UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

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WORLD METEOROLOGICAL ORGANIZATION

REPORT ON THE FIRST JOINT SESSION OF THE PANEL ON TROPICAL CYCLONES AND THE TYPHOON COMMITTEE

Pattaya, Thailand
18 - 27 February 1992

FOR PARTICIPANTS ONLY

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I. ORGANIZATION OF THE SESSION

1. Typhoon Committee was held at Pattaya, Thailand from 18 to 27 February 1992. The session was co-sponsored by the World Meteorological Organization (WMO) and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and was hosted by the Government of Thailand.

Attendance

2. The session was attended by 66 participants and observers. They represented six Members of the Panel on Tropical Cyclones, namely, Bangladesh, India, Maldives, Pakistan, Sri Lanka and Thailand, and eight Members of the Typhoon Committee, namely, China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea, Thailand and Viet Nam. Observers from Germany, Indonesia, Macau, the United States of America, the International Civil Aviation Organization (ICAO), the United Nations Office of the Disaster Relief Coordinator (UNDRO), the International Federation of Red Cross and Red Crescent Societies (IFRC), and the WMO Commission on Atmospheric Sciences (CAS) were also present. The list of participants is attached as appendix I.

Opening of the session (agenda item 1.1)

3. The opening session was addressed by representatives of the host Government and the two sponsoring organizations. Mr. Smith Tumsaroch, Director-General of the Meteorological Department of Thailand, welcomed all participants to Thailand and to the First Joint Session of the Panel on Tropical Cyclones and the Typhoon Committee. He recalled that the twenty-third session of the ESCAP/WMO Typhoon Committee, held in Seoul in November 1990, had made a specific proposal that its next annual session be held jointly with that of the Panel on Tropical Cyclones, possibly in early 1992 in Bangkok. He was pleased that Thailand was able to host this First Joint Session in Pattaya.

4. He said that substantial progress had been made since the previous session in the implementation of the Committee's and the Panel's Regional Co-operation Programmes, such as the installation and modernization of upper-air observation stations, cyclone detection radar and some satellite ground receivers as well as the upgrading of telecommunication systems. Those activities would create a better data base and analysis system, which would lead to greatly improved forecasting, warning, mitigation and preparedness systems. The combined observations from field experiments during August and September 1990 organized under the Special Experiment Concerning Typhoon Recurvature and Unusual Movement (SPECTRUM) of the Typhoon Committee had resulted in a very rich and comprehensive data set available for further studies of the motion and behaviour as well as the impact of typhoons in the Western Pacific. More accurate short-term and long-term forecasts were needed, however, through the introduction of more advanced remote-sensing techniques and development of more sophisticated numerical computer models. There was also a need for a multidisciplinary approach to reduce damage from tropical cyclones and for the promotion of technical cooperation among developing countries (TCDC).

5. Much still needed to be done, especially in the warning dissemination and community preparedness aspects, which would become extremely important in the Tropical Cyclone Programme during the period of the International Decade for Natural Disaster Reduction (IDNDR), 1990-1999. He expressed his appreciation to The United Nations Development Programme (UNDP) for its significant contributions and to WMO and ESCAP for their technical support during the past years.

6. In his opening address, Professor G.O.P. Obasi, Secretary-General of WMO, thanked the Government of Thailand for hosting the First Joint Session of the Panel on Tropical Cyclones and the Typhoon Committee. He also expressed his appreciation to Mr. Smith Tumsaroch, Director-General of the Thai Meteorological Department for the excellent arrangements made to facilitate the smooth running of the session. He extended a warm welcome to all the participants. The Secretary-General complimented the Panel and the Committee for their past achievements.

He reminded participants that the devastating impacts of tropical cyclones still posed a severe threat to the economies of many affected countries and that further efforts were necessary, particularly in the area of disaster prevention and preparedness, to minimize the loss of lives and property. The Secretary-General assured the session of the continuing support of WMO, through its Tropical Cyclone Programme, to the Panel and the Committee. He also elaborated on WMO's long-term activities that were geared towards achieving the goals of the IDNDR and cited the Organization's endeavor to emphasize the need to address natural disasters in its contributions to the preparatory process of the United Nations Conference on Environment and Development to be held in Brazil in June 1992. The Secretary-General thanked UNDP for its past support and hoped that it would continue in the coming years. He also thanked ESCAP for its co-operation and wished the session every success in its deliberations.

7. The statement of Mr. S.A.M.S. Kibria, Executive Secretary ESCAP was delivered by Ms. Seiko Takahashi, Deputy Executive Secretary. After thanking the hosts and welcoming the participants, she recalled that ESCAP had played an important role in mitigating water-related natural disasters over the last 45 years. ESCAP had assisted in establishing both the Typhoon Committee and the Panel on Tropical Cyclones and would continue to work closely with both of these important bodies. Since 1990 ESCAP had continued its earlier work on flood prevention and disaster reduction under the umbrella of the IDNDR. The Decade had officially been launched in the ESCAP region at the ESCAP/UNDRO Regional Symposium on the Decade in February 1991. The disaster managers and specialists gathered there had put together a plan of action and recommendations for disaster reduction, many of which were specific to water-related natural disasters. Other relevant activities of ESCAP in reducing water-related natural disasters were outlined; all of them had been carried out in cooperation with one or more of ESCAP's sister organizations in the United Nations system. ESCAP was most grateful for the excellent support received from all these United Nations bodies.

8. Despite the efforts of all the United Nations agencies, however,

cyclones, typhoons and other water-related natural disasters had caused major damage in Bangladesh, the Philippines, China, Viet Nam and several Pacific Island nations during 1991. The Members of the Panel on Tropical Cyclones and the Typhoon Committee had an enormous amount of work to do, involving cooperation in improving emergency facilities and early warning systems, flood protection measures and training programmes. The current session provided a unique opportunity for the Members of the Panel and the Committee to exchange experience and improve regional cooperation on disaster mitigation from the Pacific Ocean to the Indian Ocean. She expressed ESCAP's appreciation for the long-standing financial support of the UNDP for the work of these two bodies, and the valuable support and cooperation of the WMO.

9. Mr. Roungroj Sriprasertsuk, Deputy Permanent Secretary, Ministry of Transport and Communications of Thailand, welcomed all the participants to Pattaya. He said that the world currently paid much attention to climate and environment-related issues. Thailand was interested in activities related to the prevention and mitigation of natural disasters, and to the mitigation of harmful effects of tropical cyclones and related phenomena, especially in the context of the IDNDR. He mentioned that, for example, in 1989 Typhoon Gay was responsible for the death of 602 people and damage worth over US$ 450 million in Thailand. He hoped that the Members of the Panel and the Committee would take serious action to minimize the disastrous effects of cyclones, typhoons and storm surge, and that these bodies would continue to serve as a useful forum to exchange views and suggest new activities for cooperative action in mitigating disasters. He expressed his appreciation to UNDP for its financial support and acknowledged the substantive assistance and co-operation of WMO and ESCAP in past years and looked forward to their support in the years ahead.

Election of officers (agenda item 1.2)

10. The following persons were unanimously elected officers of the session: Chairman, Mr. F. M. Qasim Malik (Pakistan); Vice-Chairman, Dr. Patipat Patvivatsiri (Thailand); Chairman, Subcommittee A (Panel on

Tropical Cyclones), Dr. S. Kumar (India); Chairman, Subcommittee B (Typhoon Committee); Dr. Takashi Nitta (Japan); Chairman, Drafting Committee, Mr. P. Sham (Hong Kong).

Adoption of the agenda (agenda item 1.3)

11. The session adopted the agenda attached as appendix II.

Establishment of subcommittees and working arrangements for the session (agenda items 1.4 and 1.5)

12. Two subcommittees were established by the session: Subcommittee A to discuss agenda items specifically relevant to the Panel on Tropical Cyclones and Subcommittee B to discuss items of interest to the Typhoon Committee. The Subcommittees were to meet consecutively, since many of the topics to be discussed were of interest to the session at large. The working arrangements for the session were outlined by the representative of WMO.

II. ANNUAL PUBLICATIONS (agenda item 2)

Typhoon Committee Annual Review, 1990 (6th edition) and Committee Newsletter, 3rd issue (agenda item 2.1)

13. The session was pleased with the publication of the Typhoon Committee Annual Review, 1990 (TCAR 90) and the third issue of the Newsletter by the Typhoon Committee Secretariat (TCS). Copies had been distributed to Members of the Typhoon Committee and also to participants at the current session. It commended the chief editor Mr. Edwin S.T. Lai (Hong Kong), and the national editors on their excellent work in the preparation and printing of TCAR 90. It was noted that the Regional/Specialized Meteorological Centre (RSMC)-Tokyo also issued an annual report. It was suggested that future issues of TCAR should avoid duplication of contents with those in the RSMC annual report. It was also suggested that the Typhoon Committee newsletter should indicate in the heading the date of the publication. These suggestions

were agreed upon by the session.

14. Typhoon Committee Members requested the Royal Observatory, Hong Kong to continue to make available the services of a chief editor during the coming year. The representative of Hong Kong assured the Committee that he would do his best to meet the request. He remarked that, as printing costs in Hong Kong had sharply increased, he foresaw that soon it might not be feasible to print the publication there. After some discussions on the budgeting for the TCAR, the session agreed that the TCAR and newsletter should continue regardless of the outcome of the regional project proposal which had been submitted to UNDP.

Panel News 1991 (agenda item 2.2)

15. The Coordinator of the Technical Support Unit (TSU) presented the Panel News 1991 to the joint session. He highlighted the various aspects covered in the publication and noted with appreciation the generous financial support of UNDP for the publication. The session expressed satisfaction for the quality of the material in the publication and commended the TSU on its work. It was suggested that future issues should include the date of issue on the cover as well as the dates on which the country reports had been received. The point was noted by TSU for future guidance.

16. The WMO Secretariat informed the session about uncertainties of future funding for regional projects from UNDP and urged Members to seek alternate financial support for continuing activities of the Panel and the Committee, including annual publications. The session praised the past role of UNDP and hoped for future UNDP support of the projects. It was felt that, in the absence of other sources of funds, WMO might bring out these publications, perhaps under its Tropical Cyclone Programme (TCP) series.

III. REVIEW OF THE 1991 TROPICAL CYCLONE/TYPHOON SEASON

(agenda item 3)

Review of the 1991 Tropical Cyclone Season
RSMC-tropical cyclones New Delhi

17. In Subcommittee A, the delegate of India presented the report of RSMC-tropical cyclones New Delhi. He mentioned that eight cyclonic disturbances had formed over the north Indian Ocean during 1991, out of which five disturbances intensified into depressions and three into cyclones. All of them originated over the Bay of Bengal and none over the Arabian Sea. He also reported to the subcommittee that the year 1991 was the sixth consecutive year when no tropical cyclone actually formed in the Arabian Sea. This was the first time such a unique situation had occurred over the Arabian Sea during the last 101 years (1891-1991). He referred to the service rendered by RSMC New Delhi to the Bangladesh Meteorological Department (BMD) through the issuance of advisories during the period of the 29-30 April 1991 cyclone. He provided other details of the operation of RSMC New Delhi. Delegates from Panel Members, while appreciating the great value of the advisories provided by RSMC New Delhi, requested the Centre to increase the frequency of such advisories from six-hourly intervals to three-hourly and even hourly intervals for an approaching cyclone. The session was informed that storm advisories issued by RSMC New Delhi were based on INSAT imageries, synoptic surface and upper air charts and their prognostications; hence, the issuing of advisories at less than six-hourly intervals might be difficult. The session also suggested that issuance of satellite bulletins at hourly or three-hourly intervals might partially meet the requirement. The delegate from India was requested to bring these requests to the attention of RSMC New Delhi.

18. A summary of the 1991 cyclone season, based on the RSMC New Delhi report provided to the session, is given in appendix III.

Review of the 1991 Typhoon Season
RSMC Tokyo-Typhoon Centre

19. In Subcommittee B, RSMC Tokyo-Typhoon Centre reported that a total of 29 tropical cyclones (listed as 17 typhoons, six severe tropical storms and six tropical storms) formed in the north-western Pacific area during the period under review. The number of formations in November, with a total of six, was the largest on record since 1951. Typhoon Yuri (9128) had achieved the strongest intensity for the year with a minimum central pressure of 895 hPa and maximum wind speed of 120 knots while Tropical storm Thelma (9125) caused the greatest loss of lives in the Philippines.

20. RSMC Tokyo disseminated routinely to Typhoon Committee Members a full range of analysis and prognosis products, including advisory for analysis, advisory for forecast, and prognostic reasoning.

