruited under the WMO Voluntary Observation Scheme. China extended the experiments' scope with domestic extended IOPs for two (of the seven target) tropical cyclones which made landfall in China during the experiment period.

89. The Members reported various research activities concerning all three components; meteorological, hydrological and DPP. These dealt with the various stages of tropical cyclone development and movement, numerical weather prediction and modelling, tropical cyclone forecasting, ocean wave models, nowcasting, flood forecasting, typhoon damage, human response to tropical cyclone warnings and risk assessments, storm surge forecasting, etc.

90. The Research Co-ordinator of the meteorological component submitted a progress report of research activities by Members. The Committee expressed its appreciation to him for a job well done. JMA has been operating a WMO Commission on Atmospheric Sciences (CAS) Activity Center for tropical meteorology research and planned to issue an annual report of its activities including those of the Members. The Research Co-ordinator of the hydrological component proposed measures to the Committee to promote information exchange on their research activities taking advantage of TC Newsletter (see para. 94). The DPP Expert (part-time) informed the

/Committee

Committee of a DPP survey mission in which he participated (See para. 54).

III. REVIEW OF THE 1989 AND 1990 TYPHOON SEASONS/

ANNUAL PUBLICATIONS

(Item 5 of the agenda)

91. The Committee commended Hong Kong on the publication of the 1989 issue of the "ESCAP/WMO Typhoon Committee Annual Review". It thanked the Chief Editor and the national editors for their contributions to the publication.

92. The Committee requested Hong Kong to continue to make available the services of a Chief Editor for the coming years. In his response, the representative of Hong Kong assured the Committee that, in spite of staff constraints, every effort would be made to meet the request.

93. There was general consensus on the need for periodic review of the contents of the publication to ensure its effectiveness in publicizing the work of the Committee. Consideration would be given for the inclusion of new items whenever appropriate. In this regard, the Committee noted the recommendation of the SPECTRUM Steering Group for the results of SPECTRUM to be included in future issues of the Review.

94. The Committee agreed that research activities of the Hydrological Component should be reported to TCS and the abstracts of such reports published in the Typhoon Committee Newsletter.

IV. CO-ORDINATION WITH OTHER ACTIVITIES OF THE

WMO TROPICAL CYCLONE PROGRAMME

(Item 6 of the agenda)

95. The discussions under this agenda item were based mainly upon the information contained in the sixteenth status report on the implementation of the WMO Tropical Cyclone Programme (TCP) and supplementary information presented orally at the

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session by the WMO Secretariat representative. The Committee was pleased to note the achievement under the TCP towards the mitigation of tropical cyclone disasters and the role of international and regional co-operation and co-ordination in this regard. It made two specific proposals for enhancing co-ordination between TCP regional bodies: the convening of one of its annual sessions jointly with that of the Panel on Tropical Cyclones, possibly in January 1992 and the holding of a TCP regional component co-ordination meeting once in every four years.

96. Recalling that it had previously agreed to the recommendation of the ninth session of WMO Regional Association II for a joint session of the Committee and of the Panel, and that the Panel has also agreed to a joint session, but probably not before 1991, the Committee reiterated its willingness for such a session to be held. Among other benefits, it would facilitate consideration of items of mutual concern including the use of standard nomenclature for tropical cyclones and might most conveniently be held in December or January. Thailand indicated that it would consider hosting the next session of the Committee and if, as proposed, this were to be a joint session, suggested that it be held in January 1992. The Committee welcomed these ideas and requested WMO and ESCAP to refer this matter to the Panel at its forthcoming session (Male, January/February 1991).

97. The Committee proposed that TCP regional component co-ordination meetings be held in conjunction with the International Workshops on Tropical Cyclones (IWTCs). They would serve, among other purposes, to co-ordinate the work of and promote exchange of views, experiences and ideas between the five TCP regional bodies. It requested that consideration be given to including the chairmen of the TCP regional bodies among those invited to each IWTC. On these bases, the cost of these co-ordination meetings would be minimal.

98. In regard to IWTC-II, the Committee was informed of the major recommendations of the workshop. While recognizing the continuing need for a Committee for IWTC, currently named International Programme Committee for IWTC-II, it felt that a change

/of

of name to International Committee on Tropical Cyclones would not be appropriate. It hoped that another name better reflecting its scope, role and function and possible inter-relationships with other groups could be found. The Committee requested the representative of the president of CAS to bring its views to the attention of the president of CAS.

V. PROGRAMME FOR 1991 AND BEYOND

(Item 7 of the agenda)

99. The Committee, in consideration of its programme for 1991 and beyond, reviewed and adopted, with amendments, the Typhoon Committee's Regional Co-operation Programme Implementation Plan. The updated plan as adopted by the Committee is reflected in Appendix II.

100. The Committee was informed of the problems related to dam safety monitoring and water release from dams, and requested TCS, in consultation with ESCAP and WMO, to prepare a project document under the hydrological component for consideration during the next TC session.

A. Report of the SPECTRUM Steering Group meeting on the 1990

Field Experiment

(Item 7(a) of the agenda)

101. The Committee, after considering the Final Report of the SPECTRUM Steering Group Meeting held in Manila in May 1990, expressed satisfaction with the excellent work done by the chairman and members of the SPECTRUM Steering Group.

102. It noted that one of the activities recommended in 2.1(c) of Appendix IV of the Report was not necessary in the light of its close proximity to a technical conference on SPECTRUM which would be held in China in late 1991. Otherwise, it approved the recommendations on data management and follow-up of SPECTRUM. An extract from the report is given in Appendix III.

103. The Committee authorized the Chairman of the Typhoon Committee to approve

/recommendations

recommendations of the Steering Group arising from its evaluation meeting (Tokyo, December 1990), and which are supported by the Coordinator, TCS.

104. It expressed its gratitude to the Government of Japan for offering to host the meeting.

105. The Committee directed TCS to closely coordinate with the other national experiments, TYPHOON-90 and TCM-90, to ensure the availability of the data sets from the experiments for use of the researchers.

B. Initial Reports on the SPECTRUM Field Experiment

(Item 7(b) of the agenda)

106. The Committee thanked the six Members i.e. China, Hong Kong, Japan, Malaysia, Republic of Korea and Thailand for their reports on SPECTRUM which were submitted to the session. It also thanked the USSR for its report on its "TYPHOON-90" experiment. Some information relating to the field experiment of the "TCM-90" experiment being conducted by the USA was also given to the Committee. These reports were of interest to the Committee, particularly on the co-ordination between the three experiments, the production of data sets and the research to be conducted.

107. On the basis of the reports submitted, other information available to the session and the discussions held, the Committee arrived at a preliminary conclusion that the SPECTRUM field experiment was an outstanding success, well beyond expectations. It felt that it would stand as a model of international co-operation and goodwill. The Committee expressed its warm appreciation to all participating Members for their invaluable contributions to the preparations for and execution of this field experiment, and particularly to Japan for providing the services of RSMC Tokyo-Typhoon Center as the Experiment Center. It also thanked the Steering Group chairman, Mr. C. Y. Lam (Hong Kong), and its members and other experts who contributed so much to the planning of the experiment.

/108.

108. It was decided that further consideration should be given to the reports on SPECTRUM and relevant reports on TCM-90 and TYPHOON-90, including more detailed and up-to-date reports as may be available, by the SPECTRUM Technical Conference and Steering Group Evaluation Meeting to be held in Tokyo in December 1990. The Committee was pleased to note that, in addition to invitations to participating Members, the USA, USSR and CAS were being invited to send observers to the conference and meeting. The Committee felt that, before concluding its work, this Steering Group at the forthcoming meeting should make recommendations on mechanisms for continued co-ordinated activities related to research associated with SPECTRUM.

C. Project document on "REDUCTION OF NATURAL DISASTERS
RELATED TO TYPHOONS" for the next UNDP programming cycle 1992-1996

(Item 7(c) of the agenda)

109. Under this item, the Committee considered a project document on "Reduction of natural disasters related to typhoons" prepared in response to the request of the Committee at its twenty-second session and submitted jointly by WMO and ESCAP for the next UNDP programming cycle 1992-1996. The Committee was very pleased to learn that Mr. P. Sham (Hong Kong) had been engaged as a consultant by WMO in this connection. He visited a number of Members of the Typhoon Committee, the Typhoon Committee Secretariat at Manila and ESCAP in Bangkok before preparing his report.

