



**UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION**

**FOR ASIA AND THE PACIFIC**

**AND**

**WORLD METEOROLOGICAL ORGANIZATION**

**REPORT OF THE TYPHOON COMMITTEE**

**ON ITS TWENTY-FIFTH SESSION**

**Zhuhai, People's Republic of China  
8 - 14 December 1992**

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## I. ORGANIZATION OF THE SESSION

1. The twenty-fifth session of the Typhoon Committee was held at Zhuhai, People's Republic of China, from 8 to 14 December 1992. The session was co-sponsored by the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO), and was hosted by the Government of China.

### Attendance

2. The session was attended by 57 participants and observers. They represented ten Members of the Typhoon Committee, namely, China, Democratic People's Republic of Korea, Hong Kong, Japan, Macau, Malaysia, Philippines, the Republic of Korea, Thailand and Viet Nam. Observers from Indonesia and the United States of America attended the session. In addition, observers from the International Civil Aviation Organization (ICAO), the International Federation of Red Cross and Red Crescent Societies (IFRC) and the WMO Commission for Atmospheric Sciences (CAS) were present. The list of participants is attached as appendix I.

### Opening of the session (agenda item 1)

3. Mr. Patipat Patvivatsiri, the Vice Chairman of the Committee, declared the meeting open. Mr. Zou Jingmeng, the Administrator of the State Meteorological Administration (SMA) of China extended a warm welcome to all the participants at the session. He specially welcomed the two new Members of the Typhoon Committee, namely, the Democratic People's Republic of Korea and Macau. He drew attention to the progress made by the Typhoon Committee since its establishment in 1968 in organizing, implementing and coordinating various meteorological and hydrological observing and telecommunication networks as well as monitoring typhoons and minimizing their damage, under the guidance of ESCAP and WMO. He mentioned that the contributions made by



the Committee to achieving the goals of the International Decade for Natural Disaster Reduction (IDNDR) had been widely acknowledged by all the relevant United Nations bodies. Mr. Zou expressed his pleasure in the fact that the Chinese Government had always maintained a positive attitude towards the work of the Committee and that SMA had been an active participant in its various activities. In this regard, he drew attention to the offer by China to host the Third Technical Conference on the Special Experiment Concerning Typhoon Recurvature and Unusual Movement (SPECTRUM). Mr. Zou concluded by wishing all participants an enjoyable stay in China and a successful session.

4. In his opening address, Mr. Liang Guangda, the Mayor of the City of Zhuhai warmly welcomed the participants on behalf of the Guangdong Provincial Government and the people of Zhuhai. He said that the Province of Guangdong was affected by about 70 per cent of all the tropical cyclones which affect China, a considerable portion of which posed a threat to the City of Zhuhai. He acknowledged that the work of the meteorologists and hydrologists as well as that of disaster prevention and relief organizations was indispensable to the economic progress of Zhuhai. In that regard he placed emphasis on the importance of the coordination provided by the Typhoon Committee and the guidance of the SMA, the Ministry of Water Resources and the various levels of Government for the provision of accurate forecasts of weather and warnings of floods, thus significantly reducing the damage to property and loss of human lives. He was certain that the exchange of experience among the participants and discussions on the methods of disaster prevention and relief during the meeting, would provide a valuable source of knowledge from which his city could benefit greatly. In conclusion, the Mayor wished the session success and all the participants a happy stay in Zhuhai.

5. The representative of ESCAP delivered the statement of the Executive Secretary of ESCAP. The Executive Secretary in his statement expressed his appreciation to the Government of China for hosting the session and for the excellent arrangements it had made. He extended a warm welcome to the Democratic People's Republic of Korea and Macau as the newest Members of the Committee. It was noted that the ESCAP

Commission at its forty-eighth session in 1992 had expressed its satisfaction with the considerable progress achieved in the implementation of activities of the Typhoon Committee. He thanked those Members that had been supporting the activities of the Committee, as well as the World Meteorological Organization, the Office of the United Nations Disaster Relief Coordinator, and the International Federation of Red Cross and Red Crescent Societies, and acknowledged the significant contribution which had been made by the United Nations Development Programme (UNDP) to the progress of the Committee in the past. The Executive Secretary reviewed ESCAP's activities undertaken to support the Typhoon Committee in the past year and informed the Committee that project documents had been drafted to solicit extra-budgetary funds for other disaster reduction activities. He also stated that, in the past year, owing to reductions in manpower, ESCAP achievements in this field had not quite matched the volume of work undertaken in previous years, and that ESCAP was making the necessary efforts to restore and, if possible, increase manpower resources so that ESCAP could provide a high level of substantive service to its Members to assist them in the area of disaster reduction. In conclusion, the Executive Secretary gave an assurance that ESCAP would continue to undertake activities in support of the Typhoon Committee within the framework of its own programme of work and available resources.

6. The representative of WMO addressed the meeting on behalf of the Secretary General of WMO. He thanked the Government of China for hosting the meeting and welcomed the new Members of the Committee, the Democratic People's Republic of Korea and Macau. He noted the significant contribution that the Typhoon Committee had made to the overall WMO Tropical Cyclone Programme (TCP). He emphasized the admirable efforts being made by Members on both the national and regional levels toward the improved forecasting of typhoons and their associated flooding and the equally important warning and preparedness activities that had been demonstrated again this year in the successful completion of the operational season. Especially important had been the major research, development and training activities carried out by the Members of the Committee. He noted that in order to implement the Committee's Technical Plan for the future



development of services, external assistance was essential and encouraged the Committee to explore new and innovative sources of funding within the context of IDNDR. He concluded by wishing the twenty-fifth session success and offering the assistance of the WMO Secretariat in completing its work.

7. The Committee warmly welcomed the Democratic People's Republic of Korea and Macau as its two new Members. The delegations of these Members expressed their pleasure at joining the Typhoon Committee and thanked its other Members for the encouragement and assurance of co-operation extended to them.

8. The meeting witnessed the awarding of the ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award for 1992 to both the Office of the State Flood Control and Drought Prevention Headquarters and the National Meteorological Centre of the People's Republic of China. The awards were presented by Dr. Roman L. Kintanar, Chairman of the Typhoon Committee Foundation and consisted of a plaque and honorarium. The award to the Office of State Flood Control and Drought Prevention Headquarters was accepted by Mr. Li Jiansheng, Adviser. The citation of the award read:

"In recognition of its outstanding services in the promotion of natural disaster prevention and preparedness through its important role in the progressive development of flood control systems and active involvement on strengthening public and social awareness in the mitigation of flood-related disasters in China."

9. The award to the Chinese National Meteorological Centre was accepted by Mr. Qiu Guoqing, Deputy Director. The citation of the award read:

"In recognition of its outstanding services in the promotion of natural disaster prevention and preparedness through its leading role in improving and strengthening of national weather operations and services through efficient and timely typhoon forecasts, warnings and guidance in China."

10. The Committee warmly applauded the recognition given to these two agencies of the People's Republic of China for their contributions to the Committee's objectives.

#### Election of officers (agenda item 2)

11. Mr. Yan Hong (China) and Mr. P. Markandan (Malaysia) were unanimously elected Chairman and Vice Chairman of the session. The Committee also elected Mr. Chi-Kwan Robert Lau (Hong Kong) as the Chairman of its Drafting Committee.

#### Adoption of the agenda (agenda item 3)

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

### II. THE COMMITTEE'S ACTIVITIES DURING 1992 (agenda item 4)

13. The Committee reviewed and evaluated in detail its activities during 1992 under five separate components as shown below. The Committee was pleased that Members continued to maintain, with the assistance of WMO, ESCAP and the Typhoon Secretariat (TCS), activities called for by its Regional Cooperation Programme.

#### (a) Meteorological Component (agenda item 4(a))

14. The Committee noted that a new edition of the Typhoon Committee Operational Manual (TOM) - Meteorological Component had been published in June 1992 (Tropical Cyclone Programme Report No. TCP-23), and had incorporated all amendments made up to that date.

15. The Committee further considered the report of the rapporteur, Mr. H. Ohnishi (Japan) who had developed further proposals for amendments to the TOM in collaboration with the focal points of Members of the Typhoon Committee. It expressed



its appreciation for his excellent work and for the willingness of Japan to continue providing the services of the rapporteur.

16. In consideration of amendments to TOM, the Committee decided that the classification terminology of tropical cyclones used in the TOM should not be changed at present but that a classification note regarding the general term "Tropical Cyclone" should be entered as a footnote. The Committee agreed decided that the changes provided by the rapporteur should be incorporated in the TOM and requested the WMO Secretariat to issue a Supplement to the TOM edition 1992.

17. The representative of the ICAO emphasized the importance of an internationally uniform terminology, and stated that a formulation with a small number of classifications was desirable to meet aeronautical requirements.

18. A summary of the reports of the individual Members in relation to the meteorological component of its activities during 1992 is given in appendix III.

(b) Hydrological Component (agenda item 4(b))

Activities of the Typhoon Committee Secretariat (TCS)

19. TCS, in cooperation with ESCAP, had prepared and distributed copies of a questionnaire on the proposed project "Improvement of Reservoir Operation Systems" for the purpose of gathering information regarding requirements and current practices in the region. TCS had collected this information from each Member country and used it in preparing the draft project document.

20. TCS also surveyed TC Member countries regarding the usefulness of the Manual and Guidelines for Comprehensive Flood Loss Prevention and Management, published in 1991. The survey also sought information regarding implementation of flood forecasting

systems in each country. The survey showed that the Manual and Guidelines was indeed useful even though the implementation of flood forecasting systems was slow. The implementation had been limited in some cases because of legal factors and in others owing to the lack of the required observation stations and data.

21. The session was informed that the TCS had organized the pre-session meeting of the hydrological component in cooperation with ESCAP and WMO on 7 December 1992. The meeting had discussed and exchanged experience and expertise in flood forecasting and flood management within the region. The project document entitled "Improvement of Reservoir Operation System" under the hydrological component of the Typhoon Committee had been briefly discussed at that meeting (appendix IV).

22. In the hydrological component, the session took note of the sustained efforts of Members towards establishing and improving the flood forecasting and warning systems in their respective major river basins.

Activities of the World Meteorological Organization (WMO)

23. The Committee reiterated that the Management Overview of Flood Forecasting Systems (MOFFS) should be used within the region. It was pleased to learn that five countries in the Committee's region had completed the questionnaire in Part II (Principle characteristics of the flood forecasting system) of MOFFS version 2C of 1990, and had designated a total of 10 flood forecasting systems among them. The Committee was informed that a register, listing the characteristics of the flood forecast systems designated, had been circulated to Members of the all tropical cyclone regional bodies in August 1992. It noted with pleasure that a technical consultation on the application of MOFFS had been carried out in Kuala Lumpur in late February 1992 with participation of experts of the region from Malaysia, the Philippines and Thailand.

24. The Committee urged Members who had not yet done so, and who operated flood



forecasting systems, to designate flood forecasting systems to be monitored using the MOFFS rating system.