21. It also published and distributed to Members the Annual Report on Activities of the RSMC Tokyo-Typhoon Centre (1990), and initiated in 1991 the "Monitoring of Exchange of Information" as mandated in Chapter 6 of the Typhoon Committee Operational Manual--Meteorological Component. The RSMC Tokyo also compiled and distributed a "quick-look data set" for the SPECTRUM observations.

22. RSMC Tokyo planned to reduce by 90 minutes its lead time delivery of product dissemination by March 1992. By June 1992, it would issue an "advisory for tropical cyclones" which would comprise an integration of the present "advisory for analysis" and "advisory for forecast". At the same time it would provide Members with "advisory for tropical cyclone", "prognostic reasoning" and "forecast by numerical typhoon model" for all disturbances expected to develop within 24 hours. It planned to produce a new annual publication series tentatively entitled "RSMC Tokyo-Typhoon Centre Technical Note". The first issue would appear in 1992, covering the tropical cyclone tracks in the western North Pacific from 1951 to 1990, and would be distributed to all the Committee Members.

23. The Implementation Plan of RSMC Tokyo-Typhoon Centre for the period 1991 to 1994 is given in appendix IV. A summary of the 1991

typhoon season based on the national reports provided to the meeting is given in appendix V.

IV. NATIONAL REPORTS ON ACTIVITIES AND DEVELOPMENTS DURING 1991 UNDER THE REGIONAL COOPERATION PROGRAMMES (agenda item 4)

24. The session reviewed and evaluated in detail the activities of the Members of the Panel on Tropical Cyclones and the Typhoon Committee during 1991 under the meteorological, hydrological, disaster prevention and preparedness, training, and research components of its programme. It was pleased to note that Members had achieved considerable progress and had continued to undertake, with the assistance of WMO, ESCAP, TCS and TSU, activities called for by its Regional Cooperation Programme. The Members agreed that these detailed reports would be submitted for publication in TCAR and Panel News and that, for the purpose of the session, would only be summarized.

25. In the meteorological component, the session appreciated the invaluable contributions and services of RSMC Tokyo-Typhoon Centre, and the RSMC tropical cyclones New Delhi to the Members. These were summarized in agenda item 3, Review of 1991 tropical cyclone/typhoon season.

26. The upgrading, replacement, relocation and rehabilitation of meteorological radars were prominently reported in the activities of most Typhoon Committee and Panel Members, while a shift to automated systems for gathering data (automatic weather stations and upper-air observations) was noted along with the continued trend in achieving greater speed (and/or expanded capabilities) in telecommunications, computers, satellite systems, and limited-area numerical weather prediction models. The microcomputer-based AFDOS system provided by China to the Maldives and Myanmar allowed for automation of the analysis and forecast services of those countries through direct connection to the Global Telecommunications System (GTS).

27. The session thanked Japan for providing meteorological satellite information by operating a Geostationary Meteorological Satellite (GMS-

4) and the United States for providing information from the polar-orbiting satellite launched by the National Oceanographic and Atmospheric Administration (NOAA).

28. The session noted with regret that the Indian Ocean region was still one of the few areas on earth not covered by an operational geo-stationary meteorological satellite, which would provide data to all countries of the region in real time. This was regrettable, since countries of that region continued to suffer the greatest losses from tropical cyclones in terms of lives and property. For the global observing system, it was considered important to have satellite coverage of the area, since it encompassed one of the crucial energetic zones of the general circulation, including the major monsoon areas. The session requested WMO to take urgent note of this shortcoming and to use its influence to remedy the situation.

29. 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, in spite of some very tragic events, such as the eruption of Mount Pinatubo and flash floods in the Philippines.

30. The session was informed that the TCS had organized the pre-session meeting of the hydrological component in cooperation with ESCAP and WMO on 17 February 1992. The meeting discussed, among other things, a proposal by the TCS hydrologist of the project Improving Dam Water Release Operation System. A brief report of the meeting was presented to the session, and its recommendations were considered under the appropriate agenda items.

31. The session expressed appreciation for the completion and distribution to Members of the Japanese references concerning comprehensive flood loss and mitigation. That activity had been initiated by TCS with the support of the Japanese Government. The session urged the Committee Members to take steps to implement the concepts and principles contained in the Manual and Guidelines for Comprehensive Flood Loss Prevention and Management produced by ESCAP.

It was hoped that these would be widely applied to other regional bodies such as the Panel on Tropical Cyclones.

32. The session was pleased to note the various substantive services of ESCAP to members of the Typhoon Committee. These included a programme of roving seminars to eight Typhoon Committee Members under the comprehensive flood loss prevention and management project, ESCAP/UNDRO Regional Symposium on IDNDR, Workshop on Forecasting, Preparedness and other Operational Measures for Water-related Natural Disaster Reduction, and the project on urban flood loss prevention and mitigation in the ESCAP region.

33. Members reported that they continued to upgrade the capabilities of their disaster prevention and preparedness (DPP) agencies through the conduct of seminars and training courses for their staff, local governments and non-governmental organizations (NGOs). Publications on DPP were widely disseminated to promote public information and education. Further access to information was expanded through the print and broadcast media, telephone, telex and facsimile services, whenever practicable.

34. In connection with the IDNDR, the session recognized a strong need to improve communication between national committees and the Scientific and Technical Committee of IDNDR. For this reason, the Members were urged to create, without much delay, their national committees on IDNDR if they had not yet done so. The Philippines mentioned that its National Disaster Coordinating Council (NDCC) had been designated as National Committee for IDNDR. It was pointed out, moreover, that IDNDR, at national or international level, should involve every sort of discipline, and policy makers as well, in order to ensure success. It was envisioned that by the end of the Decade, countries would have developed their capabilities to cope with natural disasters.

35. Members continued to take advantage of a number of training grants, both from within and outside the region, in the fields of meteorology, hydrology, and disaster prevention and preparedness. Some Members had also continued to conduct symposia, workshops and training

courses for their own staff and for ordinary citizens with the aim of creating an atmosphere of mutual trust and cooperation conducive to mitigating damage caused by natural disasters.

36. The session appreciated China's initiative to increase activities under TCDC arrangements, through a roving mission to some Committee members in January 1992 to discuss and acquire more in-depth information on how best to arrange matters concerning technical cooperation and typhoon and tropical cyclone forecasting.

37. In reviewing the long lists of training in which the Members had participated, the session recorded its gratitude to the Governments of Australia, Canada, China, Hong Kong, India, Ireland, Japan, the Netherlands, the Philippines, the Russian Federation, Singapore, Thailand, the United Kingdom, and the United States for offering their training facilities to Members, and likewise recorded its gratitude to the European Community and UNDP for sponsorship of some of the training.

38. Many reports continued to highlight SPECTRUM in the national research programmes. Members were now conducting research, utilizing the data gathered. The SPECTRUM Research Coordinating Group (SRCG) had been formed in May 1991 to oversee the coordination of follow-up activities with regard to data and research. The session thanked Japan and China for hosting the SPECTRUM Technical Conference and Steering Group Evaluation Meeting (10-13 December 1990, Japan) and SPECTRUM Technical Conference (25-29 November 1991, China), respectively, both of which had been organized by WMO.

V. COORDINATION OF ACTIVITIES (agenda item 5)

Coordination within the Tropical Cyclone Programme (agenda item 5.1)

39. The session expressed its appreciation to the WMO secretariat for having presented at the plenary meeting the comprehensive report on the latest implemented activities within the framework of the Tropical Cyclone Programme (TCP). It noted with interest the accomplishments made both in the general and regional components of the TCP. The session noted with satisfaction two publications in the TCP series: the Papers Presented at the First SPECTRUM Technical Conference (Tokyo, Japan, 10-13 December 1990) as TCP-27 and Tropical Cyclones and their Forecasting and Warning Systems in the North Indian Ocean as TCP-28. It urged WMO to finalize the meteorological sections of the draft report on the TCP Project No.14, Public Information and Education, and to publish it in the TCP series as soon as possible.

40. The session recognized the importance and benefits of interregional coordination and cooperation. It suggested that WMO promote an exchange of meteorological application software on tropical cyclone forecasting services as a means to strengthen the collaboration among the five regional tropical cyclone bodies.

41. The representative of the RA IV Hurricane Committee, Mr. J. Jarrell (United States) presented information on activities being implemented by that committee. The session noted with interest the activity specifically on a satellite-based communication system, providing two-way point-to-multipoint communications between the World Meteorological Centre (WMC) - Washington, and National Meteorological Centres (NMCs) within the area of coverage of the telecommunication satellite. The session expressed its appreciation for his attendance at this joint session and for his presentation.

42. The session was pleased to be informed that WMO was planning to organize in late 1992 a technical co-ordination meeting on operational tropical cyclone forecasting and dissemination of results by RSMCs. Discussions at the meeting would include a uniform terminology for and classification of tropical cyclones as a major agenda item.

43. The session felt that TCP activities should be intensified in the 1990s, in association with the IDNDR as set out in the Third WMO long-term plan.

44. It was felt that the current joint session of the Panel and the Committee was a significant step toward strengthening cooperation

between the two regional tropical cyclone bodies. Coordination of programmes and activities of the two bodies could be further enhanced through frequent exchange of information between the TCS and the TSU. To this effect the session agreed that the existing focal point system of meteorological, hydrological and disaster prevention and preparedness components for the Typhoon Committee should be extended to the Panel on Tropical Cyclones. The session further agreed that activities under TCDC arrangements should be promoted among all Members of the Panel and the Committee, for example, provision of consultancy services, forecasters' attachment to advanced centres, group training events, exchange programmes for forecasters and study tours.

Coordination of activities common to the Panel and the Typhoon Committee (agenda item 5.2)

(a) Standardization of Nomenclature

45. The meeting reviewed the status of nomenclature used in the classification of tropical cyclones in all five regional tropical cyclone areas. The meeting noted that this was a complex subject which had been considered in numerous meetings, not only of the Panel on Tropical Cyclones and the Typhoon Committee, but also of the RA IV Hurricane Committee, WMO Regional Associations and Technical Commissions, including the Commission for Marine Meteorology and the Commission for Aeronautical Meteorology.

46. 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.

47. The meeting emphasized that the issuance of warnings was the prerogative of individual countries and that no attempt should be made to standardize either local warning signals or terminology used in local warning bulletins. Standardization of terminology used in products issued from the various RSMCs was desirable and the effort should be concentrated on this aspect of the problem.

48. After a long discussion, the meeting agreed that the issue should be further considered and carefully analyzed during the Technical Coordination Meeting on Operational Tropical Cyclone Forecasting and Dissemination of Results by RSMCs planned for late 1992. At that meeting there should be input from the marine and aviation user communities.

49. The session suggested that the following items should be considered as part of the study:

(a) The standardization of the averaging period for surface wind speed, since the classification scheme would be based on wind speed criteria.

(b) A classification of "Super Tropical Cyclone" (Typhoon, Hurricane, etc), as suggested by the delegate of China, since the possible wind speed range above 64 knots was very large and major cyclones with winds exceeding 100 knots were not uncommon. The exact threshold for such a classification should be carefully considered.

(c) A proposal submitted by the representative of the WMO Commission for Atmospheric Science (see appendix VI) that might be used in considering the nomenclature. The outcome of the Technical Coordination Meeting would then be available to the Tropical Cyclone Programme regional bodies and to the WMO Technical Commissions and Regional Associations. Following consideration by these bodies, proposals regarding recommended standardized terminology would then be formulated and considered on a global basis.

Meteorological Telecommunications

50. The session considered that the improvement of telecommunications was the highest priority activity in the effort to improve the operations of the Tropical Cyclone Programme in the regions of both the Panel on Tropical Cyclones and the Typhoon Committee.

51. The meeting was encouraged by the report from RSMC Tokyo that there had been a slight but significant improvement in the operation of the GTS and the observing system based on the results of the 1991

monitoring.

52. The meeting endorsed the proposals and recommendations of the RA II Typhoon Committee Training Workshop on Telecommunications and the Implementation Coordination Meeting on the GTS (Bangkok, December 1989), the RA V Tropical Cyclone Committee Implementation Coordination Meeting on the GTS (Melbourne, March 1991) and the Working Group on Planning and Implementation of the World Weather Watch (WWW) in Region II (Tokyo, September-October 1991).