110. The Committee was informed of the salient points of the document, namely, the justification, strategy, institutional framework, target beneficiaries, immediate objectives, outputs and activities. The immediate objectives relate mainly to :

- (a) Upgrading the capabilities of National Meteorological and Hydrological Services (NMHS) for forecasting and warning;
- (b) Provision of data and analyses for structural design for reducing typhoon and flood damage;
- (c) Training of staff of meteorological, hydrological services and disaster prevention agencies;

/(d)

(d) Establishment of a "Regional Typhoon Research Center".

111. The draft project document included, under a sub-contract, two sub-projects proposed by ESCAP as follows :

(i) Preparation of manual and guidelines for integrated river system development and management with reference to comprehensive flood loss prevention and management.

(ii) Preparation of guidelines for the formulation of a comprehensive master plan for urban flood loss prevention and mitigation,

112. The total budget for the 5-year period is US \$2,804,400 including the sub-contract of US \$791,400. The budget for the sub-project (i) is US \$150,000 and this sub-project was earlier endorsed in principle by the Typhoon Committee. Sub-project (ii) has a budget of US \$641,000 and is a relatively new concept for TC, originally proposed by participants from seven members of the Committee that participated in the Expert Group Meeting in the Phase I of the activities organized by ESCAP in April 1990.

113. The Committee was also informed of the informal discussion the WMO and the ESCAP Secretariats had with the Resident Representative of UNDP, Seoul. The Resident Representative was informed that this project proposal covers a new subject, namely IDNDR. He suggested the following:

- (a) The project should not be confined to TC Members only, but should have more participating countries from Asia and the Pacific region;
- (b) The budget should be reasonable, and the activities should be confined to IDNDR;
- (c) The national Meteorological and Hydrological Services must impress upon their Aid Co-ordinators to give topmost priority to the project.

114. All the Members attached utmost importance to the concept of this project related to IDNDR in the region and saw the urgent necessity of launching it during the UNDP fifth cycle and strongly supported it.

115. The Typhoon Committee expressed its satisfaction at the excellent work of the consultant.

116. All the Members agreed that

- (a) The activities should be confined to the aims and objectives of IDNDR;
- (b) The budget should be realistic;
- (c) Some more countries from the region should be involved in the project.

Accordingly, it was suggested that

- (a) The Project be renamed as "Reduction of natural disasters related to typhoon and typhoon induced flooding";
- (b) Government Implementing Agency : Meteorological and Hydrological Services of the Governments of People's Republic of China, Hong Kong, Japan, Cambodia, Republic of Korea, Lao People's Democratic Republic, Malaysia, the Philippines, Thailand, Viet Nam, Brunei Darusalaam, Indonesia and Singapore;
- (c) The co-ordination of the project within the regional level would be by the Typhoon Committee with the help of the Typhoon Committee Secretariat.

117. The representative of Japan mentioned that the Government of Japan makes a major contribution to UNDP and strongly supports the Typhoon Committee programme. He also endorsed the idea of enlisting more Members outside TC for participation in the project.

118. During the detailed discussion of the draft project document, while some Members supported the project proposal, some other Members expressed concern that the budget is too high compared to that of the on-going project. In response ESCAP suggested another sub-project on "Storm surge prediction and risk analysis" to be jointly executed by ESCAP and WMO as an alternative to sub-project (ii) under para.

111. This suggestion was accepted by the Committee.

119. One Member felt that sufficient importance has not been given to DPP

activities in the project document. It was suggested that activity in the field of public education and awareness be included.

120. A view was expressed that in regard to sub-project (i) of para. 111 an environmental specialist from ESCAP Secretariat could be included in the missions, and up to 3 expert group meetings might be held.

121. After prolonged discussion, the consensus which emerged was as follows:

- (a) Considering that UNDP would like to phase out its assistance to the TC and is unlikely to be in a position to approve a project with a large budget, the activities of the project proposal should be confined to IDNDR, and its budget should be kept as low as possible without jeopardising its ability to achieve its main objectives;
- (b) The project should include more countries from Asia and Pacific and an approach should be made to them for their participation;
- (c) Informal contacts should be pursued with UNDP to facilitate the timely submission and approval of the project.

D. The Typhoon Committee's role in the context of the IDNDR

(Item 7 (d) of the agenda)

122. The Committee carefully deliberated on the role the Typhoon Committee should play in the light of the International Decade on Natural Disaster Reduction (IDNDR).

123. The Committee agreed that it should respond and react positively towards achieving the objectives of the IDNDR. In this regard, it urged Members to initiate appropriate plans and actions for consideration by the next session.

124. It took note of its project proposal for UNDP approval (Item 7(c)) as a major part of its contribution to the Decade. It decided that the proposal should include participation of some other countries outside of the region.

125. It directed WMO, ESCAP and TCS to effect changes in the project document to reflect the above and attain an even balance among the three major components of the Committee's programme.

126. Extensive discussions on this subject of IDNDR took place under item 4(c) and other items.

VI. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME

(Item 8 of the agenda)

127. Under item 8 of the agenda, the Committee reviewed the need for support to carry out its current and future activities on the basis of a document submitted jointly by WMO and ESCAP.

128. The Committee considered the staffing of TCS and was pleased to learn that the Philippine Government would continue to facilitate the functioning of TCS in Manila. It also noted with appreciation the Government's offer to make available the services of a Co-ordinator, a meteorologist and an expert (at least part-time) on disaster prevention and preparedness.

129. The Committee expressed its thanks and gratitude to Dr. R.L.Kintanar for his contribution and guidance as the Co-ordinator.

130. The Committee welcomed with appreciation the offer of Japan that it would make every effort to continue to provide a hydrologist to TCS.

131. The Committee was very pleased to learn that in accordance with the decision of its twenty-second session a number of activities of the Committee were carried out under the UNDP/WMO Regional project RAS/86/175, "Programme Support to the Typhoon Committee". These activities included support to the observational programme of SPECTRUM, its Steering Group meeting, software transplantation in meteorological application, supply of microcomputer with optical disk, expert group meeting on manual and guidelines on comprehensive flood loss prevention and management, disaster prevention and preparedness and preparation of the project document for the UNDP fifth cycle. The Committee reiterated its sincere thanks to UNDP for its strong support and expressed the hope that the assistance from UNDP would continue in future.

132. Realizing that most of the fund under the project has been utilized, the Committee did not come up with any new requirements except to organize a training seminar on Disaster Management. However, the Committee felt that the pending requirements of some Members should be fulfilled.

133. The Committee was very pleased to learn that a number of activities have taken place under TCDC arrangements. Many Members benefited from this component of the UNDP/WMO project and urged that the pace of this programme accelerate in future. The Committee recognized that exchange visits of experts and support to trainees under TCDC are of immense benefit to Members and are of utmost importance in achieving self-reliance.

134. The Committee was pleased to learn that a number of short-term and long-term fellowships had been awarded under the Voluntary Co-operation Programme (VCP) of WMO. The Committee recognized the potential of this programme for support of its activities, and Members were urged to take full advantage of this system. They were also advised to update their requirements and send to WMO.

135. As regards the Trust Fund, the Committee was informed that, in accordance with the decision of the twenty-second session, this fund was used to support the following :

- (a) Observational programme and Steering Group meeting under SPECTRUM;
- (b) Travel relating to DPP mission;
- (c) Augmentation of travel funds for TCS staff missions;
- (d) Publishing newsletter by TCS;
- (e) Representation and emergency expenses of TCS;
- (f) Printing cost of documents for the twenty-third session.

136. The Committee also agreed at the session to the use of the Trust Fund for the following activities during 1990 and 1991 :

- (a) Augmentation of travel funds for TCS staff mission;
- (b) Support for organizing symposia or technical conferences;

/((c)

(c) Support for SPECTRUM;

(d) Publishing newsletter by TCS on a periodical basis;

(e) Representation and emergency expenses of TCS;

(f) Support to collaboration of research activities among TC members;

(g) Printing cost of documents for the twenty-fourth session not exceeding US \$1,000.

137. The Committee recognized the establishment of the Trust Fund as a big stride towards self-reliance. It therefore reiterated its earlier decision that the annual contribution would not be limited to a definite time span, but would continue until such time as the contribution to support the Committee's programme would no longer be required to support its programme. It was pleased to learn that the Governments of China, Japan, Malaysia, Republic of Korea and Thailand have made and/or are making their contributions for 1990. The Committee stressed the need for promoting voluntary annual cash contributions by Members to the Trust Fund with a view to increasing self-reliance, in meeting institutional support, for its programme. Members were, therefore, urged to continue sending their contributions to WMO.

138. The Committee was informed that by-laws have been framed for the Typhoon Committee Foundation which was established from the 1988 Sasakawa-UNDRO Disaster Prevention Award. The income derived as accrued interest was used for the ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award which was presented to three recipients nominated by Republic of Korea. Similar arrangements will follow for next year.