Activities of the Economic and Social Commission for Asia and the Pacific (ESCAP)

25. The Committee noted that ESCAP had continued to provide support to Typhoon Committee Members in their endeavors on flood protection. The publication "Forecasting, Preparedness and Other Operational Measures for Water-related Natural Disaster Reduction in Asia and Pacific" had been published. Advisory services had been provided to Cambodia on basinwide flood forecasting and damage reduction. The publication Manual and Guidelines for Comprehensive Flood Loss Prevention and Management had been reprinted for wider application in Asia and Pacific. China and the Republic of Korea reported that the Manual and Guidelines had been translated into each of their languages and had been published for wide distribution. China had also translated into Chinese and distributed the ESCAP publication entitled Risk Analysis and Mapping for Flood Loss Prevention and Management.

26. A summary of the reports of the individual Members in relation to the hydrological component during 1992 is given in appendix V.

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

27. The Committee noted that the ESCAP Secretariat had prepared an issue paper on natural disaster reduction and presented it to the ESCAP Commission at its forty-eighth session in 1992. The Committee was informed that the Commission in principle had supported the implementation of the plan of action and recommendations contained in the issue paper and had noted with interest the recent developments in the field of disaster prevention and preparedness in some countries of the region.

28. The Committee was informed that the publication, Natural Disaster Reduction in

Asia and the Pacific: Launching the International Decade for Natural Disaster Reduction, Volume I, had been published, and that a paper on Flood Emergency Preparedness in the Mekong River Delta had been prepared and presented at the International Workshop on Flood Mitigation, Emergency Preparedness, and Flood Disaster Management in Viet Nam.

29. The Committee expressed its appreciation to ESCAP on its work and urged that such work continue in the future.

30. The Committee was pleased to note that WMO had continued to play an active role in supporting activities related to the International Decade for Natural Disaster Reduction (IDNDR), in accordance with the WMO Plan of Action for IDNDR. In particular it expressed appreciation for the Comprehensive Risk Assessment Project aiming at promotion of a comprehensive approach to risk assessment and thus enhancement of the effectiveness of efforts to reduce loss of life and damage caused by flooding and by violent storms and earthquakes.

31. The Committee was pleased to note that the International Federation of Red Cross and Red Crescent Societies once again confirmed its continuing interest in and support of the work of the Typhoon Committee.

32. A summary of the reports of the individual Members in relation to the disaster prevention and preparedness component during 1992 is given in appendix VI.

(d) Training Component (agenda item 4(d))

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

34. A summary of the reports of the national activities in relation to the training



component during 1992 is giving in appendix VII.

(e) Research Component (agenda item 4(e))

35. The representative of the WMO Commission for Atmospheric Sciences (CAS), gave a presentation on current and future activities of the CAS Group of Rapporteurs on Tropical Meteorology Research. The Committee noted with interest the IDNDR-related research activities on tropical cyclone disasters being undertaken by WMO in cooperation with the International Council of Scientific Unions (ICSU) and CAS Projects Tropical Cyclone (TC)-1, TC-2 and Limited Area Model (LAM)-1. It also noted with interest the Third WMO/ICSU International Workshop on Tropical Cyclones (IWTC-III) to be held in Mexico in late 1993, which would serve as a forum for the interaction between forecasters and researchers and would encourage the application of research results to operational usage.

36. Research continued to assume an integral part of the three major components of the Members' activities.

37. Following the Second Technical Conference on SPECTRUM in Guangzhou in November 1991, seven topics for SPECTRUM research had been defined, covering such fields as asymmetry, environmental steering, numerical simulation and topography. Preliminary results of these studies had been presented to the Seminar on Tropical Cyclone Forecasting and Research in Nanjing.

38. Recognizing the importance of research initiatives on typhoon recurvature and unusual movement, the Committee urged all project participants to complete the collection of data from field experiments for SPECTRUM-90, Tropical Cyclone Motion (TCM)-90 and TYPHOON-90, so that the research programmes might fully utilize the complete set of data.

39. The Committee accepted with gratitude the contribution from the United States of the tapes containing the final analyses of TCM-90. It agreed to utilize this data in its research programme and to exchange information regarding the quality of the analyses with scientists in the United States.

40. A summary of the reports of the individual Members in relation to the research component during 1992 is given in appendix VIII.

III. REVIEW OF THE 1992 TYPHOON SEASON/ANNUAL PUBLICATIONS (agenda item 5)

41. The Regional/Specialized Meteorological Centre (RSMC) Tokyo-Typhoon Center at the Japan Meteorological Agency (JMA) reported that as of the end of November 1992, 31 tropical cyclones of tropical storm intensity or higher were tracked in the western North Pacific, of which nine reached tropical storm intensity, six severe tropical storm, and 16 typhoon intensity.

42. During the first half of 1992, tropical cyclone activity was rather subdued because sea surface temperatures had been below normal over the waters from the east of the Philippines to the Marshall Islands, a phenomenon associated with the development of the El Nino event. No tropical cyclone attained tropical storm intensity until the end of June except for severe tropical storm Axel (9201) in January and tropical storm Ereka (9202) in February, both of which occurred in the anomalously warm equatorial waters east of the International Dateline. Tropical convection, however, became active around the Philippines after the end of June as the El Nino event drew to a close. Thereafter, the frequency of tropical cyclone formation became near to or above normal.

43. In July, the subtropical ridge extended further to the west, steering the four successive tropical cyclones to the west-northwest towards southern China. Among them Eli (9205), Faye (9206) and Gary (9207) all took the track across the island of Luzon,



Philippines. In August, convective activity had been observed to extend eastward and the subtropical ridge shifted to the east over the south of Japan. Accordingly, most of the eight tropical cyclones tended to move along the periphery of the subtropical ridge and eventually approached Japan. Irving (9209), Janis (9210) and Kent (9211) successively struck Kyushu, Western Japan.

44. In September, the subtropical ridge decreased in strength to less than normal. Tropical cyclones developed mostly to the east of 140° E, while none developed in the South China Sea. From October, subtropical cyclones formed over waters from the Philippines to the Marshall Islands as the sub-tropical ridge resumed its westward extension. Seven storms which formed in October were the largest number experienced during that month since 1951. Some of the tropical cyclones, Angela (9224) and Colleen (9226) in particular, showed highly erratic motion.

45. The delegation of the United States asked whether studies had been made in the region on the variability of operational track and intensity forecasts of tropical cyclones and whether they had been issued by the various national centres in the area.

46. The delegate of Hong Kong responded that possibly most centres plotted each other's forecast tracks operationally although to his knowledge operational plots had seldom been published. It was noted that when storms were over the sea, the Dvorak method remained the only meaningful method to assess tropical cyclone intensity. With no aircraft reconnaissance flights into the storms, no "ground truth" observations had been made. It was agreed that a study to determine the level of uncertainties of the initial conditions which affected the forecasts should be made. There was also merit in publishing "raw" initial condition estimates and forecasts from the various forecast centres. These data would permit the various national forecast and warning centres to evaluate possible biases and "scatter" in operational forecasts that could be used as guidance for the warning process. Such knowledge would permit a more effective use of that guidance.

47. Hong Kong reported that the printing cost of the Typhoon Committee Annual Review, 1991 (TCAR 91) had been reduced by 54 per cent relative to the cost of the TCAR 90 as a result of the acquisition of an additional PC and the utilization of new word processing and desktop publication software which allowed for camera-ready manuscripts of the TCAR to be produced in-house at the Royal Observatory. The Committee commended Hong Kong on the publication of the TCAR 91. It thanked the Chief Editor and the editors from other Members for their contributions to the publication.

48. The Committee requested Hong Kong to continue to make available the services of a Chief Editor for the coming years. The delegation of Hong Kong assured the Committee that, in spite of staff constraints, every effort would be made to meet the request. The Committee agreed that the publication of TCAR and the Typhoon Committee (TC) Newsletter should continue.

49. The Committee approved the use of the TC Trust Fund as one possible source of funds for the publication of the TCAR. It was agreed that Hong Kong would prepare a camera-ready original of the TCAR and that the WMO Secretariat would coordinate the best and most economical strategy for printing and distribution in cooperation with Hong Kong and the TCS.

#### IV. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item 6)

50. The Committee expressed its satisfaction to the WMO Secretariat for the significant progress made in both the general and the regional components of the Tropical Cyclone Programme (TCP) since the last session of the Committee (Pattaya, Thailand, February 1992), in association with the International Decade for Natural Disaster Reduction (IDNDR).

51. The Committee noted with appreciation the wide distribution of the publication



entitled "Papers Presented at the Second Technical Conference on SPECTRUM" (Guangzhou, China, November 1991) issued in July 1992 as a WMO Technical Document (WMO/TC-No.472) in the TCP series (TCP-29). It noted that the publication included the outcome of TCM-90 which had been provided by Prof. R. L. Elsberry.

52. The Committee was informed that progress had been made towards implementation of TCP Project No.16, Global Guide on Tropical Cyclone Forecasting, with a view to providing guidance and assistance to tropical cyclone forecasters in all tropical cyclone regions and basins. It would be finalized by September 1993 for submission to the Third WMO/ICSU International Workshop on Tropical Cyclones (IWTC-III) in Mexico in November-December 1993.

53. The Committee was pleased to note that the meteorological sections of the draft report on the TCP Project No.14, Public Information and Education, would be finalized by mid-1993 and published it in the TCP series.

54. The Committee stressed the need for further enhancement of regional and interregional cooperation and coordination. It also encouraged stimulation of close collaboration among research scientists and operational tropical cyclone forecasters.

55. The Chairman of the RA IV Hurricane Committee, Dr. R.C. Sheets (United States) presented information on activities being implemented by that Committee. The Typhoon Committee noted with interest the activities, specifically those related to a satellite-based regional telecommunication network system and deployment of Doppler radars in the Caribbean region.

56. The Committee was informed that WMO would organize a Technical Coordination Meeting on Operational Forecasting and Dissemination of Results by RSMCs, at the Japan Meteorological Agency (JMA) from 16 to 21 December 1992. It was pleased to learn that the meeting would consider a uniform terminology for and classification of tropical

cyclones, and a standard format for tropical cyclone data as major agenda items.

57. The delegation of Hong Kong informed the Committee that a draft report on Typhoon-related Wind Climatology would be completed by the end of 1992. The Committee requested WMO to publish the report in the TCP series and to distribute it to all Members of the tropical cyclone regional bodies.

#### V. REVIEW OF THE PROGRAMME FOR 1993 AND BEYOND (agenda item 7)

##### Regional Cooperation Programme Implementation Plan

58. The Committee, in consideration of its programme for 1993 and beyond, reviewed and adopted with amendments the Typhoon Committee's Regional Cooperation Programme Implementation Plan. The updated plan as adopted by the Committee is shown in appendix IX.

59. The Committee restated the vital importance of telecommunications in its activities, and the need for a consolidated telecommunication system that would standardize and integrate some of its operational activities and that would serve to benefit the less developed Members. It requested WMO and TCS in cooperation with ESCAP to prepare a project document based on this idea for deliberation at the twenty-sixth session of the Committee.

60. The representative of China informed the Committee that the Third Technical Conference on SPECTRUM would be organized by China in co-operation with WMO and TCS, tentatively in Shanghai in October 1993. The main aspect of the Conference would be those presentations concerning the Tropical Cyclone Recurvature and Unusual Motion based on those data collected and provided by field experiments of SPECTRUM-90, and TYPHOON-90.