Global Maritime Distress and Safety System (GMDSS)

53. The meeting was informed of the implementation of this new WMO system for the preparation and dissemination of meteorological forecasts and warnings for the high seas. The representative of Japan announced that Japan had implemented its message issuing services for its area of responsibility as part of the provisional test of the system that started on 1 February 1992. It was also mentioned that Japan would implement the system on an operational basis from 1 August 1992 after consultation with Hong Kong and possibly other concerned WMO Members. Concern was raised by the delegate of India regarding the telecommunication links that were required to receive messages from centres in Kenya, Reunion and Mauritius that in turn would be issued by India for area VIII in the GMDSS. It was proposed that the areas of responsibility of issuing services should be studied and possibly adjusted so that dependence on complicated telecommunication links could be avoided. As new Regional/Specialized Meteorological Centres became operational, such adjustments could logically evolve. Concern was also expressed regarding the administrative arrangements for the cost of the transmissions made by issuing services, especially for those messages originating in other centres. The meeting noted the need for clarification of funding mechanisms within the GMDSS.

Cyclone Operational Experiment (CYOPEX)

54. The meeting was informed of the draft plans for the Cyclone Operational Experiment. The meeting suggested that, based on the experience of SPECTRUM, the experiment should have some well defined

objectives.

(b) Hydrological Component

55. The session was informed of the most recent developments with respect to the new Management Overview of Flood Forecasting Systems (MOFFS).

56. The session learned with interest that the three other WMO tropical cyclone bodies had also recommended MOFFS for use by their members; this was seen as a distinct advantage, as it would greatly facilitate the exchange of experience on flood forecasting among the various regions. The session welcomed the action by the WMO secretariat inviting all the WMO regional tropical cyclone bodies to designate flood forecasting systems to be monitored using the MOFFS rating system. The session was pleased to learn that India, Malaysia, the Philippines, the Republic of Korea and Thailand among Members of the Panel and the Committee had done so. It urged all Members operating such systems, who had not as yet designated river basins or river reaches, to do so.

57. The session was informed that the WMO Secretariat would shortly be circulating a summary register of the flood forecasting systems designated under MOFFS, requesting those responsible for the individual systems to prepare and submit rating tables where they have not yet done so. The session noted with interest that consultations on the application of MOFFS in South-east Asia would be held in Kuala Lumpur on 28 and 29 February 1992. The outcome of such discussions would be the formulation of proposals for improvements to MOFFS.

58. The ESCAP representative informed the Session of the activities of his organization under the hydrological component. He noted that the publication "Urban Flood Loss Prevention", covering recommendations for eight cities in the Typhoon Committee area, had been published and distributed. ESCAP had also produced and distributed the Manual and Guidelines for Comprehensive Flood Loss Prevention and Management. A very large number of requests had been received for the latter

publication from within and outside the region. The publication had already been translated into the Korean language and 800 copies had been distributed in the Republic of Korea. Representatives of some Panel member countries pointed out that they had not yet received copies of the Manual and Guidelines. It was agreed that, when the publication was reprinted, copies would be sent to participants of the session and concerned government departments. The representative of China informed the session that the Manual and Guidelines would soon be translated into Chinese and widely distributed in that country.

59. The ESCAP representative reported on the programme of roving seminars in eight Typhoon Committee Members (Thailand, Malaysia, Philippines, Republic of Korea, Hong Kong, China, Lao People's Democratic Republic and Viet Nam) organized to introduce the Manual and Guidelines and the concepts of and principles of comprehensive flood loss prevention and management. Panel member countries expressed their interest to receive such roving seminars in their countries. The representative noted that ESCAP had already initiated action on the subject, which he would elaborate under agenda item 7. He also reported advisory missions to the Philippines and Cambodia.

(c) Disaster Preparedness and Prevention Component

60. The representative of ESCAP informed the session of the ESCAP/UNDRO Regional Symposium on IDNDR held at Bangkok from 11-15 February 1991, attended by representatives from 22 countries of the ESCAP region, including nine from the Committee Members and five from Panel Members. The Symposium had covered the subject of water-related natural disasters, including droughts, as well as geological disasters, and had formulated a plan of action and recommendations. The session was also informed of the Workshop on Forecasting, Preparedness and Other Operational Measures for Water-related Natural Disaster Reduction, organized by ESCAP in Bangkok from 29 April to 3 May 1991 as a follow-up IDNDR activity, attended by 11 ESCAP member countries concentrating on water-related natural disasters. The session requested that those two reports be sent to each of the participants. The Session expressed its appreciation to ESCAP for its work under

those two components and urged that such work continue in the future. At this juncture some delegates referred to some problems as well as to implementation programmes on disaster preparedness and prevention in their respective countries.

61. The representative of UNDRO presented an account of the organization's activities in disaster prevention and preparedness in the region. With the advent of IDNDR, UNDRO had been entrusted with an increased level of responsibility in assisting the countries in their efforts to mitigate disasters.

62. The representative of IFRC stated that the Federation continued its traditional assistance to countries stricken by natural disasters and these services would continue well into the future.

63. The session was also informed of the work of the Asian Disaster Preparedness Centre located at the Asian Institute of Technology.

Training

64. The joint session reviewed involvement of the Members of the Panel and the Committee in the various education and training activities sponsored by UNDP, WMO/Voluntary Co-operation Programme (VCP), WMO Regular Budget and under TCDC arrangements.

65. Since the last sessions of the Panel and the Typhoon Committee, the Members had benefitted from WMO's education and training activities relating to the relevant training courses, workshops and seminars, the award of fellowships, study tours, preparation of training publications and provision of advice and assistance to the Members.

66. The Members noted with satisfaction that during 1991, 87 fellowships had been awarded to the Members under the WMO Programmes. The session was further informed of the status of fellowship candidatures being considered under VCP. The Joint Session expressed appreciation for the number of training courses and workshops organized, in particular for those events which were of direct

relevance to tropical cyclones, such as the Training Course in Monsoon Meteorology (Pune, India), Advanced Training Course on Numerical Weather Prediction (European Centre for Medium Range Weather Forecasts), Training Course on Hydrological Forecasting (University of California) and WMO/UNDP Regional Training Workshop on Tropical Cyclone Analysis and Forecasting (Fiji). The session further noted the list of training events to be organized during the biennium 1992-1993.

67. The Members were pleased to note that training workshops on Marine Meteorology, Computerized Data Processing and Radar Meteorology were being organized during 1992 under the WMO/UNDP Regional Project, Training in Meteorology for Manpower Development in Asia and South-West Pacific. Members were also informed that the Fourth Regional Workshop on Asia/African Monsoon would be held in Kuala Lumpur, Malaysia in October 1992 and that a Workshop on Tropical Cyclone Analysis and Forecasting would be hosted by China in 1993.

68. The session was pleased to note that several Members offered their national training facilities to other Members under bilateral arrangements. These cooperative efforts by the Members had been found very useful by the recipient countries, and the session strongly recommended that such endeavors should continue in the future.

69. Bangladesh and Pakistan requested an expert to visit their services and assist in implementing the application software for the Micro Vax II computers which had been installed under the Regional Computer Network (RCN). Bangladesh also requested that the training programme on computer technology and programming be organized in a location where more candidates could participate and benefit from the training. A course in the Panel region would be desirable. India requested that the training programme on winds and ocean wave forecasting which had been pending since 1987 should be considered as a high priority. The WMO secretariat took note of these requests.

70. The high priority training requirements of some of the Members were indicated during the session; these are listed in appendix VII.

(e) Research

71. The session recalled that the Eleventh Congress of WMO had encouraged further collaboration and exchange among research scientists and operational experts in the field of tropical cyclones. It noted that the the Third WMO/International Council of Scientific Unions (ICSU) International Workshop on Tropical Cyclones, approved by the forty-third session of the Executive Council, would be an excellent opportunity to accomplish such collaboration.

72. The session was informed of the establishment of an International Committee for the Third International Workshop on Tropical Cyclones, chaired by Mr. Jerry Jarrell (USA). It was pleased to confirm the designation of Professor Chen Lianshou (China) as representative of the ESCAP/WMO Typhoon Committee on the International Committee. The co-sponsorship offered by ICSU was welcomed as an important contribution to IDNDR.

73. The session noted the important role brought into research activities by IDNDR and welcomed the proposal made by ICSU for WMO co-sponsorship of a symposium on tropical cyclones in Beijing in October 1992. It recommended that forecasters, involved in research activities on tropical cyclones, be invited as well as research experts. The session welcomed the proposal by ICSU to contribute to IDNDR through the establishment, in coordination with WMO, of an Asian centre for tropical cyclone research and forecasting. The session felt that existing research activity centres in the region should be considered first as candidates to co-locate the proposed centre.

74. The session noted with satisfaction the on-going research activities based upon the Special Experiment Concerning Typhoon Recurvature and Unusual Movement in 1990 (SPECTRUM-90) and reported on the Technical Conference on SPECTRUM (Guangzhou, 25-29 November 1991). It encouraged the use of data sets collected from field experiments in 1990 including SPECTRUM-90 and Tropical Cyclone Motion (TCM-90).

75. Professor Russell Elsberry (the United States), CAS representative, presented at the plenary session a detailed concept of the so-called "Drone Reconnaissance". The session expressed its deep appreciation for his excellent presentation and fully endorsed the investigation, by a newly established Sub-Committee of CAS, on Drone Reconnaissance, for developing an observational system with unmanned aircraft. Appendix VIII contains a summary of his presentation, entitled Review of Advancements in Unmanned Aircraft Technology with Potential Application to Tropical Cyclone Reconnaissance. The session also expressed its gratitude for the efforts being made by Professor Elsberry as the Rapporteur for Tropical Cyclones, WMO/CAS Group of Rapporteurs for Tropical Meteorology.

VI. REVIEW OF THE TROPICAL CYCLONE OPERATIONAL PLAN AND THE TYPHOON COMMITTEE OPERATIONAL MANUAL (agenda item 6)

Tropical Cyclone Operational Plan (agenda item 6.1)

76. The Panel examined in depth and discussed the Tropical Cyclone Operational Plan for the Bay of Bengal and the Arabian Sea, which was issued as a new edition in 1991 in the TCP series (TCP-21). The session noted that RSMC-tropical cyclones New Delhi agreed to issue a satellite bulletin based on INSAT-1D pictures every three hours instead of every six hours. This and other amendments to the Operational Plan adopted by the session appear in appendix IX.

77. The session urged the Panel members to make further additions, modifications and changes as appropriate to the annexes to the Plan and submit them to the WMO secretariat to be incorporated in the updated plan. The session requested the Secretary-General of WMO to issue a supplement to the Operational Plan as soon as possible, resulting from the outcome of its review.

Typhoon Committee Operational Manual (agenda item 6.2)

78. The session approved with minor amendments the report of the rapporteur of the Typhoon Operational Manual, Mr. Haruo Ohnishi, whose

services had been kindly provided by the Japan Meteorological Agency since late 1990. Amendments to the Manual are attached as appendix X.

79. The Members expressed their appreciation for the fine job of the rapporteur and were grateful that Japan could provide the services of a rapporteur for the coming year as well. WMO assured the Members that an amended copy of the Manual could be made available by May 1992.

VII. REVIEW OF THE PROGRAMME FOR 1992 AND BEYOND (agenda item 7)

International Decade for Natural Disaster Reduction (IDNDR) and other activities (agenda item 7.1)

80. The session was informed of developments as regards the IDNDR. It noted the adoption by the Eleventh WMO Congress of a WMO Plan of Action for the IDNDR and the decision of the WMO Executive Council at its forty-third session that in 1993 it would review progress on implementation of the Plan of Action at its forty-fifth session.

81. As regards the projects being undertaken by WMO as specific contributions to the IDNDR, the session welcomed the initial steps that had been taken to launch the projects on comprehensive risk assessment and on a system for technology exchange for natural disasters at the global level.

82. The ESCAP representative informed the session that water-related natural disaster reduction activities had been included in ESCAP's Medium Term Plan for the period 1992-1997. ESCAP had prepared some project proposals which had been circulated to potential donors. One such project was Roving Seminars on Comprehensive Flood Loss Prevention and Management, which would be a continuation of such seminars earlier fielded to Typhoon Committee Members. The other project was Regional Training in Cyclonic Storm Hydrology which, if funded, would cover all the Panel and the Committee Members.

83. The session fully supported these programmes on the IDNDR for 1992 and beyond, urged the donor countries to give positive consideration

for funding of the project proposals and appealed to the ESCAP Commission to support an expanded level of activities on water-related natural disaster reduction in line with the goals of the Decade.

84. The session recognized the importance of national activities in furthering the aims of the Decade and encouraged Members of the Panel and the Committee to play an active role in such activities in the Asia region.

85. In the context of IDNDR, India had identified both short and long term disaster mitigation measures. To formulate a National Action Plan for IDNDR, the India Meteorological Department (IMD) had provided inputs to its four national-level IDNDR committees. An Expert Group had been constituted by the Government, with the Director-General of IMD as its Chairman, to look into the scientific requirements for mitigating some of the natural disasters in India. The national Government had also constituted a National Advisory Council on IDNDR to make specific recommendations to the Government on public policies and programmes.