139. It was encouraging to note that the participating Members of the Committee were shouldering the responsibilities for institutional support of the inter-country project of the Committee and had recognized that as an important principle in the management of the Regional Co-operation Programme. However, the Committee recognized the need of enhancing its financial position to implement its programme of work. It was therefore felt that private sectors, which avail of the meteorological,

/hydrological

hydrological and environmental services, could be potential donors. The Committee requested the Co-ordinator of TCS to approach these potential donors for their voluntary contribution to the Typhoon Committee Foundation.

140. The Committee was informed that ESCAP would continue to undertake activities in support of the Typhoon Committee within the framework of its own work programme and available resources. It noted with appreciation that the following new Japan ESCAP Co-operation Fund projects had been initiated in 1990, in which Typhoon Committee Members, as well as some other countries in the ESCAP region, would be involved :

- (a) ESCAP/UNDRO Regional Symposium on IDNDR (Bangkok, 11-15 February 1991);
- (b) Assessment of Current Preparedness Programmes, Forecasting Systems and Operational Methods for Water-related Natural Disaster Reduction in the ESCAP Region.

141. The Committee was pleased to note that Members were provided with advisory services on flood forecasting by ESCAP through its regional advisors.

VII. AGENDA FOR THE TWENTY-FOURTH SESSION

(Item 9 of the agenda)

142. The Committee requested TCS, in close consultation with ESCAP and WMO to prepare the provisional agenda for the twenty-fourth session. Should the next session be a joint session with the Panel on Tropical Cyclones, then the Panel's Technical Support Unit should also be consulted.

VIII. DATE AND PLACE OF THE TWENTY-FOURTH SESSION

(Item 10 of the agenda)

143. The representative of Thailand extended an invitation to the Committee to hold its twenty-fourth session in Thailand, subject to confirmation by his Government. It was proposed that the TC Session be held in late 1991, or should

/there

there be a joint session with the Panel on Tropical Cyclones, then the date should be January 1992. The Committee, in accepting the kind invitation, expressed its deep appreciation to the Government of Thailand. The date would be determined later on the basis of consultations by Thailand, ESCAP, WMO and TCS as well as the Panel on Tropical Cyclones.

IX. SCIENTIFIC LECTURES

(Item 11 of the agenda)

144. The following scientific lectures were presented.

1. Development of Typhoon Forecasting Models in Korea

by Dr. Soon-Chang Yoon

Professor

Department of Atmospheric Sciences

Seoul National University

2. Forecasting of Rain Distribution due to Typhoon

by Dr. Jeong-Woo Kim

Professor

Department of Astronomy and Atmospheric Sciences

Yonsei University

3. Numerical Experiment of the Storm-surge in the Seas around Korea

by Dr. Im-Sang Oh

Professor

Department of Oceanography

Seoul National University

4. Probable Maximum Precipitation Estimates of Korea

by Dr. Sung Kim

/Research

Research Fellow
Water Resources Engineering Division
Korea Institute of Construction Technology

5. Current Activities of the RSMC Tokyo-Typhoon Center

by Mr. Michio Hitsuma

Director

Forecast Division

Forecast Department

Japan Meteorological Agency

The Committee members expressed their thanks to the lecturers.

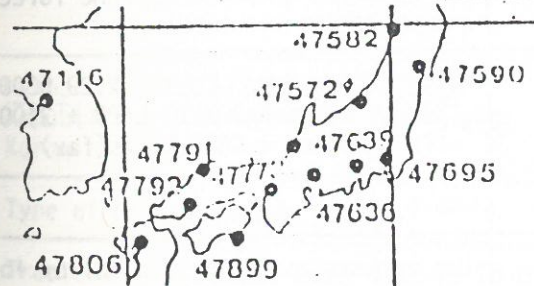
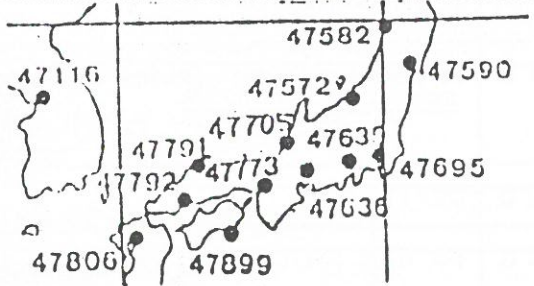
X. ADOPTION OF THE REPORT

(Item 12 of the agenda)

145. The Committee adopted its report on 1

Proposals for updating of the Typhoon Committee
Operational Manual - Meteorological Component

Page	Line	Present	Proposals for amendments
2	18	Procedures (which it is felt)	procedures (it is felt
	33	Classification of cyclonic disturbances and tropical cyclones	Classification of tropical cyclones
	34	Cyclonic disturbance (generic term: (i)-(v))	(Delete)
	37	Tropical cyclone (generic term: (iii)-(v))	(Delete)
4	1 - 3	Cyclonic disturbance: circulation	(Delete)
	10	occurrence of wind speed	occurrence of average wind speed
	12	Gale: 47 knots.	(Move before "Gale warning", Page 4, Line 9)
	22 - 23	Severe tropical storm: A cyclonic disturbance in which the maximum sustained wind speed is in the range of 48 to 63 knots.	Severe tropical storm: A tropical cyclone with maximum sustained winds of 48 to 63 knots near the center.
5	6	63 knots, wind force 10	63 knots, or wind force 10
	8 - 9	Tropical cyclone: A cyclonic disturbance with average maximum sustained wind speed of 34 knots or more.	Tropical cyclone: A non-frontal synoptic scale low pressure system originating over tropical or subtropical waters with organized convection and definite cyclonic wind circulation.
	12 - 14	Tropical depression: A cyclonic disturbance in which central position can be identified and the maximum sustained wind speed is less than 34 knots.	Tropical depression: A tropical cyclone with maximum sustained winds of 33 knots or less near the center.
	15 - 16	Tropical storm: A cyclonic disturbance in which the maximum sustained wind speed is in the range of 34 to 47 knots.	Tropical storm: A tropical cyclone with maximum sustained winds of 34 to 47 knots near the center.
	17 - 18	Typhoon: A cyclonic disturbance in which the maximum sustained wind speed is 64 knots or more.	Typhoon: A tropical cyclone with maximum sustained winds of 64 knots or more near the center.
	23	centre position of a tropical storm	centre position of a tropical cyclone
6	14	wind speed in a cyclonic disturbance	wind speed in a tropical cyclone
	16	Tropical cyclones will be serially numbered	Tropical cyclones of TS intensity or higher will be serially numbered
	19	the first cyclonic disturbance	the first tropical cyclone
	20	in the tropical cyclone area	in the responsible area of the RSMC Tokyo - Typhoon Center

Page	Line	Present	Proposals for amendments												
6	2.1	a cyclonic disturbance spans two calendar years,	a tropical cyclone spans two calendar years,												
	2.4	names of typhoons used by JTWC	names of tropical cyclones of TS intensity or higher used by JTWC												
7	9	200 km of the centre of a tropical cyclone.	300 km of the centre of a tropical cyclone of TS grade or stronger.												
	2.4	a typhoon becomes an imminent threat	a tropical cyclone becomes an imminent threat												
	2.8	radiowind observations	radiowind observations												
	3.4	affected by tropical cyclones	affected by tropical cyclones of TS intensity or higher												
	3.8	whenever a tropical cyclone is centred	whenever a tropical cyclone over TS is centred												
8	7 ~ 9	JGZK (radar) and JCCX (upper-air) when they are in the vicinity of a tropical cyclone. A newly-built weather ship JDWX from Japan started upper-air observations as from August 1988.	JGZK (radar), JDWX (upper-air) and JCCX (upper-air) when they are in the vicinity of a tropical cyclone of TS grade or stronger.												
	2.0 ~ 2.1	as long as a tropical cyclone remains	as long as a tropical cyclone of TS grade or stronger remains												
9	Fig. 2-1														
10	1.0	47625 Tokyo	47695 Tokyo												
11	9	when a tropical cyclone is located	when a tropical cyclone of TS intensity or higher is located												
13		<table><tr><th>Country</th><th>Stations</th><th>GMS</th></tr><tr><td>Republic of Korea</td><td>Seoul</td><td>1,2</td></tr></table>	Country	Stations	GMS	Republic of Korea	Seoul	1,2	<table><tr><th>Country</th><th>Stations</th><th>GMS</th></tr><tr><td>Republic of Korea</td><td>Seoul</td><td>1,2,3</td></tr></table>	Country	Stations	GMS	Republic of Korea	Seoul	1,2,3
Country	Stations	GMS													
Republic of Korea	Seoul	1,2													
Country	Stations	GMS													
Republic of Korea	Seoul	1,2,3													
15	4	analyses of various	analyses of various												
17	7	a high resolution (180 km)	a high resolution (110 km)												
18	All	Table 3.2: Outline of RSMC Tokyo prediction models	《Replace by Annex 1》												