61. The representative of ICAO informed the meeting about developments leading to the introduction of the ICAO tropical cyclone warning system. He pointed out that suitable proposals would be made to the Third Asia/Pacific Regional Air Navigation Meeting scheduled to be held in April/May 1993.

#### Report of the SPECTRUM Research Coordinating Group

62. The Committee, after considering the regional aspect of the report of the SPECTRUM Research Coordinating Group, expressed appreciation for the excellent and comprehensive document prepared by its Chairman, Mr. H. Ohnishi.

63. The Committee approved the short- and long-term research objectives as shown in appendix X.

#### Members' Activities related to IDNDR

64. The Committee was informed that its activities were recognized and had often been singled out as very productive by the IDNDR Scientific and Technical Committee. It noted with appreciation the information that three members of the Scientific and Technical Committee of IDNDR were from the Typhoon Committee Members.

65. Members, through their national committees for IDNDR, implemented activities for carrying out the aims and objectives of IDNDR.

66. In China, the Symposium on Disaster Reduction and Development in Coastal Areas had been held in Shandong Province from 29 October to 1 November 1991.

67. The International Symposium on Torrential Rain and Flood had been held at Huangshan City, Anhui Province from 5-9 October 1992. That Symposium had brought together scientists, technologists, researchers and policy makers concerned with torrential

rain and floods for the purpose of exchanging the results of studies on the genesis of torrential rain and occurrence of floods, their forecasts and response strategies for preparedness against floods.

68. Moreover, the ICSU/WMO Symposium on Tropical Cyclone Disasters had been held in Beijing in October 1992. One of its major outcomes had been a recommendation for WMO and ICSU to approach the Scientific and Technical Committee for IDNDR to sponsor a two-year programme aimed at developing an aerosonde for tropical cyclone reconnaissance use.

69. As part of the IDNDR activities, the Central Government and local governments had also conducted a number of Disaster Reduction Day activities, which had been celebrated on 11 October 1992. The departments concerned had conducted public awareness campaigns which had played a positive role in improving the efficiency of disaster reduction activities. The Vice Premier and the Director of the Chinese IDNDR Committee had delivered speeches, while experts from the meteorological service and other departments presented their reports. A number of awards of merit had been presented to the individuals and units who had contributed to natural disaster reduction. Finally, the Chinese Academy of Arts and the United Nations Association of the People's Republic of China had jointly sponsored an International Disaster Reduction Day art show in 1992.

70. Hong Kong had experienced a record hourly rain in excess of 100 millimetres on 8 May 1992. There had been serious road floodings, landslips, traffic congestion and disruption to schools. A new rainstorm warning system was devised in mid-1992, primarily to prepare both the government and the community to react efficiently to similar rainstorm recurrences.

71. As a result of concerted efforts among a large number of government departments and organizations in Hong Kong, a Contingency Plan for Natural Disaster Coordination was written up for government-wide usage in June 1992. The Contingency Plan listed and



elaborated existing natural disaster warnings, issuing and dissemination responsibilities, contact telephone numbers and recommended or required actions.

72. The Drainage Services Department of Hong Kong had started the multi-million dollar Phase II of the Territorial Land Drainage and Flood Control Strategy Study in February 1992. Under this 24-month study, the Drainage Basin Management Plans in the northwestern part of Hong Kong would be formulated with the assistance of numerical river models incorporating known hydrological and hydraulic processes.

73. A public information booklet entitled "Typhoon!", first published in 1971, had been completely revised. The contents had been upgraded and all diagrams redrawn. The English version was released in early 1992 and a Chinese version in mid-1992.

74. Japan had established the Government Headquarters for the IDNDR in May 1989, and was at present vigorously promoting various activities for the Decade. It had organized the IDNDR International Conference 1990 Japan, the IDNDR Summit Conference on Earthquake and Natural Disaster Countermeasures 1991 Japan, and the IDNDR Chiba International Conference 1992 Japan. In 1993, Japan would organize another IDNDR international conference with focus on disaster countermeasures in metropolitan areas.

75. In the Republic of Korea, since the establishment of the national committee for IDNDR in December 1991, various public activities had been carried out through the mass media to increase the awareness of the public to the importance of disaster prevention and preparedness. The Korea Meteorological Administration (KMA) on its part had developed a model to forecast the tracks and the intensities of typhoons and had strived to use it operationally.

76. The Department of Social Welfare in Malaysia prepared its disaster prevention and programmes measures before the flood season occurred. The annual project plans had been submitted by the Director of Social Welfare to enable the Department to collect and

prepare national preparedness plans for submission to the National Security Council which had met to deliberate and coordinate all activities before the flood season began.

77. In the Philippines, there was a very strong movement by civic organizations for the protection of the environment. Legislative measures had been proposed and passed to curtail illegal logging and to regulate the disposal of wastes in rivers and the atmosphere.

78. Thailand reported on improvement in the coordination among agencies concerned with disaster prevention and preparedness as well as in the efficiency of its warning systems. In this connection, Thailand had participated in several regional projects related to IDNDR. In the Bangkok area, prevention and preparedness measures in structural and non- structural flood control systems had been developed.

79. In Viet Nam, local funds for typhoon and flood prevention and preparedness had been established in 31 provinces and cities under the direction of the National Committee for IDNDR. These Funds had been collected by provinces and were used locally to reduce the impacts left by typhoons and floods. Plans of action for IDNDR had been worked out in 1992 by different ministries and state management organizations, while the Central Committee for Flood and Typhoon Control had drafted national laws on natural disaster prevention and preparedness.

80. A seminar on Strengthening of Warning Capabilities of Typhoon and Flood Prevention and Preparedness and Natural Disaster Reduction was held in Hanoi in April 1992, with participants from Viet Nam, China and the Philippines. It had been organized by the Viet Nam National Committee for IDNDR in co-ordination with the Asia Disaster Preparedness Centre of the Asian Institute of Technology (ADPC- AIT) with financial support from the European Community.

81. An international seminar on urgent response measures for flood disaster reduction and flood control and management in Viet Nam had been held in Hanoi in June 1992 by



the Viet Nam National Committee for IDNDR in co-ordination with UNDP and UNDRO with financial support from a private company in Italy. Present at the Seminar were representatives from international organizations and non-intergovernmental organizations.

82. A picture drawing competition had been launched by the Red Cross Association of Viet Nam for Young Pioneers on the topics on natural disaster prevention and preparedness, while a seminar on urgent relief for natural disaster victims was held by the Labour and Social Affairs Ministry.

#### VI. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (agenda item 8)

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

84. The Committee similarly expressed its appreciation to the Government of Japan for providing the services of a full-time hydrologist in TCS. The Committee requested Japan to consider providing the services of an expert on water-related natural disaster reduction to ESCAP on a non-reimbursable loan basis and also to continue supporting the post of hydrologist in the Typhoon Committee Secretariat.

85. The Committee was pleased to note that savings from the UNDP/WMO inter-country project RAS/86/175, Programme Support to the Typhoon Committee, had been utilized to organize a study tour for three Chinese specialists to visit selected Committee Members in order to identify further technical assistance that could be provided by China. The above savings had also provided a large part of the cost of printing the Typhoon

Committee Annual Review 1990. The Committee hence expressed appreciation to UNDP for the support provided to its work programme in the past years.

86. The Committee noted with great concern that a project proposal submitted by WMO to UNDP Headquarters on reduction of natural disasters related to typhoons within the context of the IDNDR had not so far been approved by UNDP. In this connection, the Committee urged its Members to make every effort to bring this project to the attention of the relevant national authorities in their respective Governments. It also requested WMO to contact UNDP Headquarters again to re-emphasize the importance of the project for the Typhoon Committee Members.

87. The Committee was informed on the status of the Voluntary Co-operation Programme (VCP) Projects carried out by Committee Members. Members were encouraged to update their requests for VCP assistance to WMO.

88. The Committee was informed that in the framework of its own programme of work, ESCAP would continue to undertake activities in support of the Typhoon Committee. In this connection the Committee was pleased to note that ESCAP could provide advisory services on flood protection and drainage through its Regional Adviser on Water Resources and that TCDC funding could be made available to support exchange of experts among developing countries in the fields of hydrology and disaster preparedness and prevention.

89. The Committee appealed to the ESCAP Commission to positively consider allocating adequate manpower and other resources for implementation of activities on natural disaster reduction in line with General Assembly resolution 44/236, which urged the regional commissions to play an active role in the implementation of activities in natural disaster reduction, and Commission resolution 45/5, "Fulfilling the objectives of the International Decade for Natural Disaster Reduction the ESCAP region".



90. The Committee reviewed the financial report on the Trust Fund up to 31 December 1991, prepared by WMO (see appendix XI). The Committee was pleased to note that a certain degree of self-reliance had been achieved through the establishment of the Trust Fund, in that the institutional expenses of the printing cost of TCAR 91 and a portion of the expenses of the Seminar on Tropical Cyclone Forecast and Research, Nanjing, China, 27 October - 7 November 1992 had been covered. In view of the fact that no favourable response had so far been received from UNDP, the Committee urged its Members to continue and enhance their contributions to the Trust Fund. The Committee was pleased to note that several Members pledged their contributions to the Fund.

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

- (a) Augmentation of travel funds for TCS staff missions;
- (b) Support for organizing symposia, technical conferences and workshops related to typhoons;
- (c) Support for SPECTRUM Research Coordinating Group (SRCG);
- (d) Publishing the Typhoon Committee Newsletter periodically;
- (e) Representation and emergency expenses of TCS;
- (f) Printing cost of documents for the twenty-sixth session not exceeding \$US 1000.
- (g) Support to the publication of TCAR 92.

92. The Committee reiterated the importance it attached to assistance on a bilateral basis from developed countries to its activities. In this connection, the Committee expressed its appreciation to the Government of Japan for its continuing support to developing countries.

## VII. AGENDA FOR THE TWENTY-SIXTH SESSION (agenda item 9)

93. The Committee requested TCS, in co-operation with ESCAP and WMO, to prepare the provisional agenda for the twenty-sixth session.

## VIII. DATE AND PLACE OF THE TWENTY-SIXTH SESSION (agenda item 10)

94. The representative of the Philippines informed the Committee that his country would consider hosting the twenty-sixth session of the Typhoon Committee in November or December 1993. The representatives of Macau and Malaysia indicated that their governments would offer to host future sessions of the Typhoon Committee. The Committee welcomed this information and expressed its warm appreciation to the governments concerned. It accepted the invitation of the Government of the Philippines to host the twenty-sixth session. The Committee requested ESCAP to take appropriate action, in co-operation with WMO, TCS and the host country for the convening of its twenty-sixth session.

## IX. SCIENTIFIC LECTURES (agenda item 11)

95. The following scientific lectures were presented during the session, and were followed by lively technical discussions.