86. In Thailand, the Relief Division of the Thai Red Cross Society had organized training programmes on emergency health management after natural disasters for personnel from the Thai Red Cross and other Government organizations, and it had given first-aid and disaster preparedness training to over 5,600 people concentrated in disaster-prone areas in 1991. The "Sirindhorn" Red Cross Health Station had been established at Thung Song district in Nakorn Sri Thammarat Province. This station would be the largest health station and the relief supply centre for the whole of southern Thailand, the most natural disaster-prone area of the country.

87. In Japan, an International Conference on IDNDR would be held from 27-30 November 1992 at Chiba City. The aims of the Conference included: the exchange of new ideas and experiences concerning natural disaster reduction, focusing on countermeasures against typhoons and flood; and international cooperation for development of effective knowledge transfer among disaster-prone countries. Participants would include senior-level people directly involved in disaster prevention

and management including policy planners, administrators and researchers, journalists and private enterprise executives and leaders of NGOs, from the developed and developing countries, and representatives of international organizations.

88. The Government of the Republic of Korea had inaugurated the "IDNDR Korean Committee" on 10 December 1991 under the chairmanship of the Minister of Home Affairs with membership from 17 relevant ministries. In addition to the national disaster mitigation plan, new programmes had been prepared for IDNDR, including strengthening research capabilities for minimizing natural disasters, and observing the International Day for Natural Disaster Reduction with seminars, meetings, awards, etc.

89. The delegation of Bangladesh informed the session that a National Disaster Prevention Council, chaired by the Executive Head of the Government of Bangladesh, had already been formed with functional responsibilities in the field of coordination of plans and action related to the forecast of natural disasters, disaster management and post-disaster relief and rehabilitation work.

Coordinated Technical Plan of the Panel (agenda item 7.2)

90. The session reviewed in detail the Panel's Coordinated Technical Plan, focusing on progress at the national and regional levels in each of the three major components of the Panel's Regional Co-operation Programme, namely in meteorological, hydrological and disaster prevention and preparedness components, as well as in the supporting components of training and research. The updated Plan adopted by the session, which was designed to develop the future facilities and services concerning tropical cyclone forecasting and warning systems in the Bay of Bengal and the Arabian Sea, is given in appendix XI. The Plan includes the maintenance and training activities within the RCN project.

Typhoon Committee Regional Cooperation Programme Implementation Plan (agenda item 7.3)

91. The Committee, in consideration of its programme for 1992 and beyond, reviewed and adopted, with amendments and addenda, the Typhoon Committee's Regional Cooperation Programme Implementation Plan. The updated Plan as adopted by the Committee is contained in appendix XII.

92. The session was informed of Viet Nam's kind offer of its Tropical Meteorology and Tropical Cyclones Research Centre for members who may be interested to work there and avail themselves of its facilities and data gathered over the years from aircraft and ships in the South China Sea. The session appreciated this offer.

93. The delegate of China informed the session that his country would organize a training course on the analysis and forecast of tropical cyclones in 1993 which would be open to Members of the Typhoon Committee and Panel on Tropical Cyclones. In addition, the Government of China would like to host a second international technical conference on SPECTRUM by the end of 1993 and to host cooperative research with experts from Typhoon Committee Members in 1992 with aid from national and external sources. The session thanked the Government of China for those generous offers.

94. In reviewing the report of the SPECTRUM Technical Conference in China (November 1991), the session approved in principle its recommendations and recorded its appreciation for the invaluable support and input of TCM-90, TYPHOON-90, RSMC Tokyo-Typhoon Centre, JMA, and CAS to the activities of SPECTRUM in particular, and to the Committee in general. SRCG was requested to formulate a more specific plan on its proposed short- and long-term research objectives for the Committee.

95. The delegate of Hong Kong suggested the inclusion of a study on typhoon-related wind climatology. The proposal was welcomed, and it was reported that a similar study was being undertaken in China. The session agreed that the results of those studies would be published

under the TCP series of publications.

96. The TCS hydrologist introduced to the session his preliminary project proposal with the tentative title of "Improvement of Dam Water Release Operation System". The session was informed that the project would start with a questionnaire to be sent to concerned countries to gather information on the current practices and the requirements of the countries in the region. The ESCAP secretariat would assist with the project.

VIII. SUPPORT REQUIRED FOR THE REGIONAL CO-OPERATION PROGRAMMES (agenda item 8)

Arrangements for the Technical Support Unit (agenda item 8.1)

97. Members expressed satisfaction that the TSU, located in Dhaka, Bangladesh continued to function effectively. The session expressed its deep appreciation to the Government of Bangladesh for providing the host facilities including the services of a full-time meteorologist. The Members thanked the Coordinator, Mr. M.H. Khan Chowdhury, Director of Bangladesh Meteorological Department, for his able leadership and guidance and to Mr. B. Boros Djevi for the excellent services he provided during his tenure.

98. The Members considered the continuation of TSU necessary and, at the request of the Members, Bangladesh agreed to continue to provide the host facilities including the services of a full-time meteorologist during the interim period until a permanent staff was appointed. Mr. M.H. Khan Chowdhury agreed to continue to act as the Coordinator.

99. As regards the operating expenditures of the TSU, the Members were of the view that it might not be possible to provide financial support from their Governments. However, considering that the continuation of the TSU was of utmost importance, and that the amount required was very modest (of the order of US$ 2500 per year), the Members strongly urged WMO and ESCAP as sponsoring organizations to provide the necessary funds if UNDP or other technical cooperation project resources were not

available.

Arrangements for the Typhoon Committee Secretariat (agenda item 8.2)

100. The Members expressed satisfaction that the TCS, located in Manila since its inception in 1971, continued to function very effectively. The session expressed its deep appreciation to the Government of the Philippines for providing the host facilities continuously. The Members thanked Dr. R.L. Kintanar for his contribution and guidance as the Coordinator.

101. The session considered the staffing of TCS and was very pleased to learn that the Philippines Government would continue to provide the host facilities for the TCS. It also noted with appreciation the offer of the Philippines to continue making available the services of a Coordinator, a meteorologist, and an expert on disaster prevention and preparedness on a part-time basis.

102. The session thanked the Government of Japan for providing a hydrologist to TCS and strongly requested Japan to continue to provide the services of a hydrologist in the future.

103. The Session agreed that the running expenditure of the TCS would be met at least partially from the Typhoon Committee Trust Fund.

Technical Cooperation (agenda item 8.3)

104. Under this item, the Members reviewed performance since the previous sessions, and the new project documents submitted to UNDP.

(a) Performance since the previous sessions

105. The Members were pleased to learn that, with the limited funds available, some activities had been carried out under the UNDP/WMO regional projects RAS/86/196, Programme Support to the Panel on Tropical Cyclones for the Bay of Bengal and Arabian Sea and RAS/86/175, Programme Support to the Typhoon Committee. These activities included

expert/consultancy services, fellowships, workshops, study tours, provision of equipment and publication of Panel News and the Typhoon Committee Annual Review. The Members reiterated their sincere thanks to UNDP for its strong support and expressed the hope that the assistance from UNDP would continue in future.

106. The session expressed satisfaction that a number of training activities had been carried out during 1991 under TCDC arrangements, using the UNDP/WMO regional projects funds. Many Members benefitted from this component of the UNDP/WMO projects and urged that the pace and scope of this programme be accelerated in the future and enlarged between the Typhoon Committee and Panel Members. The session recognized that exchange visits of experts and support to trainees under TCDC were of immense benefit to Members and were of importance in achieving self-reliance.

107. The Members were particularly pleased to learn that three scientists from the State Meteorological Administration in China had visited four countries on a study tour to assess the requirements of Members in the fields of training and telecommunications. As a follow-up action, a workshop on Tropical Cyclone Analysis and Forecasting would be held in China in 1993.

108. The Members expressed satisfaction that a number of requirements had been met under the Voluntary Cooperation Programme (VCP) of WMO and additional requirements were under consideration for implementation. The Members recognized the potential value of VCP support of their activities. The Members were urged to take full advantage of this system. They were advised to update their requirements and send these to WMO.

109. The Members of the Panel and the Committee recognized the importance of bilateral assistance from developed countries. The Members expressed their thanks to the Government of Japan for its generous help in the past and hoped it would continue in future.

110. As regards the Typhoon Committee Trust Fund, the Members were

informed that in accordance with the decision of the twenty-third session of the Typhoon Committee, this fund was partially used to support the following:

(a) Augmentation of travel funds for TCS staff mission;
(b) Support for organizing symposia or technical conferences;
(c) Support for SPECTRUM;
(d) Publishing the Typhoon Committee Newsletter periodically;
(e) Representation and emergency expenses of TCS;
(f) Support to collaboration of research activities among Typhoon Committee Members;
(g) Printing cost of documents for the twenty-fourth session not exceeding US$ 1000.

111. The Members agreed to the use of the Trust Fund for the above purposes until the next session.

112. The Members recognized the establishment of the Trust Fund as a big stride towards self-reliance. The Members were pleased to learn that the Governments of China, Japan, Malaysia, Republic of Korea and Thailand had made their contributions for 1991. The Members stressed the need for promoting voluntary contributions to the Trust Fund, with a view to increasing self-reliance. Members of Typhoon Committee were, therefore, urged to continue sending their contributions to WMO.

113. The Members were informed of the following three reports relating to the Typhoon Committee.

(a) A report on the survey of selected Member countries of the Typhoon Committee on Disaster Prevention and Preparedness by Victor R. Pagulayan Jr and Kunio Takase;
(b) Reports on a mission to Seven Members of the Typhoon Committee by J.S. Hickman;
(c) Draft Terminal Report on the Project RAS/86/175 "Programme Support to the Typhoon Committee" by Lim Joo Tick.

114. Due to the paucity of time these reports were not discussed at

length. However the Members expressed their appreciation to the consultants for their excellent work.

(b) New Project documents submitted to UNDP and other donors

115. The Members were informed that of the six project documents submitted to UNDP for its consideration of approval during its fifth Programming cycle (1992-1996), of which the following two were of direct relevance to the Panel and Typhoon Committee Members:

(a) Reduction of natural disaster related to cyclones in the Bay of Bengal and the Arabian Sea;
(b) IDNDR - Reduction of natural disasters related mainly to typhoons and typhoon-induced flooding.

116. The draft project documents had been prepared in cooperation with ESCAP and revised in the light of the suggestions in earlier sessions and had been submitted to UNDP. Copies of these documents had been forwarded to local UNDP Resident Representatives and the Permanent Representatives with WMO of the Member Countries, with the request that they should convey their support and endorsement to UNDP, New York.

117. The Members were informed that the UNDP fifth Meeting of Aid Coordinators of Asia and Pacific (MAC-5) was held in Manila during 20-23 January 1992 and another meeting of UNDP with United Nations agencies was planned in Europe in May 1992. The Members were informed that it was important that the Government Representatives support these projects and accord them highest priority.

118. The Members strongly supported these projects as they were directly related to IDNDR, which had a mandate of the United Nations, and urged WMO and ESCAP to take appropriate action with UNDP.

119. The Members were informed that WMO had been trying its best to get the projects approved and would continue to do so in future at the highest level, but it was the Government Representatives at the UNDP Governing Council who had to voice their support and priority. They

were also urged once again to request their Governments to write formally to UNDP, New York communicating their endorsement, support and participation in the projects, with copies to WMO.

120. The ESCAP representative reconfirmed his organization's commitment to provide substantive support to the work of the Panel on Tropical Cyclones and the Typhoon Committee within the framework of its work programme. Project proposals were being formulated for water-related natural disaster reduction in the region, and submitted to potential donors. The session reiterated its appeal to such donor countries for provision of funds to projects in line with meeting the goals of the IDNDR. The ESCAP representative also stated that exchange of expertise between Members of the Panel and the Committee in the fields of hydrology and disaster prevention and preparedness would be supported, whenever possible, through TCDC funding, once the concerned parties made the required hosting arrangements. ESCAP was fully committed to comply with the directives of the United Nations General Assembly, which among other things, urged the regional commissions to play an active role in reduction of natural disasters, which often transcended national boundaries.

IX. ELECTION OF THE CHAIRMEN FOR THE PANEL ON TROPICAL CYCLONES AND THE TYPHOON COMMITTEE (agenda item 9)

121. The session unanimously elected Mr. F.M. Qasim Malik (Pakistan) Chairman and Dr. Patipat Patvivatsiri (Thailand) Vice-chairman of the Panel on Tropical Cyclones, who shall hold office until their successors are elected at the Panel's twentieth session. It expressed its appreciation to the former chairman, Mr. Abdullahi Majeed (Maldives), for his chairmanship of the Panel carried on until this joint session.