Page	Line	Present	Proposals for amendments
20	10	Classification of cyclonic disturbances	Classification of tropical cyclones
	11 ~ 12	Classifications of cyclonic disturbances for the typhoon region for the exchange of messages	Classification of tropical cyclones for the exchange of messages
	16 ~ 17	maximum sustained wind speed is less than 34 kt.	maximum sustained wind is 33 kt or less.
	18 20 and 22	Maximum sustained wind speed is	Maximum sustained wind is
	33	(iv) prognostic reasoning if applicable;	(iv) prognostic reasoning;
22	All		«Replace by Annex 2»
23	16	The first part relates to tropical storm warnings	The first part relates to storm warnings
	17 ~ 18	issuing the tropical storm warnings	issuing the storm warnings
	23	broadcasting typhoon forecasts and warnings	broadcasting tropical cyclone forecasts and warnings
27	15	Beijing-Hong Kong Cable, 75 bauds	Beijing-Hong Kong Cable, V.29 9600 bit/s, 2400 bit/s(data) X.25 LAPB + 2400 bit/s (radar data) + 4800 bit/s(fax)
	28	GMS-III (140 ° E)	GMS-4 (140 ° E)
29	33	the dissipation of a tropical cyclone	the dissipation of a tropical cyclone of TS grade or stronger
	34 ~ 36	should prepare a report on the tropical cyclone to provide such as position and intensity of the tropical cyclone.	should disseminate a report on the tropical cyclone in the form of bulletins to provide such as position and intensity of the tropical cyclone (see the example below): «Insert Annex 3»
Appendix 1-A		List of names for tropical cyclones used by JTWC Guam	«Replace by Annex 4»
Appendix 2-A p.1		Japan (47): 665	«Delete»
		Japan (47): 912,913,	Japan (47): 912,917,918,

Page	Line	Present	Proposals for amendments
Appendix 2-A p.2		Republic of Korea(47) : 135	«Delete»
		Republic of Korea(47) : 095, 101,	Republic of Korea(47) : 095, 100, 101,
Appendix 2-E p.5		Name of station Tokyo/Kashiwa	Name of station Tokyo/Kashiwa
		Location of the station 35° 51' N 139° 56' E	Location of the station 35° 51' N 139° 58' E
Appendix 2-E p.7		Name of station Fukuoka/Sefuriyama	Name of station Fukuoka/Sefurisan
Appendix 2-E p.8		Name of station Isigakijima	Name of station Ishigakijima
Appendix 3-A p.5-2		Input: Positions of current storm, past 6-hour direction and speed or position of current storm, radius of acceptance circle.	Input: latest position of current storm, 6-hour direction and speed or (T-6h) position of current storm, radius of acceptance circle.
Appendix 3-A p.13		Name of the Member Republic of Korea	Amendment of this page is attached in the next one
Appendix 5-B		Member Republic of Korea	Member Republic of Korea
		Abbreviated Headings WTK020 RKSL, WKK020 RKSL	Abbreviated Headings WTK020 RKSL
Appendix 5-C p.2		Type of data Heading	Type of data Heading
		Tropical cyclone forecast FKK020 RKSL SL TD TD 0	Tropical cyclone forecast
Appendix 5-C p.3		Heading Receiving stations TD BJ BB III MM SL NN KK IV	Heading Receiving stations TD BJ BB III MM SL NN KK IV
		WKK030 RKSL 0	WTK020 RKSL SL TD TD 0
Appendix 6-B		(v) hourly radar observations	(iv) hourly radar observations

Amendments

Name of the Member Republic of Korea

ITEM	METHOD	TYPE OF OUTPUT
Name of method Description of the method	PC Method PC method is a statistical prediction method of a typhoon position based on persistent and climatological factor. Prediction eqs. have been established by the use of the stepwise regression methods. Independent variables: present and past 12 and 24-hr positions. Domain: 20-40 °N, 115-140 °E Frequency of forecast: 4 times a day or more	12 and 24-hr forecast positions
Name of method Description of the method	Statistical (Climatology+Persistence) Method Forecast based on modal directions and speed given by statistical data. Independent variables: present and past 12 and 24-hr positions. Climatological variables: monthly average of direction and speed of typhoon classified in hexa-direction within 4x4 degree lat./lon. grid Domain: 18-42 °N, 115-152 °E Frequency of forecast: 4 times or more a day	12 and 24-hr forecast positions
Name of method Description of the method	Analogue Method This model is designed for operation use based on an analogue technique on which the forecast tracks from the PC method are assumed to be analog tracks. Independent variables: 3-hourly positions to past 24-hr. Domain: 20-40 °N, 115-140 °E. Frequency of forecast: 4 times or more a day	12 and 24-hr forecast positions
Name of method Description of the method	Mesoscale Model Governing eqs: Primitive eqs. Vertical resolution: 10 layer σ -coordinate Domain: 4800 x 3600 km area with center of 35 °N, 125 °E on Lambert conformal projection Grid distance: 80km Integration step : 150 seconds Lateral boundary: Value from the Global Spectral Model(GSM) of JMA Frequency of forecast: twice a day	24, 36, and 48-hr forecast positions

Annex 1 to Appendix

Table 3.2: Outline of RSMC Tokyo prediction models

(a) Global prediction model

Basic equation

Primitive equation

Vertical resolution

21 level hybrid coordinate

0.010 (level 21)

0.029

0.050

0.071

0.097

0.130

0.174

0.228

0.292

0.365

0.444 (level 11)

0.526 (level 10)

0.607

0.685

0.756

0.820

0.875

0.920

0.955

0.980

0.995 (level 1)

Integration domain

Globe

Horizontal representation

Spectral, with triangular truncation at wave number 106

Grid

160 Gaussian latitudes and 320 longitudes

Horizontal DiffusionKV⁴ (linear)Time integration

Semi-implicit (Δt depends on the maximum of $V = \{(u - u_{mid})^2 + v^2\}^{1/2}$ where u_{mid} is mean zonal wind, $\Delta t = 10 \text{ min.}$ for $V_{max} = 100 \text{ m/s}$) with time filter ($\nu = 0.05$)

Orography

Included. Small scale smoothed.

Physical parameterization

(i) Surface exchanges: Flux of momentum, heat and moisture are included both for land (parameterized by SiB) and sea areas

(ii) Convection: Kuo's scheme

(iii) Latent heating: Condensation of water vapor

(iv) Radiation: Long-wave cooling and solar heating with effects of cloud. Diurnal variation included

Earth surface

Daily analyzed sea-surface temperature. Monthly averaged albedo, soil moisture, and ice cover specified geographically. Soil temperature predicted.

Annex 2 to Appendix

Advisory for prognostic reasoning

(EX. 3)

WTPQ22 RJTD 170600

ADVISORY FOR TY 9019 FLO (9019) PROGNOSTIC REASONING NO.09

1.GENERAL COMMENTS

REASONING OF THIS TIME DIFFERS FROM PREVIOUS ONE.

POSITION FORECAST IS MAINLY BASED ON NWP AND PERSISTENCY.

NWP RESULT IS MODIFIED BY CONSIDERING DIFFERENCE BETWEEN NWP AND ANALYZED SYNOPTIC FIELD.

2.SYNOPTIC SITUATION

SUBTROPICAL RIDGE WILL NOT CHANGE ITS LOCATION AND STRENGTH.

INTERACTION BETWEEN TROPICAL CYCLONE AND MIDLATITUDE TROUGH WILL BECOME WEAK.

3.MOTION FORECAST

POSITION ACCURACY AT 170600 UTC IS GOOD.

TY WILL ACCELERATE.

TY WILL RECURVE WITHIN 24 HOURS FROM 170600 UTC.

TY WILL MOVE NORTH AND THEN NORTHEAST.

4.INTENSITY FORECAST

TY WILL KEEP PRESENT INTENSITY.

FI-NUMBER WILL BE 6.0 AFTER 24 HOURS.=

Guidance for forecast by numerical typhoon model

Annex 3 to Appendix

Example of best track report

AXPQ20 RJTD 060400

RSMC TROPICAL CYCLONE BEST TRACK.