- (a) Final analysis of TCM-90 experiment and preliminary results of TCM-92 mini-field experiment .....by R.L.Elsberry (United States)
- (b) Statistical characteristics of typhoons coming into Korea  
.....by Cho Hye Jong (Democratic People's Republic of Korea)
- (c) On the study of the impact of asymmetric structure on motion with SPECTRUM target typhoons .....by Chen Lianshou (China)



- (d) The flood forecasting system and the 1991 floods in China  
.....by Zhang Ruifang (China)
- (e) The characteristics of Severe Tropical Storm Polly (9216) and the effect on the east of China .....by Jiao Peijin (China)
- (f) Hurricane Andrew (1992): Forecasts, warnings, response and impacts  
.....by R.C. Sheets (United States)

96. The Committee recorded its appreciation to the lecturers for their interesting and informative presentations and to all those who participated in the ensuing discussions. It noted that the texts of the lectures would be incorporated in the TCAR 92.

97. The report of the meeting was adopted on 14 December 1992.

## Appendix I

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Appendix II

Agenda

1. Opening of the session.
2. Election of officers.
3. Adoption of the agenda.
4. The Committee's activities during 1992:
  - (a) Meteorological component;
  - (b) Hydrological component;
  - (c) Disaster prevention and preparedness component;
  - (d) Training component;
  - (e) Research component.
5. Review of the 1992 typhoon season/annual publications.
6. Coordination with other activities of the WMO Tropical Cyclone Programme.
7. Review of the programme for 1993 and beyond.
8. Support required for the Committee's programme.
9. Agenda for the twenty-sixth session.
10. Date and place of the twenty-sixth session.
11. Scientific lectures.
12. Adoption of the report.



### Appendix III

#### Summary of National Reports on Activities Related to the Meteorological Component during 1992

1. China continued its modernization of the operations of the coastal meteorological stations that began in 1986 with the purpose of setting up a real-time meteorological operational system and for enhancing its capabilities of data collection and forecast. In addition, the construction of automatic stations on islands was progressing well, along with the continued development of new and better generation of upper wind observing systems. On 1 August 1992, the Navigation Telex (NAVTEX) operation was set up at the coastal weather stations in Shanghai, Guangzhou, and Dalian, while preparations were underway for issuing marine meteorological forecast and warnings XI (Indian Ocean Region) twice a day at regular intervals through the International Marine Satellite (INMARSAT) over the Indian Ocean.
2. The telecommunication circuit between Beijing and Hanoi was established in mid-November 1992 and had been put into operation. In addition the circuit between Beijing and Macao via Guangzhou with 9600 bps was also established.
3. In Hong Kong, King's Park (45004) replaced the Royal Observatory as its synoptic station with effect from 1 July 1992. The facsimile data exchange between Hong Kong and Beijing became operational in mid-1992. Many weather charts broadcast by China and Frankfurt by radio-facsimile could now be received through this meteorological telecommunication link. A new automatic facsimile dissemination system was also installed in mid-1992 to speed up the dissemination of forecasts and warnings to the public and other users.
4. Reception of ship observations via INMARSAT started in early 1992 to augment the conventional ways of receiving Morse codes and radio telex messages. With effect from

1 August 1992, meteorological forecasts and warnings prepared by the Royal Observatory were broadcast to the marine communities under the new WMO system for Global Maritime Distress and Safety System (GMDSS).

5. Japan reported that the Geostationary Meteorological Satellite (GMS)-5 would be launched in early 1995 to replace GMS-4 which had been operating successfully since 1989. GMS-5 would then have additional functions and a wider range of forecast capabilities not obtainable with the GMS-4.
6. As of the end of November 1992, 18 meteorological radars in Japan had been equipped with the Radar Echo Digitizing and Dissemination System (REDIS) while an automatic upper-air observation system was successfully introduced to quite a number of stations since its first installation at the aeronautical observatory (Tateno, 47646) in March 1986.
7. In March 1992, some modifications were introduced in the Japan Spectral Model (JSM): grid spacing of 40 to 30 km, and vertical resolution of 19 to 23 layers.
8. On 1 April 1992, the JMA initiated the operational issue of the probability with which a certain location was expected to have a storm (wind speeds of 25 m/s or more) within 24 hours. The probability indicated by percentage was computed based on the typhoon track forecast.
9. The Korea Meteorological Administration (KMA) had established a new division at Headquarters, a greenhouse gas monitoring station, and two radar observing stations in March 1992. The new Division, the Climatic Applied Planning Division, would take charge of atmospheric environmental work. The greenhouse gas monitoring station was established at Muan (WMO index 47165) and the two radar stations were constructed at Donghae (47106) and Kunsan (47144) which formed part of the completed nationwide radar network of five. In addition, a radar network, Radar Image Computer System (RICOS), had been developed by the KMA, which allowed for transmission of individual



radar echoes to RICOS at Headquarters to composite five echoes every 10 minutes which were then disseminated to local forecast offices.

10. KMA had set up 80 additional automatic weather stations (AWS) in 1992. A total of 248 AWSs were now operating which give an average spacing of 20 km. KMA aims to expand the number of AWS to a total of 400 by the end of 1994. The operating regional mesoscale model, Far East Limited Area Model (FELAM), had been upgraded in March 1992. The vertical resolution of the new version had been increased from 10 to 15 layers and its Kuo parameterization scheme had been replaced with the explicit schemes with substantive improvement especially in precipitation forecast of up to 48 hours. An operational typhoon model at JMA was being adapted at KMA through bilateral technical cooperation. KMA was also developing a high resolution operational National Weather Programme (NWP) model to serve the area of the Korean Peninsula and adjacent seas.

11. In Malaysia, the Kota Bharu Upper Air Station had been equipped with a Zeemet W9000 Upper Air Automatic System. The Malaysian Meteorological Service (MMS) planned to fully automate all upper air stations starting with Bayan Lepar, Kuching and Kota Kinabalu in 1993.

12. The Vaisala Digi Cora radiosonde system which was installed at the Headquarters of MMS in July 1991 was equipped with an ozone monitoring instrument. Vertical ozone monitoring commenced on 22 November 1991 with two soundings per month. This operational schedule was maintained until November 1992 when operation was stepped down to 1 sounding per month.

13. Under the Technical Cooperation among Developing Countries (TCDC) arrangement of the Committee, a coastal wave prediction model was acquired from the Japan Meteorological Agency in October 1991. This model has been successfully adapted for forecasting operations for coastal waters of Sarawak in East Malaysia as of June 1992. It is coupled to the operational numerical wave prediction model from which its boundary

wave energy is derived. A sea-breeze model developed MMS had been introduced to estimate the coastal winds for driving the coastal wave model.

14. In the Philippines, the contract for equipment procurement and construction of facilities of the Meteorological Telecommunication System Development Project of PAGASA was signed in March 1992. The project was envisioned to be completed by 1995 and is expected to ensure a faster and more reliable weather data transmission and rapid dissemination of weather information. Likewise, the French-Philippine Cooperation Project on the enhancement of PAGASA service delivery to the rural areas had started. With the departure of the US naval force from the Philippines in November 1992, PAGASA had taken over the operation of the Cubi Point upper air-synoptic station.

15. PAGASA received an equipment grant (Pesos 1.5 million) from the Department of Science and Technology to improve the programming facilities of its radio station DZCA (code name of the station) which broadcasts weather and disaster information, scientific information, official time, and other programmes.

16. The Thai Meteorological Department (TMD) reported that a S-Doppler Weather Radar had been set up at Bangkok International Airport in August 1992, while its old C-band radar was relocated to Rayong in the eastern part of the country. An S-band weather radar was being installed in Khon Kaen Province in the northeastern part and would be operational by July 1993. Weather radars would be installed in 1993 in provinces Ubon Ratchathani (Doppler C-band), Sakhon Nakhon (Doppler C-band), Surat Thani (Doppler S-band), and Chiang Rai (Doppler C-band). Lastly, a S-band Doppler Weather Radar would be installed at Hua Hin in 1993.

17. TMD was purchasing four new high resolution meteorological satellite receiving systems with facilities for receiving GMS and National Oceanic and Atmospheric Administration (NOAA) data. These would be installed at each regional meteorological centre. It was planned that in 1993 images from satellites and radars from four regional



centres would be linked with the data centre of the Meteorological Department as well as the workstation at the Aeronautical Meteorological Division, Bangkok International Airport. The existing satellite receiving system was also planned to be upgraded both in hardware and software.

18. A set of Automatic Weather Operational Systems (AWOS) of Bangkok International Airport had been reinstalled at Udon Thani Airport and had been operational since March 1992. Two new sets of AWOS were also installed at airports at Chiang Rai and Mae Hong Son. A set of mobile AWOS became available at the Meteorological Department in December 1992. By the year 1994, three more AWOS would be installed at Lampang, Sakon Nakhon and Ubon Ratchathani Airports.

19. A Wind Shear Alert System was being installed at Chiang Mai International Airport and would be operational by the end of December 1992. Another set was planned for Hat Yai International Airport by 1994. A number of plans for improving telecommunication were reported by TMD. These included: a project to install message switching systems to upgrade the Bangkok-Tokyo GTS medium speed circuit, as well as to establish the new Bangkok-Beijing GTS medium speed circuit; establishment of two GTS point to point circuits of low speed telegraph links between the Regional Telecommunication Hu (RTH) Bangkok and the National Meteorological Centre Vientiane and the RTH Bangkok with NMC Phnom Penh; installation of domestic data collection systems via satellite to upgrade efficiency in collecting data from meteorological stations; and the installation of a set of 10kW-HF transmitters of RTH radio broadcasts at Regional Telecommunication Hub-Bangkok.

20. Viet Nam reported the establishment and successful operation of the automatic message switching and data plotting systems based on microcomputers at the Central Forecast Centre and at three airports. The improvement of the national data collection for typhoon and storm surge prediction had been made by providing SSB-transceivers at most coastal and remote island stations. A new Beijing-Hanoi telecommunication satellite 75

baud circuit was established in November 1992. Two statistical models and one dynamical model had been in use for typhoon track prediction.



Appendix IV  
Informal Meeting of Hydrologists

1. The informal meeting was attended by hydrologists from China, Hong Kong, Japan, Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam. Representatives from WMO, ESCAP and the Typhoon Committee Secretariat also attended. Mr. J.D. Wang (China) was the Chairman. Mr. Robert Lau (Hong Kong) served as the Rapporteur.
2. The meeting commenced at 9:30 hours on 7 December 1992 in Zhuhai. There was no formal agenda and participating hydrologists discussed and shared their experiences in flood forecasting and flood basin management within the region during the past year.
3. Occurrences of flood events so far in 1992 were individually reported by countries and areas. No exceptionally serious floods took place in China, Hong Kong, Japan, Malaysia, Republic of Korea and Thailand in 1992. The major concern of the Philippines was the mudflows from Mt. Pinatubo during rainy days. Viet Nam experienced record flash floods in the western-central region.
4. The project document, Improvement of Reservoir Operation System, which had been discussed at the First Joint Session in February 1992 as a sub-project of Integrated River Systems and Management under the hydrological component of the Typhoon Committee, was briefly discussed again. TCS presented the drafted project documents to members who agreed to follow up this proposed project. However, the UNDP support for the proposed projects of TC was still not clear. Therefore, an alternate source of support would have to be found.
5. TCS had gathered information on the utilization of the Manual and Guidelines for Comprehensive Flood Loss Prevention and Management, and ESCAP reported that other countries in the Asian-Pacific Region were benefiting from this publication as well.