122. The session unanimously elected Dr. Takashi Nitta (Japan) Chairman and Dr. Patipat Patvivatsiri (Thailand) Vice-chairman of the Typhoon Committee for its inter-sessional period. It expressed its gratitude to Mr. Yong-dai Park (Republic of Korea), the Committee's Chairman until this joint session, for his excellent leadership.

X. AGENDA FOR AND DATE AND PLACE OF THE TWENTIETH SESSION OF THE PANEL ON TROPICAL CYCLONES AND THE TWENTY-FIFTH SESSION OF THE TYPHOON COMMITTEE (agenda item 10)

123. The delegation of Pakistan informed the session that his country would consider hosting the twentieth session of the Panel on Tropical Cyclones, possibly at Karachi in February 1993.

124. The session welcomed this information and expressed its warm appreciation to the Government of Pakistan. It requested WMO to take appropriate action, in consultation with ESCAP, TSU and the host country, for the convening of its twentieth session. The session requested TSU, in consultation with WMO and ESCAP, to prepare the provisional agenda for the twentieth session.

125. The representative of China informed the session that his country would consider hosting the twenty-fifth session of the Typhoon Committee in December 1992 in China. The session welcomed this information and expressed its warm appreciation to the Government of China. It requested ESCAP to take appropriate action in consultation with WMO, TCS and the host country for the convening of its twenty-fifth session. The session requested TCS, in consultation with ESCAP and WMO, to prepare the provisional agenda for the twenty-fifth session.

126. The session recognized the advantages and benefits gained from the First Joint Session of the Panel on Tropical Cyclones and the Typhoon Committee and agreed that another joint session of the two bodies should be held in a few years' time. In view of the unique status of Thailand as being the only country with membership in both bodies and the success of the current session, it was strongly recommended that Thailand consider the possibility of hosting the next joint session. The representative of Thailand indicated that he would refer the request to his government.

XI. SCIENTIFIC LECTURES AND TECHNICAL DISCUSSIONS (agenda item 11)

127. The following scientific lectures were presented to the session, and active technical discussions were stimulated:

(a) IDNDR : Activities and developments at the international level .....by R.L. Kintanar;

(b) Progress report on Tropical Cyclone Motion (TCM-90) data set and research activities.....by R.L. Elsberry;

(c) A study of some characteristics of the April 1991 Cyclone during its movement and the preparedness measures taken in Bangladesh .....by M.H. Khan Chowdhury and E. Hossain;

(d) Scientific strategy of RSMC Tokyo-Typhoon Centre .....by T. Nitta;

(e) Flood forecasting experiences in the Chao Phraya River Basin, Thailand .....by Virat Khao-uppatum;

(f) Weather-induced disasters and the counter-measures taken in IDNDR in China.....by Ma Henian;

128. The session recorded its appreciation to the lecturers for their interesting and informative presentations and to all those who participated in the ensuing discussions. The session noted that the texts of the lectures would be incorporated in the TCAR 91 and the Panel News 1992 respectively.

129. The following video films were also shown during the session:

(a) "To ensure safety in the Future" (45 min.).....by Japan;

(b) "Foundation of River and Basin Integrated Communications" (25 min.) .....by Japan;

(c) "Typhoon Warning in China" (5 min) .....by China.

XII. ADOPTION OF THE REPORT (agenda item 12)

130. The report of the First Joint Session was adopted on 27 February 1992.

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FOR PARTICIPANTS ONLY

WRD/JS.1/1
16 January 1992

ENGLISH ONLY

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

Joint Session of the Panel on Tropical Cyclones and the
Typhoon Committee
First session
18-27 February 1992
Pattaya, Thailand

ANNUAL PUBLICATIONS

(Item 2 of the Provisional agenda)

Note by the ESCAP Secretariat

1. The following publications were presented to the session: The ESCAP/WMO Typhoon Committee Newsletter (No. 3, 1991); the ESCAP/WMO Typhoon Committee Annual Review (TCAR) 1990; and the WMO/ESCAP Panel on Tropical Cyclones Panel News 1991.

2. The sixth edition of the Typhoon Committee Annual Review was prepared by the Chief Editor from the Royal Observatory of Hong Kong with the assistance of national editors from six other Typhoon Committee Members. The Royal Observatory of Hong Kong also undertook the printing of the publication.

3. The third issue of the Typhoon Committee Newsletter was prepared and published by the Typhoon Committee Secretariat, and the seventh issue of Panel News was prepared and published by the Technical Support Unit of the WMO/ESCAP Panel on Tropical Cyclones.

4. The Session is invited to:

(a) Take note of the information given in these annual publications;

(b) Comment on the contents of these publications and make suggestions for future editions.

LIMITED

WRD/JS.1/L.1
15 October 1991

ORIGINAL: ENGLISH

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

Joint Session of the Panel on Tropical Cyclones and the Typhoon Committee
First session
18-27 February 1992
Pattaya, Thailand

PROVISIONAL AGENDA

1. Organization of the session:

   1.1 Opening of the joint session;
   1.2 Election of officers for the session;
   1.3 Adoption of the agenda;
   1.4 Establishment of sub-committees;
   1.5 Working arrangements for the session.

2. Annual publications:

   2.1 Typhoon Committee annual review and Typhoon Committee newsletter;
   2.2 Panel news.

3. Review of the 1991 tropical cyclone/typhoon season.

4. National reports on activities and developments during 1991 under the regional cooperation programmes.

5. Coordination of activities:

   5.1 Coordination within the Tropical Cyclone Programme;
   5.2 Coordiantion of activities common to the Panel and the Typhoon Committee.

6. Review of the Tropical Cyclone Operational Plan and the Typhoon Committee Operational Manual.

7. Review of the programmes for 1992 and beyond:

   7.1 International Decade for Natural Disaster Reduction and other activities;
   7.2 Coordinated technical plan of the Panel;
   7.3 Typhoon Committee Regional Cooperation Programme Implementation Plan.

/8.

8. Support required for the regional cooperation programmes:

   8.1 Arrangements for the Technical Support Unit;
   8.2 Arrangements for the Typhoon Committee Secretariat;
   8.3 Technical cooperation.

9. Election of the Chairmen for the Panel on Tropical Cyclones and the Typhoon Committee.

10. Agenda for and date and place of the twentieth session of the Panel on Tropical Cyclones and the twenty-fifth session of the Typhoon Committee.

11. Scientific lectures and technical discussions.

12. Adoption of the report.

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LIMITED DISTRIBUTION

WRD/JS.1/L.2
1 October 1991

ENGLISH ONLY

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

Joint Session of the Panel on Tropical Cyclones
and the Typhoon Committee
First session
18-27 February 1992
Pattaya, Thailand

ANNOTATED PROVISIONAL AGENDA

1. ORGANIZATION OF THE SESSION

1.1 Opening of the joint session

The first joint session of the Panel on Tropical Cyclones (PTC) and the Typhoon Committee (TC) will be held at Pattaya, Thailand and will open on 18 February 1992.

1.2 Election of officers for the session

Representatives of participating governments are invited to elect a chairman and a vice-chairman to serve during the session. They are also invited to elect a chairman of sub-committee A and sub-committee B, respectively (see 1.4 below).

1.3 Adoption of the agenda

The provisional agenda, contained in WRD/JS.1/L.1, has been prepared by the WMO Secretariat in close consultation with ESCAP, the Typhoon Committee Secretariat (TCS) and the Technical Support Unit (TSU) of the Panel on Tropical Cyclones. Representatives of participating governments may propose additions or changes to the agenda if they so desire.

1.4 Establishment of sub-committees

A proposal is made to establish (i) sub-committee A to deal with items on the specific subjects related to PTC and (ii) sub-committee B to deal with items on the specific subjects related to the TC (see 1.5 below).

1.5 Working arrangements for the session

The working language will be English only. Each sub-session will consider specific subjects related to the individual PTC or TC matters. These sub-sessions will not be held concurrently, with a view to facilitating participants, including the Secretariats of ESCAP and WMO, TCS, and TSU, to become involved in discussions of both sub-sessions. Under this item the session will decide on its working hours and any other arrangements for the meeting.

2. ANNUAL PUBLICATIONS

2.1 Typhoon Committee Annual Review and Typhoon Committee Newsletter

The session may wish to express its views on the sixth edition of the Typhoon Committee Annual Review for 1990, published with the commendable efforts of the Chief Editor (Hong Kong) and national editors and the third issue of the Typhoon Committee Newsletter prepared by TCS. The session is invited to make suggestions and comments on the seventh edition of the Typhoon Committee Annual Review for 1991 as well as the fourth issue of the Typhoon Committee Newsletter.

2.2 Panel News

The session will review Panel News for 1990 prepared by TSU and consider the future arrangements for issuance of Panel News.

3. REVIEW OF THE 1991 TROPICAL CYCLONE/TYPHOON SEASON

A review of the 1991 tropical cyclone and typhoon season is expected to cover meteorological and hydrological aspects as well as assessments of damage and the effectiveness of disaster prevention and preparedness arrangements. It will be carried out based on national reports on the impact of tropical cyclones and typhoons as well as on technical reports of the 1991 cyclone season to be provided by the Regional Specialized Meteorological Centre (RSMC) - tropical cyclones, New Delhi and the RSMC Tokyo - Typhoon Center. It is proposed that the above national reports, of 60 copies each, be submitted directly to the session.

4. NATIONAL REPORTS ON ACTIVITIES AND DEVELOPMENTS DURING 1991 UNDER THE REGIONAL COOPERATION PROGRAMMES

The session will be informed of national activities regarding all components of each of the Regional Cooperation Programmes developed during 1991. All Members are invited to contribute reports on such activities developed by their respective countries as of 1 November 1991 to TCS or TSU for submission as a composite document.

It is expected that the above national reports should include difficulties and problems encountered during 1991 towards implementation of the Regional Cooperation Programme at national level. It is proposed that completed national reports, of 60 copies each, be submitted to the session.

5. COORDINATION OF ACTIVITIES

5.1 Coordination within the TCP

A document is being prepared by the WMO Secretariat, including a report on the status of implementation of the Tropical Cyclone Programme (TCP), which will be submitted to the Session. The document should serve to provide an overview of the whole range of activities

being conducted under the programme, including activities in other tropical cyclone areas and of the cooperation and coordination between WMO and interested organizations, such as ESCAP, UNDRO and LORCS, related to IDNDR disaster mitigation. The session is invited to comment on the activities within the programme and the framework within which it operates and to make proposals for further development of the TCP.

5.2 Coordination of activities common to the Panel and the Typhoon Committee

Discussions will focus on activities of mutual concern to be developed in the fields of meteorological, hydrological, disaster prevention and preparedness, training and research components between the Panel and the Typhoon Committee, with a view to ensuring closer coordination between the adjacent regional tropical cyclone bodies, which includes the use of standard nomenclature for tropical cyclones.

6. REVIEW OF THE TROPICAL CYCLONE OPERATIONAL PLAN AND THE TYPHOON COMMITTEE OPERATIONAL MANUAL

Discussions will centre on a review of the Tropical Cyclone Operational Plan for the Bay of Bengal and the Arabian Sea, 1991 edition, which was adopted by the Panel and of the Typhoon Committee Operational Manual which was updated by the rapporteur, Mr. H. Ohnishi (Japan), in cooperation with Members. In doing so, the session may wish to update and supplement the information in the Plan and the Manual, as well as to consider if there are changes which could be made to the regional and multi-regional cooperative arrangements to strengthen the forecasting and warning systems and hence to be reflected in the Plan and the Manual, respectively,

7. REVIEW OF THE PROGRAMME FOR 1992 AND BEYOND

7.1 IDNDR and other activities

The session is invited to elaborate on activities related to IDNDR to be carried out by the Panel and/or the Typhoon Committee in cooperation with ESCAP, WMO and interested organizations such as UNDRO, LORCS and AIT.

7.2 Panel's Coordinated Technical Plan

It is suggested that the Panel's Coordinated Technical Plan be reviewed at sub-session A, focusing on progress at the national and regional levels in each of the three major components of the Panel's programme of activities, namely in meteorological and hydrological components, disaster prevention and preparedness, as well as in the supporting components of training and research.

7.3 Typhoon Committee's Regional Cooperation Programme Implementation Plan

Discussions at sub-session B will review the Typhoon Committee's Regional Cooperation Programme Implementation Plan for future developments of services, which include the research activities on SPECTRUM and the mission report on disaster prevention and preparedness (DPP) carried out in August/September 1990. Sub-session B may wish to update the plan according to the degree already implemented by Members and the Committee. It will also introduce new activities and items as deemed necessary in the Plan.