NAME 9009 TASHA (9009)

PERIOD FROM JUL2612UTC TO AUG0100UTC

2612	20.0N	119.6E	1002HPA	//KT	2618	19.6N	120.0E	1000HPA	//KT
2700	19.2N	120.2E	1000HPA	//KT	2706	18.8N	120.2E	1000HPA	//KT
2712	18.6N	119.8E	1000HPA	//KT	2718	18.6N	119.2E	1000HPA	//KT
2800	18.6N	118.3E	996HPA	35KT	2806	18.6N	118.0E	992HPA	40KT
2812	18.7N	117.6E	990HPA	45KT	2818	18.8N	117.4E	990HPA	45KT
2900	18.9N	117.2E	990HPA	45KT	2906	18.8N	116.5E	985HPA	50KT
2912	18.8N	116.0E	985HPA	50KT	2918	19.0N	116.0E	985HPA	50KT
3000	19.4N	115.5E	980HPA	55KT	3006	20.1N	115.8E	980HPA	55KT
3012	21.4N	115.8E	980HPA	55KT	3018	22.0N	116.0E	980HPA	55KT
3100	23.6N	115.1E	985HPA	50KT	3106	25.0N	114.7E	990HPA	45KT
3112	25.5N	114.4E	996HPA	35KT	3118	25.8N	114.3E	998HPA	//KT
0100	26.2N	114.6E	1000HPA	//KT					

REMARKS

TD FORMATION AT JUL2612UTC
 FROM TD TO TS AT JUL2800UTC
 FROM TS TO STS AT JUL2906UTC
 FROM STS TO TS AT JUL3106UTC
 FROM TS TO TD AT JUL3118UTC
 DISSIPATION AT AUG0106UTC=

ANNEX 4 to APPENDIX

Appendix 1 - A

List of names for tropical cyclones used by JTWC Guam

The list in Table 1-A.1 contains the names prepared by JTWC (Guam) for identifying tropical cyclones in the western north Pacific region. The first name to be used in a year will be the one immediately following the last named used in the previous year. Subsequent name will be assigned in succession according to the list of names in Table 1-A.1. However, if a tropical cyclone acquires special notoriety because of strength, death tolls, damages or other special reasons, its name may be withdrawn at the request of any Member.

Table 1-A.1 Names for tropical cyclone

Column 1	Column 2	Column 3	Column 4
ANGELA	ABE	AMY	AXEL
BRIAN	BECKY	BRENDAN	BOBBIE
COLLEEN	CECIL	CAITLIN	CHUCK
DAN	DOT	DOUG	DEANNA
ELSIE	ED	ELLIE	ELI
FORREST	FLO	FRED	FAYE
GAY	GENE	GLADYS	GARY
HUNT	HATTIE	HARRY	HELEN
IRMA	IRA	IVY	IRVING
JACK	JEANA	JOEL	JANIS
KORYN	KYLE	KINNA	KENT
LEWIS	LOLA	LUKE	LOIS
MARIAN	MIKE	MIREILLE	MARK
NATHAN	NELL	NAT	NINA
OFELIA	OWEN	ORCHID	OMAR
PERCY	PAGE	PAT	POLLY
ROBYN	RUSS	RUTH	RYAN
STEVE	SHARON	SETH	SIBYL
TASHA	TIM	THELMA	TED
VERNON	VANESSA	VERNE	VAL
WINONA	WALT	WILDA	WARD
YANCY	YUNYA	YURI	YVETTE
ZOLA	ZEKE	ZELDA	ZACK

Note:

- Names are assigned in rotation and alphabetically. When the last name in Column 4 (ZACK) has been used, the sequence will begin again with the first name in Column 1 (ANGELA).
- Names for tropical cyclones reaching storm or hurricane intensity in the National Hurricane Center's area of responsibility or the Central Pacific Hurricane Center's will be assigned from the lists published in the National Hurricane Operations Plan.

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1. METEOROLOGICAL COMPONENT

1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	90	91	92	93			
1.1.1 Maintaining services specified in the Operational Manual, including intensified observations (surface, upper-air and radars)					Members	National	Continuous activities
1.1.2 Provision of automated observation facilities and real-time telemetry of meteorological parameters, e.g., winds, rainfall, pressure, etc., by replacing with automatic instruments					- ditto -	- ditto -	
1.1.3 Establishment of AMeDAS, ASDAR, anemometer, tide gauge and water recorder networks					- ditto -	- ditto -	
1.1.4 Expansion of observational programme: - 98223 Laoag (Philippines) at 12 GMT Radiosonde/Radiowind					Philippines	National and external assistance	
1.1.5 Replacement/Upgrading of old radars					Malaysia, Philippines	- ditto -	
1.1.6 Establishment of new weather radars: - Pusan (Republic of Korea) - Donghae (Republic of Korea) - Kunsan (Republic of Korea) - Da Nang (Viet Nam) - Vientiane (Lao People's Democratic Republic)					Republic of Korea - ditto - - ditto - Viet Nam Lao People's Democratic Republic	National - ditto - - ditto - National and external assistance External assistance	

1.1 Support to Meteorological Observing Systems and Facilities (cont'd.)					
T A S K S	TIME SCALE				REMARKS
	90	91	92	93	
- Bangkok (Thailand)					Thailand National
- Phuket (Thailand)					" - ditto -
- Surat Thani (Thailand)					- ditto - - ditto
- Phitsanulok (Thailand)					- ditto - - ditto -
- Sakon Nakhon (Thailand)					- ditto - - ditto -
- Unocal Oilrig Platform (Thailand)					- ditto - - ditto -
- Rayong (Thailand)					- ditto - - ditto -
- Khon Kaen (Thailand)					- ditto - - ditto -
- Chantburi (Thailand)					- ditto - - ditto -
1.1.7 Establishment/Upgrading of satellite equipment (GMS/TIROS-N)					
- Hanoi (Viet Nam)					Viet Nam External assistance
- Chiang Mai (Thailand)					Thailand National
- Ubon Ratchathani (Thailand)					- ditto - - ditto -
- Songkhla (Thailand)					- ditto - - ditto -
- Phuket (Thailand)					- ditto - - ditto -
1.1.8 Establishment of a WWW data user system for the reception of FAX and GPV data via GMS (see Appendix)					Members Republic of Korea National - ditto -
1.1.9 Establishment of the operational systems with micro-computers to operate forecasting and marine meteorological warning services in fifteen Meteorological Offices in coastal region.					China National

1.2 SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES					
T A S K S	TIME SCALE				REMARKS
	90	91	92	93	
1.2.1* Maintaining (a) services and facilities for the real-time exchange of data and products;					Members National Continuous activities
(b) monitoring of data exchange					RTHs Bangkok Beijing and Tokyo Members concerned - ditto -
1.2.2 Improvement of facilities and their operation as necessary for the rapid and reliable collection and distribution of the required observational and processed information					
1.2.2.1 Establishment of regional telecommunication links					
- Bangkok-Hanoi					Thailand and Viet Nam National and External assistance
1.2.2.2 Improvement of data completeness and quality, including use of real-time and non-real-time monitoring results for this purpose					Members National
1.2.2.3 Review of existing arrangements for dissemination of typhoon warnings with a view to introducing improvements where necessary					- ditto - - ditto -
1.2.2.4 Improvement of national data collection and re-transmission to associated RTHs:					
- Lao People's Democratic Republic					Lao PDR National
- Philippines					Philippines National and bilateral support
- Viet Nam					Viet Nam External assistance

*During 1990 items with an asterisk to be given priority attention.

1.3 REQUIREMENTS SPECIFICALLY FOR TROPICAL CYCLONE FORECASTING AND WARNING									
T A S K S	T I M E S C A L E				B Y W H O M	R E S O U R C E S	R E M A R K S		
	90	91	92	93					
1.3.1* Continuing provision and dissemination of processed information, advisories and other products needed by TC Members for their forecasting and warning systems, archival of information on typhoon data in accordance with the TC Operational Manual					RSMC, Tokyo	Japan	Continuous activity		
1.3.2 Exchange of forecasts including products of different objective methods in accordance with the TC Operational Manual					Members	National	- ditto -		
1.3.3* Enhancement of co-operation in typhoon monitoring, forecasting and warning					- ditto -	- ditto -	- ditto -		
1.3.4 Establishment of a regional computer network					Members	National and external assistance			
1.3.5 Installation of a computer processing system with a view to integrating satellite radar and rainfall data so as to provide spatial distribution of rainfall amount over a large region					- ditto -	- ditto -	TCDC, Technical Consultancy & assistance from external sources would be required		
1.3.6 Setting up of electronic equipment maintenance and repair workshops					- ditto -	National & External assistance including TCDC			
1.3.7 Promotion of developments at the interface between the Meteorological warning services and the users of warnings for increasing the impact and effectiveness of these services					- ditto -	National and external assistance in conjunction with IDNDR			

*During 1990 items with an asterisk to be given priority attention.