6. The group requested Japan to consider providing the services of an expert on water-related natural disaster reduction to ESCAP on a non-reimbursable loan basis and also to continue supporting the post of hydrologist in the Typhoon Committee Secretariat. The meeting closed at 12:00 hours.



Appendix V  
Summary of National Reports on Activities Related to the  
Hydrological Component in 1992

1. In China, the second China/America Symposium/Workshop for Flood Forecasting was held in Shanghai from 14 to 17 April 1992. At the symposium, the hydrologists exchanged their experiences in hydrological forecasting and discussed future developments related to the hydrology of the two countries.
2. In order to meet the requirement of flood control and disaster reduction, the Hydrological Forecasting and Water Control Centre, Ministry of Water Resources (MWR), had in 1992 translated into Chinese and published the Manual and Guidelines for Flood Risk Analyses and Mapping Application to Typhoon Committee Areas, and the Manual and Guidelines for Comprehensive Flood Loss Prevention and Management.
3. In Hong Kong, in the automated rain-gauge network, 17 rain-gauges have been upgraded and three are in the development stage. The automated water-level reporting system was also being upgraded to obtain water level and rainfall data at five-minute intervals from 15 field stations.
4. In Japan, in cases where the potential for flooding of particular rivers is high, the Ministry of Construction and the Japan Meteorological Agency jointly issue flood forecasts. Under the Flood Fighting Act, such flood forecasts are made for rivers flowing in two or more prefectures or those with a wide river basin, designated by the Minister of Construction and the Minister of Transport as being seriously hazardous to the national economy. These forecasts are communicated to the relevant prefectural agencies and to local residents by the media.
5. The Ministry of Construction developed its own radar raingauge systems and a total of 25 radar raingauge systems have been constructed, in order to form a nationwide network.

Many efforts are under way to develop new technology for the next generation radar system, such as a dual linear polarization radar system that improves observation accuracy by measuring the sizes of raindrops and a Doppler radar system.

6. In the Republic of Korea, with the completion of installation of a modern flood forecasting and warning system at the Yong-San River Basin, five major rivers basins which cover about two-thirds of the whole Korean territory are now operating modern flood forecasting system.
7. The Ministry of Construction has been successfully conducted the International Hydrological Programme (IHP) since 1975. For the fourth phase of IHP (1990-1995), continuing efforts have been made to cope with the objectives set up by UNESCO.
8. In Malaysia, the Tank Model and the Linear Transfer Function (LTF) Model continued to be used for real-time forecasting operation in the Kelantan and Pahang river basins, respectively, during the 1991/92 monsoon season with satisfactory results.
9. Installation of telemetric forecasting systems for the Batu Pahat and Sarawak rivers was completed and commissioned. Installation of new telemetric flood monitoring systems for the Pinang River in Penang, Muda River in Kedah and Lojing in the Upper Kelantan River Basin made steady progress.
10. The Management Overview of Flood Forecasting Systems (MOFFS) proposed by WMO has been designated and applied for monitoring the performance of the Tank Model in real-time forecasting operation in the Kelantan River Basin.
11. In the Philippines, a major component of the Flood Forecasting and Warning System for Dam Operations (FFWSDO) Phase II was officially realized with the inauguration of the Data Information Centre (DIC) on 11 March 1992. The DIC is a two-story edifice housing the Flood Forecasting Branch and the Weather Forecasting Branch of PAGASA,



and serves as the central station of the FFWSO. An integral component of the centre is an Apollo Computer System, interconnected by an Ethernet Local Area Network capable of processing and monitoring all hydrological data and information needed by the FFWSO.

12. Flood forecasting and warning for the Bicol/Ambuklao and Magat dams started actual operation this year. In addition to the Angat-Pantabangan dam which started operation in 1986, there are now a total of four dam areas being serviced by PAGASA.

13. In Viet Nam, improvement of the rainfall measurement network to ensure data quality for hydrological and flood forecasts was reported.

14. One expert from Thailand participated in the consultative meeting on the application of MOFFS in Southeast Asia held in Kuala Lumpur, Malaysia, 28-29 February 1992. The flood forecasting and warning system in the Pasak River Basin have so far been constantly monitored. Structural and non-structural measures are under implementation for developing the flood control systems in the Bangkok area. The telemetric flood monitoring system has been further augmented by additional telemeters. The structural measures are expected to be completed by 1994.

## Appendix VI

### Summary of National Reports on Activities Related to the Disaster Prevention and Preparedness Component during 1992

1. The Committee was informed that in Malaysia the Standing Committee on Natural Disaster Management had been established particularly to deal with seasonal floods. In 1991-92 only 1373 persons had been affected by floods in Malaysia, where 3062 evacuation centres to accommodate over 700 000 persons had been established.

2. The Committee was pleased to note that in the Republic of Korea, special attention had been given to natural disaster reduction in 1992 and that a very significant number of disaster prevention and preparedness activities, such as, engineering works, education and training, and disaster preparedness exercises, had been undertaken. Consequently, the effects of natural hazards had been much less than the annual average.

3. The Committee was informed that in 1992 there had not been serious flooding in the seven major rivers in China, and that floods were experienced only in some local rivers. In one river a catastrophe had been prevented owing to strengthening of river banks in the previous years. The hydrologists had transmitted timely and correct hydrological information to flood control headquarters at various levels providing scientific basis for policy-making for flood control.

4. The Committee was also informed that the Typhoon No. 16 had affected the coastline in the eastern part of China, subjecting Shanghai to the second highest storm surge on record. People's lives and agricultural and industrial production had been protected by taking the appropriate measures.

5. In order to coordinate with the activities of the IDNDR, the Chinese Disaster Preparedness Association, the Chinese Academy of Arts and the United Nations Association of the People's Republic of China co-sponsored a series of activities



commemorating the 1992 International Disaster Reduction Day, including an Art Show. Many well-known performers had been invited to give artistic performances related to the theme, Reduction of Natural Disasters and Sustainable Development.

6. The National Symposium on Disaster Reduction and Development of the coastal Area was held in Yantai, Shandong Province from 29 October to 1 November 1991. The workshop was attended by 180 experts, who presented 161 papers covering research on disasters in coastal areas and response strategies.

7. The Committee noted that in Thailand disaster mitigation activities had been further strengthened and improved by undertaking test exercises, upgrading transportation and communications facilities at disaster prone areas, and by setting up additional emergency operation centres and four rehabilitation centres to serve the population in those areas.

8. The Committee was informed that in 1992 four typhoons and one tropical depression had affected Viet Nam, causing serious damage especially at the central and southern parts of the country. The Committee was also informed that local funds for natural disaster prevention and preparedness had been established in 31 provinces and cities and that national laws on natural disaster prevention and preparedness had been drafted and submitted to the Government for approval.

9. The Committee noted that Hong Kong had experienced a record hourly rainfall in excess of 100 millimetres in May 1992, and consequently a rainstorm warning system had been introduced and implemented in order to ensure that government personnel and the community could be geared up to handle the recurrence of similar situations. A programme to promulgate a colour-coded system had been undertaken and various publicity measures had been implemented.

Appendix VII  
Summary of National Reports on Activities Related  
to the Training Component during 1992

1. China convened a workshop on the techniques of weather radar data analysis and applications in Hangzhou from 11 to 19 November 1992 in order to improve the capabilities in the analysis and applications of weather radar data and to focus attention on the importance of monitoring and forecasting of tropical cyclones and torrential rain. China organized and co-sponsored with WMO the Seminar on Tropical Cyclone Forecasting and Research held in Nanjing, from 27 October to 7 November 1992. The ICSU/WMO International Symposium on Tropical Cyclones Disasters was held in Beijing from 12 to 16 October 1992. China welcomed cooperative research with experts from Typhoon Committee Members in 1992, in preparation for the Third International Technical Conference on SPECTRUM to be organized in China by the end of 1993, with the aim of strengthening technical cooperation among developing countries and scientific research with aims similar to SPECTRUM.

2. Two forecasters from China attended the UNDP/WMO Marine Meteorological Workshop which was held in Malaysia from 21 July to 11 August 1992.

3. In Hong Kong, training courses were run by the Royal Observatory for Class I, Class II and Class III meteorologists. Four overseas participants from the Maldives, Macau and Brunei attended a meteorological training course at the Royal Observatory from 24 February to 30 June. Two agrometeorologists from the Viet Nam Hydrometeorological Service completed an attachment to the Royal Observatory in August to study the construction and operational procedures of lysimeters for evapotranspiration measurement. Seven meteorologists from Hong Kong were sent to various overseas institutions for advanced and special training.



4. The Japan Meteorological Agency had been making continuous efforts to expand technical cooperation. Training events were offered to Members of the Typhoon Committee on the subject of numerical weather prediction and telecommunications.
5. A number of Korea Meteorological Administration staff had been sent overseas to training courses in various fields of meteorology for specialization and continued build up of manpower resources.
6. The Malaysian Meteorological Service (MMS) provided several training courses to overseas meteorological personnel of Brunei and availed of several overseas training courses for its own personnel.
7. The Training Assistance Council (TAC) of the Department of Foreign Affairs of the Philippines and the World Meteorological Organization co-organized and co-sponsored the TAC/WMO Training Course on Weather Forecasting (for Class III meteorological personnel) which was hosted by PAGASA from 1 October to 11 November 1992. Ten foreign participants came from Cambodia, Indonesia, Kiribati, Malaysia, Maldives, Nepal, Thailand, Viet Nam and Vanuatu. Ten local participants also took part in the training.
8. Three Filipinos candidates from the Philippines received foreign study grants while 47 attended overseas seminars, workshops and training courses related to disaster reduction.
9. The personnel of the Thai Meteorological Department (TMD) participated in several overseas training courses in 1992.
10. In Viet Nam, the Regional Seminar on Climate Change and Its Impact on Ecological Environment in Southeast Asia was held in Hanoi in November 1992. A seminar on strengthening of warning capabilities for typhoon and prevention and preparedness and natural disaster reduction was held in Hanoi in April 1992 by the Viet Nam National Committee for IDNDR in coordination with the Asian Disaster Preparedness Center

(ADPC) and the Asian Institute of Technology (AIT).

11. A seminar on urgent response measures for flood disaster mitigation and flood control and management in Viet Nam was held in Hanoi in June 1992 by the Viet Nam National Committee for IDNDR in coordination with UNDP and UNDRO offices in Viet Nam. Viet Nam Hydrometeorological Service conducted two local training courses for hydrological and meteorological observers, while training on urgent relief activities for natural disasters victims was conducted by the Ministry of Labor and Social Affairs.
12. Seven personnel from the Hydrometeorological Service of Viet Nam attended short training courses abroad.