8. SUPPORT REQUIRED FOR THE REGIONAL COOPERATION PROGRAMMES

8.1 Arrangements for the TSU

At its eighteenth session (Male, Maldives, 29 January to 4 February 1991), the Panel considered the continuation of TSU necessary and at the request of Panel Members, Bangladesh agreed to continue to

provide the host facilities including the services of a full-time meteorologist during the interim period until an alternative was found. Mr. M.H. Khan Chowdhury, Director of the Bangladesh Meteorological Department, agreed to continue as the Coordinator.

8.2 Arrangement for the TCS

The Typhoon Committee at its twenty-third session (Seoul, Republic of Korea, 13-19 November 1990) considered the staffing of TCS and was pleased to learn that the Philippine Government would continue to facilitate the functioning of TCS in Manila. It also noted with appreciation the Philippine Government's offer to make available the services of a coordinator, a meteorologist and an expert (at least on a part-time basis) on disaster prevention and preparedness. It also welcomed with appreciation the offer of Japan that it would make every effort to continue to provide a hydrologist to TCS. The session is invited to review the arrangements made for TCS and to advise on its future arrangements.

8.3 Technical cooperation

The session will review the resources currently available from all sources to support activities of their Regional Cooperation Programmes, both with regard to the contributions made by Members themselves and external support available from a variety of sources such as UNDP, WMO/VCP, ESCAP extra-budgetary funding, bilateral assistance, trust funds, TCDC, etc.

The session will be informed of the detailed items of support provided by UNDP through the regional projects and may discuss the relevant activities of their programmes to be carried out under the proposed UNDP regional projects (1992-1996). It is invited to further review the other resources needed for implementation of their

activities (see above).

9. ELECTION OF CHAIRMEN FOR THE PANEL ON TROPICAL CYCLONES AND THE TYPHOON COMMITTEE

The session is invited to elect from among representatives of both the Panel and Typhoon Committee, a chairman and a vice-chairman respectively, who shall hold office until their successors are elected at the next respective sessions of each. After this session, their approval or advice might be sought on proposals to be addressed by Members or the Secretariats of ESCAP and WMO, TCS and TSU on behalf of the Panel or the Typhoon Committee.

10. AGENDA FOR AND DATE AND PLACE OF THE TWENTIETH SESSION OF THE PANEL ON TROPICAL CYCLONES AND THE TWENTY-FIFTH SESSION OF THE TYPHOON COMMITTEE

The session is invited to draw up a provisional agenda for the Panel and the Typhoon Committee, respectively, which it will consider at the twentieth session of the Panel and at the twenty-fifth session of the Typhoon Committee. The session may wish to invite respective Members to offer to host the twentieth session of the Panel early in 1993 and the twenty-fifth session of the Typhoon Committee in late 1992.

11. SCIENTIFIC LECTURES AND TECHNICAL DISCUSSIONS

It is proposed that one day of the session be devoted to scientific lectures and subsequent discussions. Details of the programme will be submitted to this session after coordination between WMO, ESCAP, TSU and TCS.

12. ADOPTION OF THE REPORT

The session will adopt its report on 27 February 1992.

13. CLOSURE OF THE SESSION

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FOR PARTICIPANTS ONLY

WRD/JS.1/2 (1)
25 November 1991

ENGLISH ONLY

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

Joint Session of the Panel on Tropical Cyclones and the
Typhoon Committee
First session
18-27 February 1992
Pattaya, Thailand

NATIONAL REPORTS ON ACTIVITIES AND DEVELOPMENTS DURING 1991 UNDER THE REGIONAL COOPERATION PROGRAMMES

(Item 4 of the provisional agenda)

THE COMMITTEE'S ACTIVITIES DURING 1991

Note by the Typhoon Committee Secretariat

I. Background Information[1/]

ESCAP

ESCAP/UNDRO Regional Symposium on IDNDR

1. The ESCAP/UNDRO Regional Symposium on the International Decade for Natural Disaster Reduction (IDNDR) was held at Bangkok from 11 to 15 February 1991. The symposium, which launched the IDNDR in the region, was attended by 72 participants, including 39 representatives of 22 members and associate members of ESCAP, 17 representatives of international and regional organization and 12 resource persons. The Symposium included topics on water-related natural disasters, as well as volcanic and seismic hazards. The group elaborated a comprehensive framework of recommendations, which included a Plan of Action and recommendations for the reduction of all hazards and specific recommendations for: water-related natural disasters; drought; earthquakes and tsunamis; and volcanic hazards.

Comprehensive Flood Loss Prevention Project

2. Under the Comprehensive Flood Loss Prevention and Management project which has been implemented as a part of UNDP-funded regional project RAS/86/175, "Programme Support for the Typhoon Committee", the Manual and Guidelines for Comprehensive Flood Loss Prevention and Management were published on February 1991.

3. As the last planned activity of the project, a programme of roving seminars to selected Typhoon Committee Members was undertaken. The programme involved seminars in eight Typhoon Committee countries/areas; namely, China, Hong Kong, Lao People's Democratic Republic, Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam. The seminars were organized by the ESCAP secretariat in co-operation with the Typhoon Committee Secretariat and each of the eight member Governments. A lead authority (Ministry or Department) of each member assumed responsibility for detailed organization of the seminar within each member country/area, including the provision of facilities, invitation to participants, meeting rooms, etc.

4. The purpose of the seminars was to introduce the concepts and principles of comprehensive flood loss prevention and management contained in the manual and guidelines, to the administrators, floodplain managers and technologists involved in combating flood disasters in each member country or area. Additional information to further illustrate the contents of the manual and guidelines was presented at each seminar by way of a series of lectures. These

1/ Not including relevant activities of WMO, a summary of which is given in WRD/JS.1/3(1) and other documents.

lectures were supported by appropriate slides, overhead transparencies and specific case studies relevant to each member's experience of flooding.

5. The composition of the missions sent to typhoon Committee members to conduct the seminars was as follows:

- Mr. Cengiz Ertuna, Chief, Water Resources Section, Natural Resources Division, ESCAP (for Philippines, Republic of Korea and Thailand);
- Mr. Minoru Kuriki, Flood Loss Prevention Expert, Water Resources Section, Natural Resources Division, ESCAP (for China, Hong Kong, Lao People's Democratic Republic, Malaysia, Thailand and Viet Nam);
- Mr. George Whitehouse, Consultant (for all the Members);
- Mr. Atsushi Yoshii, Hydrologist, Typhoon Committee Secretariat (for all the Members).

6. The seminars were held as follows:

· Bangkok (Thailand)	25-26 February 1991;
· Kuala Lumpur (Malaysia)	28 February - March 1991;
· Manila (Philippines)	4-5 March 1991;
· Seoul (Republic of Korea)	7-8 March 1991;
· Hong Kong	11-12 March 1991;
· Beijing (China)	14-15 March 1991;
· Vientiane (Lao PDR)	19-20 March 1991;
· Hanoi (Viet Nam)	22-23 March 1991;

7. The conduct of the seminars followed a pre-arranged programme which was agreed upon by the Third Expert Group Meeting on Comprehensive Flood Loss Prevention and Management held at Bangkok in July 1990. The formal presentation of technical material and the proposed management systems contained in the manual was enhanced by relevant case studies which were designed to further emphasize the utilization of the manual and guidelines. In addition to the formal presentations, the programme included a comprehensive session for questions and answers. This segment gave the participants an opportunity to seek clarification of the points raised in the course of the seminar.

8. The seminar was well received by all the members. The participants were well selected and representative of the range of administrators and technical specialists involved in flood disaster management. Most of the participants were drawn from top management positions, including departmental director level.

Forecasting, Preparedness and Other Operational Measures Project

9. The Workshop on Forecasting, Preparedness and Other Operational Measures for Water-related Natural Disaster Reduction was held at Bangkok from 29 April to 3 May 1991. The Workshop was organized by the Economic and Social Commission for Asia and the Pacific (ESCAP) with generous financial support from the Government of Japan. It formed part of the activity on promotion of measures for reduction

of water-related disasters in Asia and the Pacific through research, training and advisory services.

10. The Workshop was attended by 22 participants from 11 members/associate members of ESCAP (China, Hong Kong, Lao People's Democratic Republic, Myanmar, Nepal, Pakistan, Philippines, Solomon Islands, Thailand, Tonga and Viet Nam). Four observers from AIT, the Mekong Committee Secretariat and the Government of Thailand also attended the workshop.

11. Resource persons were invited from the Government of Japan, WMO, UNESCO and United Nations Center for Regional Development (UNCRD). They gave lectures on:

- Disaster preparedness planning;
- Early warning systems for cyclones/typhoons;
- Hydrological forecasting models;
- Emergency and post-emergency activities.

These lectures were much appreciated by the participants as highly informative.

12. Case studies on recent water-related natural disasters in selected countries as well as an account of the situation of water-related disasters and measures being taken for reducing them in each participating country were presented. These presentations, which were contrasted with the lecture presented by the resource persons, gave illustrative examples in considering future activities.

13. The Workshop, reviewing the recommendations made by the ESCAP/UNDRO Regional Symposium on the IDNDR, made a number of recommendations on the establishment, promotion and extension of forecasting and warning systems, disaster preparedness programmes and other required measures for reduction of water-related natural disasters.

14. The participants concluded that preparedness, early warning systems, emergency and post-emergency measures should be introduced or strengthened urgently in the countries suffering from water-related natural disasters.

Urban Flood Loss Prevention Project

15. The proceedings of the Expert Group Meeting on Urban Flood Loss Prevention and Mitigation in the ESCAP Region, which was held at Bangkok from 16 to 20 April 1990, were published as Water Resources Series No. 68, "Urban Flood Loss Prevention and Mitigation" at the end of 1990.

16. The publication was widely distributed among members and associate members of ESCAP, and judging from the replies to the questionnaire which was sent with the publication for evaluation, it was received positively. Copies are available for US$15.00 each.

17. TCS, in co-operation with WMO, fully accomplished its share of the action plans which came out of the SPECTRUM Technical Conference and Steering Group Evaluation Meeting in Tokyo, Japan, 10-13 December 1990.

18. Following the authority given by the Typhoon Committee (TC) in its twenty-third session (Seoul, November 1990) to the TC Chairman to approve recommendations of the SPECTRUM Steering Group arising from its evaluation meeting in Tokyo in December 1990, TCS secured the approval of the Chairman in February 1991, and consequently, completed the formation of the SPECTRUM Research Co-ordinating Group (SRCG) by May 1991.

19. TCS closely assisted WMO in organizing the Technical Conference on SPECTRUM (Guangzhou, China, 25-29 November 1991). In this conference, it organized an informal meeting of the SRCG as suggested by WMO. It also took part in the pre-organization meeting of this conference among WMO, TCS, and the host China on 24 November 1991.

20. TCS, with support from RSMC Tokyo - Typhoon Center, JMA, coordinated activities between TC SPECTRUM and concurrent experiments, viz, TCM-90 and TYPHOON-90, especially as regard replication and distribution of data sets of both sides.

21. TCS, in co-operation with ESCAP and WMO, accomplished its share of the action plans coming out of the twenty-third session of the Committee and of the documentation plan leading to the twenty-fourth session.

22. TCS continued to manage the Typhoon Committee Foundation, Inc. ~~In one aspect, it prepared the cash and plaque awards for the third ESCAP/WMO Typhoon Committee Natural Disaster Prevention Award which for 1991 was given to recipient(s) in Thailand~~.

23. TCS hydrologist participated in a roving seminar to some TC Members in February to March 1990 under the ESCAP project on Preparation of a Manual and Guidelines for and Dissemination of the Techniques of Comprehensive Flood Loss Prevention and Management Applicable under RAS/86/175.

24. TCS hydrologist was also involved for two months (August-September) in assisting the various Japanese teams of volcanologists in setting up lahar warning system as a result of the eruption of Mount Pinatubo in Zambales, Philippines.

25. TCS hydrologist also helped the Department of Public Works and Highways (DPWH), PAGASA and JICA in organizing a one-month seminar course on Sabo, River, Dam, Coastal Works and Flood Forecasting (SARDAC-FF) from 5 November 1991 in Quezon City, Philippines.

26. TCS hydrologist visited Thailand and Malaysia from 5-10 September 1991. In Thailand, he made consultation talks regarding the next TC session and [illegible] familiarized himself with ESCAP, Meteorological and Hydrological Department. In Malaysia, he visited the Drainage and Irrigation Department and met its members, and inspected the flood control works. He also made consultation about the new pilot project with UNDP on Improvement of Dam Safety Monitoring and Water Release Operation System.