2. HYDROLOGICAL COMPONENT

2.1 FLOOD FORECASTING AND WARNING

T A S K S	T I M E S C A L E				B Y W H O M	R E S O U R C E S	R E M A R K S		
	90	91	92	93					
2.1.1 Installation and operation of networks of observing stations required for flood forecasting systems					Members	National	Continuous activity		
- Installation of telemetering systems complemented by radar-raingauges and satellite systems for important cities and other densely populated areas prone to flash floods					China	- ditto -			
- Integration and use of data from existing meteorological and hydrological observing stations operated by various agencies					China	- ditto -			
- Improvement of means of transmission to reduce data collection time					Malaysia	- ditto -			
- Development of an on-line system					China	- ditto -			
- Development of hydrometric stations on urban drainage					Hong Kong	- ditto -			
2.1.2 Establishment and operation of flood forecasting and warning systems:					Members	National	Continuous activity		
- Nam Ngum and Se Bang Hieng basins (Lao People's Democratic Republic)					Leo PDR	- ditto -	Includes real-time data collection and hydrological modelling		
- Pasak River Basin (Thailand)					Thailand	- ditto -			
- One river basin (Viet Nam - to be selected by Viet Nam)					Viet Nam	- ditto -			
- Application of computer-based mathematical models to study the hydrology of urban zones					Hong Kong	- ditto -	In cooperation with ESCAP		

2.1 Flood forecasting and warning (cont'd.)									
T A S K S	TIME SCALE				BY WHOM	RESOURCES	REMARKS		
	90	91	92	93					
- Extension of flood forecasting services to other basins subject to flooding especially in medium scale catchment					Malaysia Republic of Korea Thailand	National National & bilateral support			
- Development of forecasting of the location and intensity of rainfall in densely populated areas which are subject to flash floods (e.g., Metro Manila)					Philippines	National JICA			
- Increased use of existing radar raingauges for providing OPF data					Philippines	National			
2.1.3 Establishment of flood forecasting and warning systems for dam operations					Philippines, Malaysia & Interested Members	Members concerned & external assistance	Faulty dam operation aggravates flooding downstream		
2.1.4 Establishment of flood forecasting and warning systems for inundation from storm surges					Members concerned	Members concerned & external assistance including TCDC	Includes interaction of river floods and storm surges		
2.1.5 Monitoring of and reporting on performance of existing flood forecasting systems					Members	National & external assistance including TCDC and with support of TCS and WMO	Coordinated by WMO, using MOFFS		

2.1 Flood Forecasting and Warning (cont'd.)									
T A S K S	TIME SCALE				BY WHOM	RESOURCES	REMARKS		
	90	91	92	93					
2.1.6 Further improvement of existing flood forecasting and warning systems, making use, where appropriate, of the results of TOPEX					Members	Members concerned & external assistance including TCDC	Includes catchment modelling		
- Improvement of existing models and their application in catchments subject to flash floods					Philippines Malaysia Thailand	National - ditto - - ditto -			
- Improvement of currently used model on the Han River basin					Republic of Korea	- ditto -			
- Improvement of existing flood forecasting systems for the rivers Hong and Thai Binh using micro-computers					Viet Nam				
2.1.7 Implementation of recommendations of mission by experts to provide technical guidance on items 2.1.1 to 2.1.6					Members concerned	External assistance. Missions to be organized by WMO and ESCAP	Using, where appropriate technology available through HOMS		
2.1.8 Exchange of technical visits among flood forecasters					Members	National external assistance	Coordinated by WMO		
2.1.9 Development and application of guidance on hydrological technology models for tropical cyclone regions					Members	External assistance WMO	On the basis of OHP (HOMS)		

2.1 Flood Forecasting and Warning (cont'd.)									
T A S K S	TIME SCALE				BY WHOM	RESOURCES	REMARKS		
	90	91	92	93					
2.1.10 Development and use of improved techniques for Quantitative Precipitation Forecast (QPF) taking advantage of data provided by satellite and radar					Members	Members and external assistance	WMO to assist in development and promulgation of improved techniques		
- Development and application of QPF derived from radar raingauges and satellites to issue flash flood warnings in densely populated small river basins					Malaysia	National & external assistance	WMO to assist in development and promulgation of the techniques		
- Development of QPF and its application to flood forecasting in central region					Viet Nam	National & external assistance			

2.2 COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT									
T A S K S	TIME SCALE				BY WHOM	RESOURCES	REMARKS		
	90	91	92	93					
2.2.1 Establishment of pilot area for comprehensive flood loss prevention and management					Members	Bilateral multi-lateral support if available	Detailed programme will be established by respective Members		
2.2.2 Investigation and survey including:					Members	National	ESCAP & WMO to assist in organizing investigations and surveys		
a) Determination of flood-prone areas subject to heavy damage;									
b) Determination of magnitude and corresponding frequency of floods in each flood-prone area;									
c) Assessment of potential flood damage in each area for various flood magnitudes;									
d) Preparation of flood risk maps.									
2.2.3 Preparation and application of a manual and guidelines for/and dissemination of techniques for comprehensive flood loss prevention and management					Members	National & external assistance (sub-contract under regional project)	With assistance of ESCAP and WMO		
2.2.4 Implementation of selected aspects of comprehensive flood loss prevention and management plans						- ditto -	- ditto -		
2.2.5 Mission of experts to provide technical guidance to Members on items 2.2.1 to 2.2.4 above					Members	UNDP & TCDC & bilateral multi-lateral support, if available	With assistance of ESCAP & WMO		

*There is no commitment for further UNDP support beyond the current project which terminates 1990.

2.2 Comprehensive Flood Loss Prevention and Management (cont'd.)						
T A S K S	TIME SCALE				BY WHOM	REMARKS
	90	91	92	93		
2.2.6 Preparation and application of a manual and guidelines for integrated river system development and management with reference to comprehensive flood loss prevention and management					Members	National & external assistance (sub-contract under regional project)
2.2.7 Preparation of guidelines for the formulation of a comprehensive master plan for urban flood loss prevention and mitigation					- ditto -	National & external assistance (sub-contract under regional project)
2.2.8 Storm surge prediction and risk analysis					- ditto -	National & external assistance

3. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 PUBLIC AWARENESS						
T A S K S	TIME SCALE				BY WHOM	REMARKS
	90	91	92	93		
3.1.1* Improvement of public awareness on typhoon and flood threat and preparedness coupled with studies of human response to warnings					Members	National & external assistance in conjunction with IDNDR
3.1.2 Production of materials (audio-visual aids, pamphlets and booklets) related to public information and education					- ditto -	National & external assistance

*During 1990 items with an asterisk to be given priority attention.

3.2 DISASTER MANAGEMENT		TIME SCALE				BY WHOM	RESOURCES	REMARKS
T A S K S		90	91	92	93			
3.2.1	Establishment/Upgrading of national disaster prevention and preparedness plans					Members	Bilateral or multi-lateral support if available	With advice and if possible support from ESCAP
3.2.2	Strengthening national co-ordination and co-operation between departments and agencies involved in DPP activities					- ditto -	National	
3.2.3	Improvement in the timely dissemination of warnings of typhoons, floods and storm surges with particular attention to remote areas					- ditto -	- ditto -	
3.2.4	Improvement of communication systems for warning dissemination and relief operation					- ditto -	Bilateral or multi-lateral support if available	
3.2.5	Improvement of damage assessment and reporting					- ditto -	Multi-lateral support if available	With advice from ESCAP roving mission
3.2.6	Development and exchange of information and guidance materials on structural and non-structural measures for mitigation of disasters					- ditto -	External assistance	With guidance from international agencies such as UNDRO, LRCS, ESCAP and WMO
3.2.7	Conducting case studies of response to major disasters					- ditto -	External assistance	With advice from UNDRO, LRCS and WMO

3.2 Disaster Management (Cont'd.)		TIME SCALE				BY WHOM	RESOURCES	REMARKS
T A S K S		90	91	92	93			
3.2.8	Compilation of annual information on loss of life and damage caused by typhoons, floods and storm surges including damage to houses, public facilities, agricultural products, and so on					Members	External assistance	With advice from UNDRO in cooperation with ESCAP
3.2.9	Archiving of damage caused by natural disasters					TCS	Members	From 1986 onwards or earlier if possible
3.2.10	Where appropriate, implementing the recommendations of joint missions and seminars to evaluate DPP procedures and to provide advice on local problems					Members	Bilateral or multi-lateral support if available	
3.2.11	Establishment of disaster research and training institute					- ditto -	- ditto -	
3.2.12 *	Production of material related to public information and education on the Typhoon Committee activities, particularly storm warning and DPP					- ditto -	External assistance	With support of ESCAP, WMO and TCS
3.2.13	Story of the Typhoon Committee					TCS	- ditto -	- ditto -
3.2.14	Establishment of a Philippine training and research centre for disaster prevention and preparedness, through consultancy services where appropriate					Philippines	- ditto -	With advice from UNDRO

*External assistance in conjunction with IDNDR.