### Appendix VIII

#### Summary of National Reports on activities related to the Research Component during 1992

1. In China, research on the National five-year key project of operational monitoring and forecasting systems on typhoons and torrential rains had been carried out for almost a year. It included topics on: numerical prediction model on tropical cyclone motion; scientific experiments and theoretical research on tropical cyclones; objective prediction methods for tropical cyclone motion, intensity and rainfall; improvement in tropical cyclone disaster assessment and warning systems; and disaster prevention and preparedness strategies.
2. In Hong Kong, an evaluation of the performance of the ECMWF model on tropical cyclone track forecasting gave positive impact on short-range forecasts due to enhanced observations collected by SPECTRUM and concurrent field experiments (TCM-90 and TYPHOON-90) during August and September 1990. A new tropical cyclone climatology database, representing the age of satellite tracking of tropical cyclones, was being compiled for the 30-year period of 1961-1990.
3. Using SPECTRUM and other data, the contrasting weather scenarios during the dissipating stages of Yancy (9012) and Dot (9017) were being investigated. Research activities were also undertaken at the City Polytechnic of Hong Kong. Tropical cyclone studies using SPECTRUM and TCM-90 data included asymmetric flow associated with tropical cyclone motion, upper level influences on movements and intensity changes, steering flow and tropical cyclone motion based on vorticity advection, and binary interaction between tropical cyclones.
4. In the Japan Meteorological Agency (JMA), the effect of using the convective adjustment parameterization scheme on typhoon track forecast was found to achieve a better result than Kuo's parameterization scheme. The scheme with convection adjustment

achieved a better result.

5. In the Meteorological Research Institute (MRI) of JMA, the triple-nested numerical typhoon model was integrated for eight typhoons observed during SPECTRUM in August and September 1990. The integration successfully simulated typhoon movements of three to five days ahead.
6. The Meteorological Research Institute of the Korea Meteorological Administration was developing a typhoon forecast model using Quasi-Lagrangian and a real-time very short-range precipitation forecast system of up to 3 hours by using raingauge measurements (conventional plus AWS) with satellite and radar observations. The latter was expected to be realized by the end of 1993.
7. A hydrological research project had been carried out since 1987 in the Republic of Korea by the Ministry of Construction to provide the fundamental techniques for efficient design of river works and management of water resources.
8. Research activities in Viet Nam Hydrometeorological Service included:
  - Application of a vortex initialization scheme to a dynamical model for typhoon track prediction;
  - Prediction of typhoon intensity with the use of satellite cloud imageries;
  - Application of statistical and numerical methods for prediction of storm surge;
  - Flood and inundation characteristics in the coastal provinces of the central part of Viet Nam;
  - Development of software systems applicable to microcomputers used for prediction of typhoons and floods;
  - Improvement of the database for hydrometeorological research.
9. The Thailand Meteorological Department reported that:
  - All Numerical Weather Prediction (NWP) products received had been



analyzed and graphically displayed by software developed on IBM-PC/AT for purposes of research and operation of weather forecasts.

It had established a working group with close coordination of scientists from various research institutes with the aim to develop models of Numerical Weather Prediction.

The existing five-level Limited Area Model was under study and modification for use over Thailand and neighbouring areas.

# Appendix IX

## TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

### 1 METEOROLOGICAL COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES							
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	=====	=====	=====	=====	Members	National	
1.1.3 Establishment of AMedas, ASDAR, anemometer, tide gauge and water recorder networks	=====	=====	=====	=====	Members	National	
1.1.4 Expansion of observational programme:							
• 98223 Laoag (Philippines) at 12 UTC Radiosonde/Radiowind	=====	=====	=====	=====	Philippines	National and external assistance	Completed along with Legaspi City (98444)
1.1.5 Replacement/Upgrading of old radars (Malaysia and Philippines)	=====	=====	=====	=====	Malaysia, Philippines	National and external assistance	
1.1.6 Vinh (48845)	=====	=====	=====	=====	Viet Nam	National and external assistance	To replace 48900 (Ho Chi Minh)
1.1.7 Establishment of new weather radars:							
• Kunsan & Donghae (Republic of Korea)	=====	=====	=====	=====	Republic of Korea	National	Completed in March 1992
• Da Nang (Viet Nam)	=====	=====	=====	=====	Viet Nam	National and external assistance	
• Vientiane, Lao PDR (Lao People's Democratic Republic)	=====	=====	=====	=====	Lao PDR	External assistance	







**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**1 METEOROLOGICAL COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>1.2 SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES</b>							
1.2.1 <sup>1</sup> Maintaining: • services and facilities for the real-time exchange of data and products • Monitoring of data exchange	=====	=====	=====	=====	Members  RTHs Bangkok, Beijing and Tokyo  RTHs Bangkok Vientiane-Hanoi Bangkok-Vientiane-Ho Chi Minh	National  Members concerned	Continuous activities  Continuous activities
1.2.2 Improvement of facilities and their operation as necessary for the rapid and reliable collection and distribution of the required observational and processed information							
1.2.2.1 Establishment of regional telecommunication links • Bangkok-Hanoi - upgraded from 50 to 75 bauds • Bangkok-Cambodia • Bangkok-Beijing					Thailand and Viet Nam  Thailand and Cambodia  Thailand and China	National and external assistance  National and external assistance  National and external assistance	Completed in 1991   Under technical discussion

<sup>1</sup>Will be given priority attention in 1992.

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**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**1 METEOROLOGICAL COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>1.2 SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES (cont'd)</b>							
1.2.2.1 Establishment of regional telecommunication links (cont'd) • Bangkok-Vientiane							
1.2.2.2 Improvement of data completeness and quality, including use of real-time and non real-time monitoring results for this purpose	=====	=====	=====	=====	Thailand and Lao PDR  Members	External assistance  National	
1.2.2.3 Review of existing arrangements for dissemination of typhoon warnings with a view of introducing improvements where necessary	=====	=====	=====	=====	Members	National	Continuous activities
1.2.2.4 Improvement of national data collection and retransmission to associated RTHs • Lao PDR • Philippines • Viet Nam • Upgrading of telecommunication circuit linking Hanoi and Bangkok from 75 bauds to 100 or 200 bauds • Establishment of telecommunication circuit between Hanoi and Beijing with speed of 2400 bauds	=====	=====	=====	=====	Lao PDR  Philippines  Viet Nam  Viet Nam  Viet Nam	External assistance  National and bilateral support  External assistance  National and external assistance  National and external assistance	Continuous activities      Speed is under negotiation

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

2 HYDROLOGICAL COMPONENT

2 HYDROLOGICAL COMPONENT									
TASKS		TIME SCALE				BY WHOM	RESOURCES	REMARKS	
		92	93	94	95				
2.1	FLOOD FORECASTING AND WARNING								
2.1.1	Installation and operation networks of observing stations required for flood forecasting systems								
	•	Installation of telemetering systems complemented by radar rain gauges and satellite systems for important cities and other densely populated areas prone to flash floods (China)					National	Continuous activity	
	•	Integration and use of data from existing meteorological and hydrological observing stations operated by various agencies (China and Malaysia)					National		
	•	Improvement of means of transmission to reduce data collection time (China)					National		
	•	Development of an on-line system (China)					National		
	•	Development of hydrometric stations on urban drainage (Hong Kong)					National		
2.1.2	Establishment and operation of flood forecasting and warning system								
	•	Nam Ngum and Se Bang Hieng basins (Lao PDR)					National	Continuous activity	
	•	Pasak River Basin (Thailand)					National	Includes real-time data collection and hydrological modelling Completed in 1991?	

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

2 HYDROLOGICAL COMPONENT

TASKS	TIME SCALE					BY WHOM	RESOURCES	REMARKS
	92	93	94	95				
2.1 FLOOD FORECASTING AND WARNING (cont'd)								
2.1.2 Establishment and operation of flood forecasting and warning systems: (cont'd)								
• One river basin (Viet Nam - to be selected by Viet Nam)	=====	=====	=====	=====	Viet Nam	National		
• Application of computer-based mathematical models to study the hydrology of urban zones (Hong Kong)	=====	=====	=====	=====	Hong Kong	National		In cooperation with ESCAP
• Extension of flood forecasting services to other basins subject to flooding especially in medium-scale catchment (Malaysia, Republic of Korea, Thailand)	=====	=====	=====	=====	Malaysia Republic of Korea Thailand	National National National and bilateral support		Completed in 1991
• Development of forecasting of the location and intensity of rainfall in densely populated areas which are subject to flash floods (e.g., Metropolitan Manila, Philippines)	=====	=====	=====	=====	Philippines	National and JICA		Multi-agency project
• Increased use of existing radar rain gauges for providing QPF data	=====	=====	=====	=====	Philippines	National		
2.1.3 Establishment of flood forecasting and warning systems for dam operations (Malaysia, Philippines and interested Members)	=====	=====	=====	=====	Malaysia, Philippines and interested Members	Members concerned and external assistance		Faulty dam operation aggravates flooding downstream. Project PFWSDO II in the Philippines was completed in March 1992.



**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**2 HYDROLOGICAL COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>2.1 FLOOD FORECASTING AND WARNING (cont'd)</b>							
2.1.4 Establishment of flood forecasting and warning systems for inundation from storm surges	=====	=====	=====	=====	Members concerned	Members concerned and external assistance including TCDC	Includes interaction of river floods and storm surges
2.1.5 Monitoring of/and reporting on performance of existing flood forecasting systems	=====	=====	=====	=====	Members	National and external assistance including TCDC and with support of TCS and WHO	Coordinated by WHO, using MOFSS
2.1.6 Further improvement of existing flood forecasting and warning systems, making use, where appropriate, of the results of TOPEX	=====	=====	=====	=====	Members	Members concerned and external assistance including TCDC	Includes catchment modelling
• Improvement of existing models and their application in catchments subject to flash floods (Malaysia, Philippines, Thailand)	=====	=====	=====	=====	Malaysia Philippines Thailand	National National National	Updating basin parameters forced by Pinatubo eruption
• Development and establishment of flood forecasting systems which are appropriate for 5 small basins in Korea	=====	=====	=====	=====	Republic of Korea	National	New task and until 1996
• Improvement of existing flood forecasting systems for the rivers Hong and Thai Binh using microcomputers					Viet Nam		

**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**2 HYDROLOGICAL COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>2.1 FLOOD FORECASTING AND WARNING (cont'd)</b>							
2.1.7 Implementation of recommendations of mission by experts to provide technical guidance on items 2.1.1 to 2.1.6	=====	=====	=====	=====	Members	External assistance, Missions to be organized by WHO and ESCAP	Using, where appropriate, technology available through HOMS
2.1.8 Exchange of technical visits among flood forecasters	=====	=====	=====	=====	Members	National and external assistance	Coordinated by WHO
2.1.9 Development and application of guidance on hydrological technology models for tropical cyclone regions	=====	=====	=====	=====	Members	External assistance WHO	On the basis of OHP (HOMS)
2.1.10 Development and use of improved techniques for Quantitative Precipitation Forecast (QPF) taking advantage of data provided by satellite and radar	=====	=====	=====	=====	Members	National and external assistance	WHO to assist in development and promulgation of improved techniques
• Development and application of QPF derived from radar rain gauges and satellites to issue flash flood warnings in densely populated small river basins (Malaysia)	=====	=====	=====	=====	Malaysia	National and external assistance	WHO to assist in development and promulgation of the techniques
• Development of QPF and its application to flood forecasting in central region (Viet Nam)	=====	=====	=====	=====	Viet Nam	National and external assistance	



TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

2 HYDROLOGICAL COMPONENT		TIME SCALE					BY WHOM	RESOURCES	REMARKS
TASKS		92	93	94	95				
2.2	COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT								
2.2.1	Establishment of pilot area for comprehensive flood loss prevention and management						Members	Bilateral or multilateral support if available	Detailed programme will be established by respective Members
2.2.2	Investigation and survey including:						Members	National	ESCAP & WMO to assist in organizing investigations and surveys
	• Determination of flood-prone areas subject to heavy damages								
	• Determination of magnitude and corresponding frequency of floods in each flood-prone area								
	• Assessment of potential flood damage in each area for various flood magnitudes								
	• Preparation of flood risk maps								
2.2.3	Preparation and application of a manual and guidelines for/and dissemination of techniques for comprehensive flood loss prevention and management						Members	National and external assistance (sub-contract under regional project)	With assistance of ESCAP & WMO Completed in April 1991
2.2.4	Implementation of selected aspects of comprehensive flood loss prevention and management						Members	National and external assistance (sub-contract under regional project)	With assistance of ESCAP & WMO

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TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

2 HYDROLOGICAL COMPONENT

TASKS		TIME SCALE					BY WHOM	RESOURCES	REMARKS
		92	93	94	95				
2.2	COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT (cont'd)								
2.2.5	Mission of experts to provide technical guidance to Members on items 2.2.1 to 2.2.4 above						Members	UNDP <sup>3</sup> , TCDC & bilateral, multilateral support if available	With assistance of ESCAP & WMO
2.2.6	Preparation and application of a manual and guidelines for integrated river system development and management with reference to comprehensive flood loss prevention and management						Members	National and external assistance (sub-contract under regional project)	With assistance of ESCAP & WMO
2.2.7	Preparation of guidelines for the formulation of a comprehensive master plan for urban flood loss prevention and mitigation						Members	National and external assistance (sub-contract under regional project)	With assistance of ESCAP & WMO
2.2.8	Storm surge prediction and risk analysis						Members	National and external assistance (sub-contract under regional project)	With assistance of ESCAP & WMO
2.2.9	Improvement of dam water release operation system						Members	National and external assistance	With assistance of ESCAP & WMO
									With assistance of TCS, ESCAP and WMO

<sup>3</sup>RAS/86/175 (Programme support to Typhoon Committee) terminated in 1991.



TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

### 3 DISASTER PREVENTION AND PREPAREDNESS COMPONENT

[illegible]

<sup>4</sup>To be given priority attention in 1992.

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

### 3 DISASTER PREVENTION AND PREPAREDNESS COMPONENT

TASKS	TIME SCALE					BY WHOM	RESOURCES	REMARKS
	92	93	94	95				
3.2 DISASTER MANAGEMENT								
3.2.1 Establishment/upgrading of national disaster prevention and preparedness plans	=====	=====	=====	=====		Members	Bilateral or multilateral support if available	With advice, and if possible, support from ESCAP
3.2.2 Strengthening national coordination and cooperation between departments and agencies involved in DPP activities	=====	=====	=====	=====		Members	National	
3.2.3 Improvement in the timely dissemination of warnings of typhoons, floods and storm surges with particular attention to remote areas	=====	=====	=====	=====		Members	National	
3.2.4 Improvement of communication systems for warning dissemination and relief operation	=====	=====	=====	=====		Members	Bilateral or multilateral support if available	
3.2.5 Improvement of damage assessment and reporting	=====	=====	=====	=====		Members	Multilateral support if available	With advice from ESCAP roving mission
3.2.6 Development and exchange of information and guidance materials on structural and non-structural measures for mitigation of disasters	=====	=====	=====	=====		Members	External assistance	With guidance from international agencies, such as, UNDR0, IPRC, ESCAP and WHO
3.2.7 Conducting case studies of response to major disasters	=====	=====	=====	=====		Members	External assistance	With advice from UNDR0, IPRC and WHO
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 UNDR0 in co-operation with ESCAP



### TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

#### 3 DISASTER PREVENTION AND PREPAREDNESS COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
3.2 DISASTER MANAGEMENT (cont'd)							
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 multilateral support if available	
3.2.11 Establishment of disaster research and training institute	=====	=====	=====	=====	Members	Bilateral or multilateral support if available	
3.2.12 <sup>5</sup> Production of material related to public information and education on the Typhoon Committee activities, particularly storm warning and DPP	=====	=====	=====	=====	Members	External assistance	With support of ESCAP, WHO and TCS
3.2.13 Story of the Typhoon Committee	=====	=====	=====	=====	TCS	External assistance	With support of ESCAP and WHO
3.2.14 Establishment of a Philippine training and research center for disaster prevention and preparedness through consultancy services where appropriate	=====	=====	=====	=====	Philippines	External assistance (JICA)	Proposal re-submitted to local <i>National Economic and Development Authority</i> (NEDA). This is initially a PAGASA project.

<sup>5</sup>External assistance in conjunction with IDNDR

### TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

#### 4 TRAINING COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
4.1 METEOROLOGY							
4.1.1 Training on engineering application of tropical cyclone climatological data	=====	=====	=====	=====	Members	External assistance	Conferences, seminars and overseas training programmes, including roving missions and arrangements
4.1.2 Training on applications of radar and satellite data in tropical cyclone tracking, forecasting and very short-range precipitation forecasts	=====	=====	=====	=====	Members	External assistance	
4.1.3 Training in calibration, maintenance and repair of electronic meteorological instrumentation	=====	=====	=====	=====	Members	National and external assistance	Coordinated by WHO
4.1.4 Training on utilization of software for integrating satellite/radar/rainfall data	=====	=====	=====	=====	Members	Short-term fellowships with external support	Coordinated by WHO
4.1.5 Training on quantitative precipitation forecast (QPF) models	=====	=====	=====	=====	Members	Short-term fellowships with external support	Coordinated by WHO
4.1.6 Training of personnel through fellowships on tropical cyclone forecasting	=====	=====	=====	=====	Members	UNDP, WHO and other international organizations concerned	Coordinated by WHO
4.1.7 Training on:	=====	=====	=====	=====	Members	UNDP, WHO and other international organizations concerned	Courses and seminars organized by WHO and Members
• Training course on weather forecasting including tropical cyclones	=====	=====	=====	=====	China	National and external assistance	As a result of roving seminar to some TC member countries on TCDC and weather forecasting matters
4.1.8 Continuation of group training courses	=====	=====	=====	=====	Japan	JICA	Japan International Cooperation Agency (JICA)



TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

4 TRAINING COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
4.1 METEOROLOGY							
4.1.9 Exchange of forecaster(s) between tropical cyclone forecasting and warning centers					Members	External assistance	Through TCDC arrangement
4.1.10 Training on observing technology					Members	External support	Seminars
4.1.11 Exchange of meteorological experts between Members other than 4.1.9 above					Members	Bilateral or TCDC arrangements	
4.1.12 Training on storm surge and wave prediction					Members	Short-term fellowships with external support	
4.1.13 Training in message-switching, wave forecasting, numerical weather prediction and cloud physics, through attachments					Members	External assistance	TCDC arrangements
4.1.14 <sup>6</sup> Training personnel through fellowships on maintenance of electronic meteorological and hydrological equipment					Members	External assistance	For both meteorological and hydrological equipment

<sup>6</sup>Will be given priority attention in 1992.

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

4 TRAINING COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
4.2 HYDROLOGY							
4.2.1 Training on repair and maintenance of electronic equipment used in flood forecasting and warning					Members	WMO, UNDP <sup>7</sup> and other sources	Roving seminars to be organized by WMO
4.2.2 Training on advanced techniques for flood forecasting and warning associated storms, including hardware and software					Members	WMO, UNDP <sup>7</sup> and other sources	Courses and seminars to be organized by WMO
4.2.3 Training in hydrology with emphasis on flood forecasting					Members	WMO, UNDP <sup>7</sup> and other sources	Courses and seminars to be organized by WMO
4.2.4 Training on personnel through fellowships on flood loss prevention					Members	WMO, UNDP <sup>7</sup> and other sources	Courses and seminars to be organized by WMO
4.2.5 Training on appropriate topics relating to flood loss prevention and management					Members	ESCAP, UNDP <sup>7</sup> and other sources	Seminar to be organized by ESCAP
4.2.6 Group training courses on river engineering					Japan	Japan International Cooperation Agency (JICA)	At the request of TC
4.2.7 Exchange of flood forecasting experts					Members	WMO, UNDP <sup>7</sup> and other sources	TCDC arrangements

<sup>7</sup>For next UNDP programme cycle.



**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**4 TRAINING COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>4.3 DISASTER PREVENTION AND PREPAREDNESS</b>							
4.3.1 Training of disaster managers and volunteer leaders	=====	=====	=====	=====	Members	National and external assistance	With advice from international agencies
4.3.2 Test exercises	=====	=====	=====	=====	Members	National and external assistance	With advice from international agencies
4.3.3 Training in DPP	=====	=====	=====	=====	Members	External assistance	Regional seminars organized by TCS with help of UNDR0, IFRC, ESCAP and WMO
4.3.4 Exchange of information on the socio-economic impact of disaster	=====	=====	=====	=====	Members	UNDR0, IFRC	Seminars organized by UNDR0, IFRC and WMO
4.3.5 Training on disaster vulnerability and risk assessment	=====	=====	=====	=====	Members	UNDR0, IFRC	Courses and seminars organized by UNDR0, IFRC and ESCAP
4.3.6 Group training courses on technology for disaster prevention	=====	=====	=====	=====	Japan	JICA	Continuation
4.3.7 Exchange of DPP personnel	=====	=====	=====	=====	UNDR0, IFRC, TCS and ESCAP	UNDR0, IFRC, ESCAP and other sources	TCDC arrangement organized by UNDR0, IFRC, TCS and ESCAP
4.3.8 Emergency health management after natural disasters (Thailand)	=====	=====	=====	=====	Thailand IFRC	National	Organized by relief organizations and Thai Red Cross
4.3.9 First aid training and disaster preparedness (Thailand)	=====	=====	=====	=====	Thailand IFRC	National	Organized by relief organizations and Thai Red Cross

**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**5 RESEARCH COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>5.1 METEOROLOGY</b>							
5.1.1 General studies on:							
5.1.1.1 Methods of typhoon location and accuracy	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.2 Typhoon development mechanism and forecasting	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.3 Disastrous weather associated with typhoons	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.4 Forecasting of precipitation by use of new approaches or techniques, such as, interactive techniques for integrating satellite, radar and other information	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.5 Influences of meso- and micro-scale systems on typhoon characteristics	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.6 Interaction between typhoons and the environmental circulation	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.7 Possibility of extended track forecasting methods	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.8 Evaluation and improvement of present objective forecasting methods	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.9 Sensitivity of objective methods to initial data distribution and quality	=====	=====	=====	=====	Members or regionally coordinated programme	National	
5.1.1.1.10 Typhoon Climatology in relation with anomalies in regional circulation	=====	=====	=====	=====	Members or regionally coordinated programme	National	



# TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

## 5 RESEARCH COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
5.1 METEOROLOGY (cont'd)							
5.1.1 General studies on: (cont'd)							
5.1.1.11 Forecasting storm surge and heavy rainfall (see also 5.2.1.6)					Members or regionally coordinated programme	National	
5.1.2 <sup>8</sup> Utilization of TOPEX data set and those of SPECTRUM, TCM-90 and TYPHOON-90 data set (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modeling, with the aim of improving existing methods of predicting formation, development and steering:					Members or regionally coordinated programme	National	Need for short-term attachment of experts to advanced centers in the typhoon region
5.1.2.1 Establishment and operation of a tropical cyclone data bank for the northwestern Pacific and East Asia with software exchanges between Members					RSMC Tokyo	Japan	According to the procedure described in TOM
5.1.2.2 Development of an operational WWP model for typhoon movement and development					Members or regionally coordinated programme	National	
5.1.2.3 Irregular tropical cyclone behavior, such as, sudden turning of tracks, sudden increase/decrease of intensity, rainfall and storm surge					Members or regionally coordinated programme	National	

<sup>8</sup>Former subparagraph "5.1.2.5 Utilization of SPECTRUM, TCM-90 and TYPHOON-90 data" has been incorporated in this subheading to reflect the proper status of SPECTRUM with respect to that of TOPEX and those activities (in subparagraphs) that follow.

# TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

## 5 RESEARCH COMPONENT

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
5.1 METEOROLOGY (cont'd)							
5.1.2 Utilization of TOPEX, SPECTRUM data.. (cont'd)							
5.1.2.4 Air-sea interactions associated with the occurrence of typhoons, with emphasis on wave and storm surge generation					Members or regionally coordinated programme	National	
5.1.2.5 Study on typhoon-related wind climatology (China, Hong Kong)					China, Hong Kong	National	To be published in the WHO TCP series
5.1.2.6 Third <sup>9</sup> technical conference on SPECTRUM					China	National and external	

<sup>9</sup>Misquoted as second in the First Joint Session of the Panel on Tropical Cyclones and the Typhoon Committee, 18-27 February 1992, Pattaya, Thailand. The previous technical conference on SPECTRUM are as follows:

1. *SPECTRUM Technical Conference and Steering Group Evaluation Meeting* was hosted by the Japan Meteorological Agency in Tokyo in December 1990.
2. *Technical Conference on SPECTRUM* was hosted by the State Meteorological Administration in Guangzhou, China in November 1991.



**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**5 RESEARCH COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>5.2 HYDROLOGY</b>							
5.2.1 Studies for development or improving techniques for:	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.1 Comprehensive flood loss prevention and management	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.2 Flood risk analysis, including flood risk mapping	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.3 Flood run-off models appropriate for the region	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.4 Application of meteorological inputs to flood forecasting	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.5 Comparison of the performance of the different models, using the post-TOPEX data set	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.6 Forecasting floods caused by the combined effects of storm surges, heavy rainfall and stream flow (see also 5.1.1.11)	=====	=====	=====	=====	National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.1.7 Flash flood forecasting	=====	=====	=====	=====	Members	National	In cooperation with ESCAP
5.2.1.8 Study of effects of deforestation, urbanization and changing land use on the hydrology of the catchment and on the intensity of floods	=====	=====	=====	=====	China, Malaysia, Philippines	National	
5.2.1.9 Study and evaluation of the economic and social benefits of hydrological forecasting	=====	=====	=====	=====	National or regionally coordinated program	National	In cooperation with ESCAP

**TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN**

**5 RESEARCH COMPONENT**

TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
	92	93	94	95			
<b>5.3 DISASTER PREVENTION AND PREPAREDNESS</b>							
5.3.1 Studies on the socio-economic impact of typhoon and flood disasters	=====	=====	=====	=====	Members	National	With advice and possible support of UNDRO, IFRC, ESCAP, and WHO
5.3.2 Vulnerability and risk assessment of disaster-prone areas	=====	=====	=====	=====	Members	National	With advice and possible support of UNDRO, IFRC, ESCAP, and WHO
5.3.3 Socio-economic implication of availability and quality of typhoon and flood forecasts and warnings	=====	=====	=====	=====	Members	National	With advice and possible support of UNDRO, IFRC, ESCAP, and WHO
5.3.4 Disaster impact modelling	=====	=====	=====	=====	Members	National	With advice and possible support of UNDRO, IFRC, ESCAP, and WHO
5.3.5 Vulnerability and risk assessment of lahar-prone areas in Central Luzon (debris flow)	=====	=====	=====	=====	Philippines	National with external assistance	In connection with Mt. Pinatubo volcano eruption



Short- and Long-term Research Objectives

1. Several international meetings concerning research on tropical cyclones are scheduled in 1993, namely:

- Joint International Meeting of IAMAP/IAHS (11 to 23 July, Yokohama, Japan);
- The third international workshop on tropical cyclones (IWTC-III, late 1993, Mexico); and,
- The third technical conference on SPECTRUM (late 1993, China).

2. The short-term research objectives of the Typhoon Committee should be focussed on achieving development of skills in existing forecast techniques through research, the results of which are organized and discussed in meetings. The Typhoon Committee and the SRCG should stimulate and organize SPECTRUM-related research activities. In the studies, comprehensive observational data of SPECTRUM should be utilized.

3. As recommended at the SPECTRUM Technical Conference (Guangzhou, 1991) and approved in principle at the First Joint Session of the Panel on Tropical Cyclones and the Typhoon Committee (Pattaya, 1992), WMO should explore financial support for coordinating SPECTRUM-related research with other bodies, and for supporting attendance of meteorologists and researchers at the said meetings.

4. The long-term research objectives of the Typhoon Committee could be addressed in stimulating more basic research on understanding the overall mechanisms governing tropical cyclone genesis, movement, intensification and decay. In this procedure, well-organized cooperation between developed and developing countries should be realized.

5. The statistical or statistical-dynamical forecast scheme is, and will be, the most useful and suitable method to be used in the countries without sufficient computer facilities. In

developing such a scheme, long-period historical data of tropical cyclone track and intensity are indispensable. Some of the centres, e.g., China, Hong Kong and Japan, have such historical data, and it will be useful to exchange information about these data. The dataset prepared by the RSMC Tokyo-Typhoon Centre contains centre position, central pressure, maximum wind speed and wind distribution of tropical cyclones for the 40-year period starting 1951. The data will be provided in magnetic media.

6. Upgrading of numerical prediction models would be the most scientific and promising way to reduce forecast errors in track and intensity of tropical cyclones. In this connection, studies to develop more proper initialization techniques and parameterization schemes of physical processes such as cumulus convection are of the highest importance. These studies should be done with highest priority at the centres with advanced computer facilities.

7. Research to develop a numerical model of limited area and of limited purpose, such as forecast of storm surges, sea surface conditions, and precipitation distribution would also be important for the Members of the Typhoon Committee. Utilization of grid point values of a sophisticated numerical model as a boundary condition of these simple models would contribute to more reasonable and precise forecasts. In developing such a model, it is indispensable to attach researchers of participating members to an advanced centre.

8. Such opportunities as the training seminar held in Nanjing, China in October-November 1992 and the invitation by Viet Nam to assist cooperative research with experts from the Typhoon Committee members are very beneficial and significant ones for stimulating research activities within the Typhoon Committee. Efforts to extend such an opportunity should be taken by the TCS and each Typhoon Committee Member.

9. Table A.1 presents the observations of SPECTRUM recorded so far and table A.2 lists the phenomena to be studied, short and long-term research objectives of SPECTRUM in the future.



Table A.1 Observations of SPECTRUM

Observation Station	Code Form	S P E C T R U M							TCM-90	TYPHOON-90
		C	H	J	M	P	K	T		
Surface Observation (Special Observation)	SYNOP	55	1	131		4	31			
Upper-air Observation	TEMP, PILOT	10	1	15	4	5	4	4	6	
Meteorological Observation Ship	SHIP, TEMP SHIP			2				2		4
Buoy (moored)	SHIP			4				4		
Buoy (drifting)	DRIBU								11	
Radar	RADOB	5	1	18			1		25	
Wind Profiler				1					1	
Doppler Radar				1					1	
Geostationary Meteorological Satellite	SAREP, SATOB			1					1	
Aircraft (NASA)	TEMP DROP									1
Polar-orbiting Satellite	SATEM									2
Aircraft	AIREP, ASDAR									
Voluntary Observation Ship	SHIP									
UNFIXED										

C = China, H = Hong Kong, J = Japan, M = Malaysia, P = Philippines, K = Republic of Korea, T = Thailand

Table A.2 Phenomena to be studied, short- and long-term research objectives

Scale	Phenomena	Short-term objectives (-1993) (comprehensive SPECTRUM datasets)	Long-term objectives (1993- ) (SPECTRUM plus other data)
Large scale (-2,000 km) (mainly barotropic)	subtropical ridge monsoon trough mid-latitude trough → large-scale steering weak environmental flow → large-scale unusual motion	Analytical and theoretical studies on structure, organiz- ing and maintaining mechanisms, scale interaction, etc.  Studies to raise performance of numerical prediction models  → Improvement of existing forecasting techniques	Further studies to understand overall mechanisms concerning tropical cyclone movement and intensity change.  Studies to develop more prop- er parameterizing scheme for cumulus convection, initial- ization, etc. for advanced numerical models.
Meso- $\alpha$ scale (2,000-200 km)  (barotropic- baroclinic interaction)	asymmetric features beta effect beta-gyre cooler SST induced by upwelling orography → meso-scale steering → meso-scale long-period unusual motion tropical upper tropospheric trough (TUTT)		Studies to develop limited- purpose forecasting models using GPM of advanced models as the boundary conditions.
Meso- $\beta$ scale (200-20 km) mainly baroclinic)	meso-scale convective system (MSC) spiral rain band asymmetric structure around eye wall orography → meso-scale short-period unusual motion		Studies concerning interac- tion between barotropic and baroclinic processes.
Meso- $\gamma$ scale (20-2 km) (baroclinic)	cumulus convection cumulus-cumulus interaction		→ New analytical, statistical and dynamical forecasting techniques.



Appendix XI

**ESCAP/WMO TYPHOON COMMITTEE TRUST FUND**

**Account for the Biennium 1990/1991**

As at 31 December 1991

	\$	\$
Balance of fund as at 1 January 1990		80,021
Advances received	108,000	
Other income	<u>11,504</u>	<u>119,504</u>
Total revenue		199,525
Less: Expenditure		
Sessions of Committee	1,412	
Administration Costs - Local	14,913	
Administration Costs - WMO	10,204	
Bank Charges	10	
Spectrum Technical Conference	28,019	
Expert Meetings	0	
Steering Group	1,665	
Publications and Reports	1,972	
Missions	<u>7,305</u>	
Total Expenditure		<u>65,500</u>
<b><u>Balance at 31 December 1991</u></b>	<b>\$</b>	<b><u><u>134,025</u></u></b>
Represented by:		
Cash at Bank		147,171
Less : Unliquidated obligations		<u>13,146</u>
	<b>\$</b>	<b><u><u>134,025</u></u></b>