27. TCS, in one way or another, hosted/received/met the following missions:

- Messrs. G. Ertuna (of ESCAP), M. Kuriki (of ESCAP), G. Whitehouse (Consultant), and A. Atsushi (of TCS) as mission members of a roving seminar to selected TC Members to introduce and promote the concepts and principles of comprehensive flood loss prevention and management contained in the manual and guidelines, from 4 to 5 March 1991 in Quezon city, Philippines;

- Dr. Lim Joo Tick of the Malaysian Meteorological Service; 3 - 9 June, in connection with the WMO consultancy mission to prepare the draft terminal report on UNDP/WMO Regional Project RAS/86/175 "Programme Support to Typhoon Committee";

- Mr. D. O. Vickers of WMO Secretariat, in 22 July 1991, on a mission to review and incorporate changes in the proposed document "Reduction of Natural Disasters Related to Typhoons", wherein some suggestions were made particularly on things related to IDNDR, budget, inclusion of non-TC Members, and ESCAP subprojects;

- Mr. M. Kuriki of ESCAP Secretariat, 21 - 27 July 1991, who served as lecturer in the Special Course in Hydrology under Flood Forecasting and Warning System for Dam Operation Project II, in Quezon City, Philippines; and,

- Dr. J. S. Hickman, former Director of New Zealand Meteorological Service, as a WMO consultant on a roving consultancy mission which was kindly provided by UNDP under RAS/86/175 to assist TC Members in preparing a continued programme after the phaseout of UNDP assistance before the end of 1991.

28. The third issue of TC Newsletter was published and distributed by TCS in November 1991.

SPECTRUM 29. The World Meteorological Organization (WMO) organized the SPECTRUM Technical Conference and Steering Group Evaluation Meeting which was hosted by Japan Meteorological Agency (JMA) at its Headquarter in Tokyo, Japan from 10 to 13 December 1990.

30. This Conference/Meeting was tasked to conduct an evaluation of the planning and execution of the field experiment which was hailed as an outstanding success. At its closing, the Steering Group recognized that it had completed its task with respect to planning, execution and evaluation of the experiment that it recommended the formation of a new group, the SPECTRUM Research Coordinating Group (SRCG), to oversee the coordination of follow-up activities with regard to data and research.

31. Following the decision of the Committee in its 23rd session, WMO organized the Technical Conference on SPECTRUM which was hosted by China in Guangzhou from 25 to 29 November 1991.

32. RSMC Tokyo - Typhoon Center, JMA went ahead in replicating and distributing the magnetic tapes of SPECTRUM data set in favor of TCS in order to hasten its delivery to Members and participating concurrent experiments, TCM-90 and TYPHOON-90.

33. The technical director of TCM-90 took advantage of his visit to Japan Meteorological Agency in July to deliver personally the TCM-90 data set in two magnetic tapes and successfully passed on a set each to Hong Kong and China.

34. TCS replicated copies of the TCM-90 data set and distributed a set each to Republic of Korea, Malaysia, Thailand and Viet Nam in September. The sets for Democratic Kampuchea and Lao PDR were airmailed in November.

35. The TCM-90 Data Users Guide Manual was likewise replicated and distributed by TCS to all TC Members in September in separate cover.

36. Technical difficulty was encountered in retrieving the data set of TYPHOON-90 which was contained in a floppy disk. Even the advanced facilities of RSMC Tokyo - Typhoon Center, JMA could not solve the problem. TCS has not received a reply to a request for a back-up copy.

II. Meteorological Component

Automatic Weather Station (AWS)

Korea

1. Korea Meteorological Administration (KMA) has established 85 AWS in 1990, and is operating a total of 100 AWS now. There is no addition of new AWS this 1991, however, 80 more will be established in 1992.

2. Each observation is collected at the local collection post by auto dial-up system and the data are transmitted to the local weather offices and district meteorological services. The data are also transmitted to the Headquarters through PC network and collected at the Headquarters and disseminated nationwide. Previous system was a direct collection at the Headquarters using auto dial-up system.

Upper-air Observations

Malaysia

3. In an effort to modernize the observation programme, the Malaysian Meteorological Service (MMS) has replaced the manual upper-air systems at Petaling Jaya and Kuantan with fully automatic systems. The new systems which consist of the Vaisala Digi Cora rawinsonde set MWII as its main component were commissioned in July 1991. The upper-air system for Petaling Jaya is also equipped with ozone monitoring instrumentation. Vertical ozone monitoring will be carried out once a month beginning from December 1991.

Philippines

4. Of the ten upper-air stations, there are at present only five which are generally functional. These were all involved in the implementation of the SPECTRUM: Davao (98753), Laoag (98223), Mactan (98646), Legaspi (98444) and Puerto Princesa (98618).

Meteorological Radar

Hong Kong

5. The commencement of radar data exchange between Guangzhou (China) and Hong Kong has provided a more comprehensive coverage of the precipitation systems in the vicinity of the Pearl River estuary. Armed with the extra real-time information, forecasters can readily make operational decisions on flood, landslip and thunderstorm warnings. Softwares have also been developed to store and retrieve radar imageries from floppy disks. Forecasters, from their PC terminals, can now make quick references and draw on experience from past events.

6. Specifications for a replacement storm detecting radar system were completed and the radar will be installed in early 1993. It will replace the digital radar system used since 1983 as the main surveillance radar of the Royal Observatory.

Korea

7. KMA established 3 more doppler radars at Cheju (47185), Pusan (47159), and Donghae (47106) this 1991, and is operating 4 radars now. The fifth radar station at Kunsan is now under construction and is expected to be operational in 1992. Along with the Kwanaksan radar station (47116), the KMA is in progress to construct nationwide radar network system to composite echoes of the five radars.

Malaysia 8. With the courtesy of PCM Electronics, Australia, a RAPIC display system designed by the Bureau of Meteorology, Australia, was installed for demonstration purpose at the Subang Weather Radar Station in May 1991. Radar data are also remoted via dial-up line to a workstation in the Research Division at the MMS Headquarters in Petaling Jaya. This PC based radar processing and display system has several important features including mouse driven facility, effective ground cluster reduction and sequencing displays. The opportunity to operate the demonstration unit would stand MMS in good stead to plan for the acquisition of a cost effective radar acquisition and display system in the near future.

Philippines 9. Six of the ten weather radars are now operational. These include radars of Puerto Princesa (98618), Davao (98754), Daet (98440), Mactan (98646), Virac (98447) and Tanay (98tny). The others are temporarily out of commission due to defective radar/generator set and lack of spare parts.

Thailand 10. Doppler S-band radar is being set up at Bangkok International Airport to replace the old S-band radar which is planned to be relocated at Rayong in the eastern part of Thailand;

11. An S-band radar is being newly installed at Khon Kaen Province in Northeastern Thailand;

12. Relocation of C-band radar from Songkhla to Sathing Phra site, 30 kilometers north of the original site, has been completed as well as the relocation of the S-band radar from Hat Yai International Airport to Phitsanulok in the northern part.

Viet Nam 13. The RML5 radar installed at Phu Lien has been brought into operation. Two new radar stations are under installation at Tamky (Quang Nam-Da Nang) and Vinh (Nghe An).

Telecommunication

Hong Kong 14. Implementation of facsimile data exchange via the Hong Kong-Beijing meteorological telecommunication circuit was in progress. The exchange will be operational in early 1992.

15. Reception of ship observations via INMARSAT started in late 1991 in addition to the conventional ways of receiving morse codes and radio telex messages.

Korea 16. The currently operating computer for telecommunication (TANDEM-TXP since 1985) will be replaced in 1992, and the specification is being studied. The new computer will emphasize non-stop system and image communication along with A/N transmission. KMA will also replace the computer for database (PDP 11/34 since 1980) in 1992, and the new system is being planned to support demands on weather forecast and climate.

17. The KMA established the so-called 'All-Call-Fax-System' at the Headquarters of KMA this 1991. The previous system could only call registered organizations one at a time. With the new system, all organizations could be accessed at the same time. The quick

dissemination of weather forecast and warning to mass media and DPP agencies is now possible.

Malaysia 18. Although the procurement of the software, RNET-X25/32 had been made by WMO in 1990 for MMS to upgrade the Kuala Lumpur-Singapore GTS circuit from 1200 to 4800/9600 bps, MMS encountered several problems in implementing the activity. One of the main problems was related to the software license issue which was raised by Concurrent Computer Singapore. With the resolution of the problem recently, MMS has initiated action with the local telecommunication authority as well as the Singapore Meteorological Service on the possible course of action relating to the upgrading exercise.

Philippines 19. The pre-construction activities pertaining to the Meteorological Telecommunication System Development Project (MTSDP) proceeded as planned. The installation of the system has been started and is expected to be completed by 1995, which would hopefully systematically link all the weather stations in the country.

Viet Nam 20. Preparations are being made to establish the Regional Telecommunication link between Hanoi and Bangkok.

Meteorological Satellite

Philippines 21. The Australian-Philippine Remote Sensing Project came into reality with the installation of the NOAA HRPT (National Oceanic and Atmospheric Administration High Resolution Picture Transmission) satellite reception station. The Philippine HRPT system is composed of an integrated NOAA AVHRR (Advanced Very High Resolution Radiometer) and TOVS (TIROS Operational Vertical Sounder) processing and archiving facility.

22. The AVHRR provides images at visible and infrared wavelengths and the data can be used in various fields such as meteorology, agriculture, oceanography, etc. The TOVS provides data which can be processed to provide vertical profiles of atmospheric temperature and moisture, ozone content, cloud amount, surface temperature, etc. With the availability of such data, PAGASA could enhance its capability in weather forecasting and typhoon research. The project is expected for completion in December 1992.

23. Regular operation of the GMS-VISSR System continued with the system functioning satisfactorily. It has been a great help in forecasting the areal extent and movement of tropical cyclones.

Thailand 24. Purchasing four additional new high receiving systems for reception of GMS and NOAA imageries is in progress.

Numerical Weather Prediction

Hong Kong 25. Two high speed computing workstations dedicated to numerical modeling were installed in early 1991. Operational limited-area models were adapted to run on the workstations and numerical products were made available to the Central Forecasting Office in a more timely manner. Both the analysis and forecast components of the models will be modified to improve the forecast accuracy.

Korea

26. KMA established the Numerical Weather Prediction Division this 1991. It is currently operating 3 models twice a day, the Asia Limited Area Model (A-LAM), the Far-east Limited Area Model (F-LAM), and Ocean Forecast Model (OFM). The models are continuously being updated concurrently with the division's development of the Korea Limited Area Model (K-LAM), which is a fine mesh model with detailed physical processes. KMA agreed with the Japan Meteorological Agency for continuation of bi-lateral technical cooperation in the numerical weather prediction, especially on developing the severe weather prediction model and utilizing model output statistics.

Philippines

27. PAGASA has newly acquired a GRAPTEC Pen Plotter which enhances the efficiency of plotting output products, i. e., 850 hPa wind, 500 hPa wind, geopotential heights, etc. In addition, it is now using a software to interpret radar messages with graphical representations using AUTOCAD. In tracking and forecasting tropical cyclones, PAGASA continued to utilize the existing objective techniques.

Marine meteorology

China

28. The setting up of automatic anemometer stations in China was started in early 1980 by the Changchun Meteorological Instrument Research Institute to provide for accurate detection of strong winds caused by tropical cyclones. The samples of the first generation were installed on the off-shore oil platforms in Bohai Sea and were tested for 18 months. The maximum wind speed detected was 38 m/s. On this basis, the automatic anemograph was finalized as WDZF and put into production by small amount for the utilization of meteorological and marine departments. So far, 10 automatic anemometer stations were set up and fully functioning on the islands. The setting up of these automatic anemometer stations is an important component of the plan of marine meteorology in China. It will provide valuable information for the marine meteorological forecast and research.

Hong Kong

29. Two new tide gauge stations are being added to the existing tide gauge network of some 8 stations to better monitor sea levels. Data from these new gauges would also be useful for the calibration of storm surge models.

III. Hydrological Component

Hong Kong

1. The hardware and software of a replacement Rainfall Data Acquisition System have been designed. The new system is expected to be operational by early 1992. Rainfall data from field units will be telemetered by economical minilink circuits to the central station at the Royal Observatory Headquarters.

2. The hardware and software of the Automatic Water Level Reporting System was being modified to cope with data from a larger number of hydrological stations. The new system will be operational by early 1992.

3. Statistics of extreme rainfall and design rain-storm profiles for rainfall data at the Royal Observatory in 1947-1990 have been compiled. Similar statistics will be compiled for three other rain gauge stations in the northern part of the New Territories. Reports on two of the stations will be completed by the end of this year; while the remaining one is scheduled to finish by April 1992.