4.1 METEOROLOGY									
T A S K S		TIME SCALE				BY WHOM	RESOURCES	REMARKS	
		90	91	92	93				
4.1.1	Training on engineering application of tropical cyclone climatological data					Members	External assistance	Conferences seminars & overseas training programmes, including roving missions & arrangements	
4.1.2	Training on applications of radar and satellite data in tropical cyclone tracking, forecasting and very short-range precipitation forecasts					- ditto -	- ditto -		
4.1.3	Training in calibration, maintenance and repair of electronic meteorological instrumentation					- ditto -	National & external assistance	Coordinated by WMO	
4.1.4	Training on utilization of software for integrating satellite/radar/rainfall data					- ditto -	Short-term fellowships with external support	- ditto -	
4.1.5	Training on quantitative precipitation forecast (QPF) models					- ditto -	- ditto -	- ditto -	
4.1.6	Training of personnel through fellowships on tropical cyclone forecasting					- ditto -	UNDP, WMO and other international organizations concerned	- ditto -	
4.1.7	Training on:					- ditto -	- ditto -	Courses & seminars organized by WMO and Members	
	- meteorology								
	- electronics								

4.1 Meteorology (cont'd.)

T A S K S	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	90	91	92	93			
4.1.8 Continuation of group training courses					Japan	Japan International Co-operation Agency (JICA)	
4.1.9 Exchange of forecaster(s) between tropical cyclone forecasting and warning centres					Members	External assistance	Through TCDC arrangements
4.1.10 Training on observing technology					- ditto -	External support	Seminars
4.1.11 Exchange of meteorological experts between Members other than 4.1.9 above					- ditto -	Bilateral or TCDC arrangements	
4.1.12 Training on storm surge and wave prediction					- ditto -	Short-term fellowships with external support	
4.1.13 Training in message-switching, wave forecasting, numerical weather prediction and cloud physics, through attachments					- ditto -	External assistance	TCDC arrangements
4.1.14* Training of personnel through fellowships on maintenance of electronic meteorological and hydrological equipment					- ditto -	- ditto -	For both meteorological & hydrological equipment

*During 1990 items with an asterisk to be given priority attention.

4.2 HYDROLOGY		TIME SCALE				BY WHOM	RESOURCES	REMARKS
T A S K S		90	91	92	93			
4.2.1	Training on repair and maintenance of electronic equipment used in flood forecasting and warning					Members	WMO, UNDP and other sources	Roving seminars organized by WMO
4.2.2	Training on advanced techniques for flood forecasting and warning and associated storms, including hardware and software					- ditto -	- ditto -	Courses and seminars organized by WMO
4.2.3	Training in hydrology with emphasis on flood forecasting					- ditto -	- ditto -	- ditto -
4.2.4	Training on personnel through fellowships on flood loss prevention					- ditto -	- ditto -	- ditto -
4.2.5	Training on appropriate topics relating to flood loss prevention and management					- ditto -	ESCAP, UNDP and other sources	Seminar organized by ESCAP
4.2.6	Group training courses on river engineering					Japan	Japan International Cooperation Agency (JICA)	At the request of TC
4.2.7	Exchanges of flood forecasting experts					Members	WMO, UNDP and other sources	TCDC arrangements

4.3 DISASTER PREVENTION AND PREPAREDNESS		TIME SCALE				BY WHOM	RESOURCES	REMARKS
T A S K S		90	91	92	93			
4.3.1	Training of disaster managers and volunteer leaders					Members	National & external assistance	With advice from inter-national agencies
4.3.2	Test exercises					- ditto -	- ditto -	- ditto -
4.3.3	Training in DPP					- ditto -	External assistance	Regional seminars organized by TCS with help of UNDRO, LRCS ESCAP and WMO
4.3.4	Exchange of information on the socio-economic impact of disaster					- ditto -	UNDRO, LRCS ESCAP and other multi-lateral support if available	Seminars organized by UNDRO LRCS and ESCAP
4.3.5	Training on disaster vulnerability and risk assessment					- ditto -	- ditto -	Course and seminars organized by UNDRO, LRCS and ESCAP
4.3.6	Group training courses on technology for disaster prevention					Japan	Japan International Cooperation Agency (JICA)	Continuation

4.3 Disaster Prevention and Prevention (cont'd.)					
T A S K S	TIME SCALE				REMARKS
	90	91	92	93	
4.3.7 Exchange of DPP personnel					UNDRO, LRCS, TCS and ESCAP UNDRO, LRCS ESCAP and other sources TCDC arrangement organized by UNDRO, LRCS, TCS & ESCAP

5. RESEARCH COMPONENT

5.1 METEOROLOGY					
T A S K S	TIME SCALE				REMARKS
	90	91	92	93	
5.1.1 General Studies on:					
5.1.1.1 Methods of typhoon location and accuracy					Members or regionally coordinated programme National
5.1.1.2 Typhoon development mechanism and forecasting					- ditto - - ditto -
5.1.1.3 Disastrous weather associated with typhoons					- ditto - - ditto -
5.1.1.4 Forecasting of precipitation by use of new approaches or techniques such as interactive techniques for integrating satellite, radar and other information					- ditto - - ditto -
5.1.1.5 Influences of meso- and micro-scale systems on typhoon characteristics					- ditto - - ditto -
5.1.1.6 Interaction between typhoons and the environmental circulation					- ditto - - ditto -
5.1.1.7 Possibility of extended track forecasting methods					- ditto - - ditto -
5.1.1.8 Evaluation and improvement of present objective forecasting methods					- ditto - - ditto -
5.1.1.9 Sensitivity of objective methods to initial data distribution and quality					- ditto - - ditto -
5.1.1.10 Typhoon climatology in relation with anomalies in regional circulation					- ditto - - ditto -
5.1.1.11 Forecasting storm surge and heavy rainfall (see also 5.2.6)					- ditto - - ditto -

5.1 Meteorology (cont'd.)					
T A S K S	T I M E S C A L E				REMARKS
	90	91	92	93	
5.1.2 Utilization of TOPEX data set (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modelling, with the aim of improving existing methods of predicting formation, development and steering					Members or regionally coordinated programme
5.1.2.1 Establishment and operation of a tropical cyclone data bank for the north western Pacific and East Asia with software exchanges between Members					RSMC, Tokyo
5.1.2.2 Development of an operational NWP model for typhoon movement and development					Members or regionally coordinated programme
5.1.2.3 Irregular tropical cyclone behavior such as sudden turning of tracks, sudden increase/decrease of intensity, rainfall and storm surge					- ditto -
5.1.2.4 Air-sea interactions associated with the occurrence of typhoons, with emphasis on wave and storm surge generation					- ditto -
5.1.2.5 Utilization of SPECTRUM data					Members

5.2 HYDROLOGY					
T A S K S	T I M E S C A L E				REMARKS
	90	91	92	93	
5.2 Studies for developing or improving techniques for:					
5.2.1 Comprehensive flood loss prevention and management					National or regionally coordinated programme
5.2.2 Flood risk analysis, including flood risk mapping					- ditto -
5.2.3 Flood run-off models appropriate for the region					- ditto -
5.2.4 Application of meteorological inputs to flood forecasting					- ditto -
5.2.5 Comparison of the performance of the different models, using the post-TOPEX data set					- ditto -
5.2.6 Forecasting floods caused by the combined effects of storm surges, heavy rainfall and stream flow (see also 5.5.1.11)					- ditto -
5.2.7 Flash flood forecasting					Members
5.2.8 Study of effects of deforestation, urbanization and changing land use on the hydrology of the catchment and on the intensity of floods					China, Philippines, Malaysia

5.3 DISASTER PREVENTION AND PREPAREDNESS					
T A S K S	TIME SCALE				REMARKS
	90	91	92	93	
5.3.1 Studies on socio economic impact of typhoon and flood disasters					Members National With advice and possible support of UNDRO/LRCS/ESCAP/WMO
5.3.2 Vulnerability and risk assessment of disaster-prone areas					- ditto - - ditto - - ditto -
5.3.3 Socio-economic implication of availability and quality of typhoon and flood forecasts and warnings					- ditto - - ditto - - ditto -
5.3.4 Disaster impact modelling					- ditto - - ditto - - ditto -

IMPLEMENTATION PLAN OF THE RSMC TOKYO-TYPHOON CENTRE					REMARKS
PRODUCT	90	91	92		
GMS Observation					
GMS S-VISSR WEFAX					24 tms/dy (full) 4 sector: 8 tms/dy, Image H: 24 tms/dy Image I or J: 24 tms/dy
Cloud motion wind					4 tms/dy
Analysis					
SAREP (for tropical cyclone)					4 8 tms/dy, Dvorak intensity (estimation included)
Report of typhoon analysis					4 tms/dy
Sea surface temperature					10-day mean and its anomaly
Objective analysis					
conventional					FAX (Polar stereo)
conventional					FAX (Mercator)*, GPV*
stream line					FAX*
Cloud distribution					GPV*
Long-wave radiation					GPV*
Forecast					
Report of typhoon forecast					4 tms/dy, 24 & 48 hr forecast
Prognostic reasoning					
Outputs of the numerical prediction model for typhoon movement					4 tms/dy, up to 60 hrs
NWP products					
conventional					FAX (Northern Hemisphere Model)
conventional					FAX (Global Model, Polar stereo)
conventional					FAX (Mercator)*, GPV*
streamline					FAX
Other Best Track					Mail GTS

*Some of these products will be disseminated within the capacity of traffic of the GTS and JMH.

SUPPORTING ACTIVITY	90	91	92	REMARKS
Data archive				Subject to budgetary allocation
Product dissemination via GMS				
Typhoon intensity prediction modelling				

Extracts from Report of SPECTRUM Meeting (Manila 1990)

5. DATA MANAGEMENT (Agenda item 5)

5.1 As agreed earlier, data sets will be compiled by participating Members. As a kind gesture from the RSMC Tokyo-Typhoon Center, the Experiment Center will accommodate data, either received in real time through GTS or as delay-mode reports on magnetic tapes, provided they are received before the end of October. The Experiment Center will forward the data set on a reel of the magnetic tape to each participating Member free of charge before the end of December 1990 (see Appendix VIII).

5.2 In addition, The Experiment Center will prepare a data catalogue, based on draft catalogues supplied by participating Members before the end of October 1990, and distribute this catalogue free of charge to the participating Members before the end of December 1990. This catalogue, the format of which is given in an annex to Appendix VIII, will be on paper, and as suggested by some members, to be provided also in diskettes, subject to prior arrangement with the Experiment Center.

5.3 The group expressed gratitude to JMA for this kind gesture in agreeing to undertake the great effort required for preparing the quick-look data set and the Spectrum data catalogue.

5.4 Speaking for TCM-90, Dr. Elsberry (USA) reported that in six months time after TCM-90, raw data sets on tapes will be ready and available to TCS for distribution to Typhoon Committee Members. In a years time, a comprehensive checked data set will be ready for the same purpose. These data sets will contain observations collected during the experiment in addition to grid-point value data at 50-km resolution, on 20 vertical levels and at 6-hourly frequency over the domain 5N-40N and 105E -150E.

This will be provided on tapes in FGGE levels II/IIIb format. Furthermore, Dr. Elsberry reported that a catalogue of the data on paper will also be produced by the U.S. and will be given to TCS for distribution to Members.

5.5 The meeting was informed of the intention of TCM-90 to provide copies of the comprehensive data sets on optical discs.

5.6 The meeting took note of information provided by Hong Kong on the utilization of a microcomputer-based optical data storage and processing system, the cost of which is in the range of forty thousand US dollars. In particular, the capability to handle satellite imagery data was seen as a major advantage. The meeting recommended to participating Members that active consideration be given to acquiring similar systems to enable them to generate and process data. Considering that this will be of special value in facilitating the utilization of SPECTRUM data sets and the promotion of associated research, the meeting recommended that external support be provided by UNDP regional funds for the acquisition of these systems, if required by Members.

6. FOLLOW-UP ACTION PLAN (Agenda item 6)

6.1 The outline of the follow-up action plan is given in Appendix IX. It was decided in the meeting to request WMO/TCS to organize a Steering Group Evaluation Meeting together with a small technical conference preferably on 18-21 December 1990 taking into consideration the expressed willingness of JMA to host such a meeting. It was strongly felt by the Group that this technical conference should be attended by a forecaster from each participating Members, in addition to Steering Group members, so as to reflect operational perspectives that can define areas for research. In this regard, it was agreed to ask for financial support from the current UNDP regional Project.

6.2 The Group tasked TCS to communicate with Typhoon Committee Members to submit a list of tentative research topics and of meteorologists

and other scientists from meteorological services and universities, etc., who are interested in the data set for research. This list is to be compiled for the said planned meeting in December.

6.3 The meeting recommended that the existing group of research correspondents should serve as a venue for communicating the progress reports on SPECTRUM researches. A concise report on these researches could be published in the existing Typhoon Committee Annual Review (TCAR).

6.4 It was agreed in the meeting that the first half of 1991, before the data set is completed by the year's end, could be utilized for enhanced training of meteorological personnel from Typhoon Committee Members in the handling and scientific interpretation of complex data sets in preparation for research work to be done using the SPECTRUM data set. In this connection, it proposed an exchange programme among TC Members, utilizing the TCDC scheme and the UNDP financial support.

6.5 The meeting noted with gratitude the invitation of China to host a Technical Conference in late 1991. The meeting encouraged the participation of both operational forecasters and researchers, including those from universities, in this conference.

6.6 The meeting was pleased to learn that TCM-90 will prepare a bibliography of research papers in relation to TCM-90 and to make this available to Typhoon Committee Members through TCS.

6.7 The Group expressed the hope that in some appropriate time, the results of TCM-90 and TYPHOON-90 might be included in TCAR.

SPECTRUM

EVALUATION AND FOLLOW-UP ACTION PLAN

(Annex IX to Report of SPECTRUM Meeting)

1. Evaluation

Steering Group evaluation meeting in December 1990 to consider:

- (a) report by Experiment Center/RSMC Tokyo-Typhoon Center
- (b) report by members' Operation Centers: information on observations made and/or transmitted
- (c) report by JMA: quick-look data set (to reconcile with Members' reports at meeting), catalogue of data sets
- (d) future activities in the evaluation of progress and the promotion of research aimed at elucidating scientific problems identified

2. Promotion of Research

2.1 Conference/Workshops

- (a) small technical conference to coincide with the Steering Group meeting in late 1990 (see above):
 - to review forecast problems encountered during IOPs
 - to define associated scientific issues as a contribution to the planning of future research work
- (b) technical conference in China in late 1991 (details to be worked out)
- (c) major conference on SPECTRUM-related subjects in the latter part of 1992, close to the time of the Typhoon Committee 25th session (details to be worked out).
- (d) Third WMO International Workshop on Tropical Cyclones in late 1993.

Note: Other relevant events include:

- (a) USSR Technical Conference on TYPHOON-90 in Obninsk, 20-23 May 1991.
 - (b) US Technical Conference on Hurricanes and Tropical Meteorology, Miami, 14-16 May 1991 with a mini-workshop on TCM-90 immediately before or after the conference.
- 2.2 Annual progress reports on research: by Research Correspondents in latter half of 1991, 1992 and 1993 for Typhoon Committee sessions; summarized version in Typhoon Committee Annual Review.
- 2.3 Training attachments on the handling and scientific interpretation of complex data sets in preparation for SPECTRUM-related research: in the first half of 1991; bilateral arrangements with external support.
- 2.4 Attachment of Typhoon Committee scientists at advanced centers: after availability of TCM-90 data set in late 1991 (details to be worked out).
- 2.5 Exchange visit of researchers: as in 2.4
- 2.6 Establishment of a list of tentative research topics and of meteorologists and other scientists from meteorological services and universities, etc., who are interested in the SPECTRUM data sets: action by TCS, for presentation to Steering Group Meeting, December 1990.
- 2.7 Award for outstanding research work: procedures to be set up e.g., scope, judges, form of prize
- 2.8 Research grants: to cover acquisition of data, travel etc., idea to be developed.
- 2.9 Ad hoc international research group: idea to be further developed.

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

Typhoon Committee
Twenty-third session
13-19 November 1990
Seoul

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