Korea

4. Hydrological activities in Korea are divided into:

- Hydrologic data collection;
- Development of water resources management techniques;
- Activities in International Hydrological Program (IHP);
- Installation of the flood forecasting and warning system for the Youngsan River Basin.

5. Hydrologic data in Korea are mainly collected by the Ministry of Construction (MOC) and the Korea Meteorological Administration (KMA). Also, Korea Water Resources Corporation and the Rural Development Corporation have been operating the hydrological data system in connection with their works independently. And many of local provincial administrations have their own hydrometeorological stations although they are operated in non-recorded system.

6. During the period from 1987 to 1991, a research priority has been given to develop a national hydrological data base, because the data base can be used as fundamental background for other researches. This led to the development of hydrological data base named HISS (Hydrological Information Support System).

7. Currently, two kinds of the hydrological data base are developed, one is the workstation-based system for hydrological services and the other is the personal computer-based system for managing hydrological data for a specific project. In 1990, a preliminary national service program of retrieving hydrological data has been tested using the workstation-based system, and a seminar to implement the personal computer-based system is scheduled.

8. Another major effort planned during the period from 1991 to 1992 is to develop guidelines for flood estimates. In the 1991 period, historical flood records have been investigated and organized for calibration of the methods that will be developed in 1992. In addition, a development of a guideline to choose a flood estimation method is carried out.

9. To cope with the objectives set up by UNESCO for the fourth phase of IHP, the following subjects were selected for study in the year 1990 as the Korean IHP activities:

- Validity of SCS curve number method in estimating effective rainfall for small midsize watersheds;
- Small watershed peak flow prediction;
- Dynamic wave models in river system for heavy flood;
- Multiple regression model for the estimation of monthly runoff from ungauged watersheds;
- Environmental impact assessment methodology for water resources development;
- Collection and basic analysis of hydrologic data of the representative basins. -

10. In the past decade and a half, MOC has developed real-time flood forecasting systems. The Han river Flood Forecasting and Warning System (FFWS) was firstly installed in 1974 and has been operated since then. The Nakdong river FFWS was completed in 1986 and has been operated since 1987. Now, MOC is in the process of installing FFWS for medium scale catchments besides the larger catchments mentioned previously. For this objective, MOC has installed the system for the Sumjin river and the Geum river in March and August 1990, respectively, which have been in operation since then.

11. As the fifth flood forecasting system which may be the last FFWS for medium scale basins in Korea, the Youngsan river FFWS was designated and designed to predict floods in advance and minimize flood damages in 1990. For this purpose, hydrological data collection network was designed and a conceptual run-off model was proposed for run-off computation. The system was completed in June 1991 and is expected to be operational in Autumn this year.

Malaysia 12. The Tank Model and the Linear Transfer Function Model continued to be used for real-time flood forecasting for the Kelantan and Pahang River Basins respectively during 1990 monsoon season with satisfactory results. Preparations have been made for testing the Linear Transfer Function Model on the Muar River Basin and the Tank Model on the Segamat River. Up to this time of writing, no serious floods were available for testing.

13. No serious floods occurred during the northeast monsoon of 1990 though some minor ones and flash floods took place in several places.

14. Telemetric flood forecasting systems for Batu Pahat and Sarawak River were completed. New systems have been proposed for the States of Kedah and Penang.

15. Lotus 123 continued to be used as FLOOD CATALOGUE for storing the flood information in chronological order and providing an effective flood monitoring means of updating as well as retrieving flood information for future analysis. Database 4 is being tried.

16. ESCAP Roving Seminar on Comprehensive Flood Loss Prevention and Management (CFLPM) was successfully held on 1-2 March 1991 and was attended by more than 70 participants from all Department/Agencies involved in activities related to floods.

Philippines 17. The occurrence of several meteorological phenomena in the country caused rampant floodings. Flood operation procedures prompted the issuance of fifty six flood bulletins composed of thirty two flood outlooks, twenty two flood advisories, and two flood warnings covering the river basins of Pampanga, Agno, Bicol, and Cagayan de Oro. Two special flood information were likewise issued for Metropolitan Manila.

18. Hydrologic studies were undertaken which included post-flood investigations and surveys in the provinces of Iloilo, Roxas, and Ilog Hilabangan, Negros Occidental due to Typhoon Ruping (Mike 9025). Ocular surveys of the Pampanga River Basin was conducted to determine the effects of the volcanic eruption (Mt. Pinatubo) in the basin.

19. In lieu of the continuous application of the Slope-Area Method, streamgauging and cross-sectioning activities were conducted at the sites of water-level stations in the Pampanga and the Agno river basins.

20. Various information were provided to the WMO. These are in relation to the hydrological services in water resources management, identification of large river systems in the country, inquiry on Management Overview of Flood Forecasting Systems (MOFFS), and the HOMS Components' computer usage and languages for WMO Hydrology and Water Resources Department. In addition, PAGASA hosted two ESCAP sponsored seminars on comprehensive flood loss prevention and management.

21. The OECF funded Flood Forecasting and Warning System for Dam Operations (FFWSDO) Project II carried out the implementation of contracts B and C. Contract B includes the civil, telemetry, warning and telecommunication works for the Binga/Ambuklao dam and Magat dam systems; supply, delivery, testing and commissioning of computer systems at the Data Information Center; rehabilitation of the existing flood forecasting systems and provision of human resource training. The training completed within the calendar year include Systems Management Course for supervisory level, Hydrology On-the-job Training Course and Telecommunications Training Course. The Systems Management Course for non-supervisory level is expected to be completed in November.

22. Contract C includes manly the establishment of the Data Information Center (DIC) Building, which is now in the finishing stage. The DIC will house the operational units of the PAGASA such as the Flood Forecasting Branch and the Weather Forecasting Branch. The hydrological component at the DIC would mainly serve as the centralized monitoring and data processing center for effective flood forecasting activities.

Thailand 23. The flood forecasting and warning system in the Pasak River Basin is being monitored routinely.

24. The roving seminar on comprehensive flood loss prevention and management was held in Bangkok from 25-26 February 1991.

25. Workshop on forecasting, preparedness and other operational measures

for water-related natural disaster reduction was held in Bangkok from 29 April to 3 May 1991.

Viet Nam 26. Forecasts on flood occurrences on the main rivers were made. Special attention was given to high floods on the main river system. The flood on the Red River attained its highest peak in Hanoi at 11.49m on 16 August. The flood level on Thai Binh river system at Phalai was 5.40m on 16 August.

27. All the forecasts on tropical cyclones and floods was timely relayed to the Central and Local Committees for flood and typhoon control for disaster prevention and preparedness, while at the same time was broadcast on mass media.

Malaysia

36. The main form of national disaster experienced in Malaysia is floods which occur during the northeast monsoon season. However now and again certain areas in the country experience flash floods which occur after heavy rainfall. As such the measure normally undertaken is the preparation of relief and relief centers for flood victims.

37. The Department of Social Welfare has been assigned three main functions, viz:-

- Locate, prepare and administer evacuation centers;
- Prepare and forward food, clothings and other needs for the victims;
- Responsible for the rehabilitation of victims.

38. For the year 1990/1991, the Department of Social Welfare located and prepared 3,062 evacuation centers throughout the country which can provide accommodation for 791,645 evacuees. They are sited at strategic positions in flood-prone areas. Registration of victims is carried out at these centers.

39. Food supplies are important relief items. Therefore, the Welfare Department maintains close liaison with the Padi and Rice Board to ensure the adequate supply of rice. This is stockpiled by the Board and can be obtained at any time as required. The Department also has close liaison with the Ministry of Domestic Trade and Consumer Affairs in order to ensure the immediate supply of dry rations and canned food, mats, pillows, blankets and the like.

40. The Department has also prepared a total of 276 "forward bases" in remote areas where food and other essential items can be stored. In the event of any flood victim being stranded in isolated or "cut off" areas, the Royal Malaysian Air Force will air drop supplies on behalf of the Department.

41. The Department has a standing arrangement with the Malaysian Red Crescent Society which runs a mobile kitchen service to prepare food provided by the said agency.

42. In addition, the Department also enlists the assistance of the other organizations such as the Civil Defense Corps, St. John Ambulance Brigade, and voluntary organization to man evacuation centers and to provide essential facilities required by the victims. A register of those voluntary agencies and individuals are constantly reviewed and updated and these agencies and individuals can be called upon at any time in the event of an emergency.

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

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

45. The amount of relief supplied to the flood victims for the year 1991 (until September) is $30,075/-. The amount may increase considerably if severe flood occurs at the end of this year, that is, during the coming North East Monsoon.

Philippines

46. The unrelenting onslaught of natural disasters in the country has crystallized the country's determination to persevere in the improvement of its disaster preparedness and prevention system. With the realization that disaster-affected communities may be cut-off from the rest of the country, the emphasis is on developing a community-based, self-reliant disaster response units and intensified information and education campaign.

47. The Office of Civil Defense (OCD) pursued the organization and reorganization of the Disaster Coordinating Councils (DCC) in line with the community-based, self-reliant approach. Organization of DCCs was also made at the village level supported with training programs and recruitment of volunteers. Its public eduction program continued to be undertaken through radio and television broadcasts, in close liaison with government warning agencies, in the development of information materials.

48. For the period January to August 1991, OCD organized 1,158 DCCs and reorganized some 239 others. Some 300 Disaster Control Groups (DCGs) were organized in other institutions and establishments. A total of nearly 8,000 DCC and DCG members and volunteer workers were trained in collaboration with other government agencies, particularly the Department of Local Government (DLG) and the private sectors. About 5,375 local officials and private sector representatives were given briefings and orientation on all aspects of civil defense and DPP. Local DCCs were activated in the drought-stricken areas, thus facilitating the conduct of relief services spearheaded by the Department of Social Welfare. It likewise extended assistance to farmers in cooperation with the Department of Agriculture. Massive information and education campaign on disaster preparedness and prevention was undertaken causing the reproduction and distribution of the following information materials: 593 copies of the "Calamities and Disaster Preparedness Plan" manual; 3,811 copies of "Barangay Disaster Manual"; 8 copies of "How to Assess Damage and Impact"; 1,090 copies of other civil defense information materials; 50 copies of the Pinatubo Volcano Emergency.

49. OCD continuously monitored the occurrence and effects of lahar (mudflow) from Mt. Pinatubo and other related incidents and response activities. It assisted the Department of Public works and Highways (DPWH) and the Japan International Cooperation Agency (JICA) in the installation of a debris flow warning system, which consists of two monitoring stations, two relay stations and eight sensors. This warning system augments the existing lahar alert watch system, and would be turned over to DCC region III.

50. Furthermore, it disseminated warning information on tropical cyclones to all its regional centers and other agencies, for the conduct of preparedness and response activities in the areas concerned.

51. Prompted by the sad experiences from various disastrous typhoons

which devastated the country (a recent example of which is Typhoon Ruping [TY MIKE 9025] in November 1990), PAGASA further improved on its tropical cyclone warning bulletin. The modification and revision was undertaken as a response to the sentiment of people for a need of a "higher danger" warning signal; and the inclusion of more explicit precautionary measures. The old Domestic Bulletin heading was changed and split into Weather Advisory and Severe Weather Bulletin headings. Included in the Severe Weather Bulletin are two stages - the Tropical Cyclone Alert and the Tropical Cyclone Warning. A fourth warning level (Public Storm Signal Number 4) was added, which pertains to a very dangerous and highly destructive situation associated with a very intense typhoon. To make the warning more response-oriented, the meaning of each signal in terms of potential danger are given by statements describing the degree of associated damage to indigenous vegetation and structure. The wind strength range and the warning lead time for every storm signal number were also redefined. Cognizant of the very important role of the mass media in the effective information dissemination of the warning modifications, a series of lectures/seminars were conducted for members of the tri-media and disaster managers in Metropolitan Manila and in the provinces.

52. The USAID-assisted project on Disseminating Public Information on Natural Hazards in the Philippines is undergoing preliminary evaluation. An assessment survey of the program is currently being conducted at several pre-identified pilot provinces. The principal concerns of the evaluation are: how far the information dissemination approaches which were earlier formulated have been carried out; the effectiveness of the audio-visual materials in educating the people, and the public response to the program. Printing and production of additional audio-visual materials in educating the people, and the public response to the program. Printing and production of additional audio-visual materials in the form of 16 mm documentary films, VCR tapes, posters, and comic magazines are being seriously considered to support the increased demands for these in the field.

53. Aside from performing the basic functions of synoptic stations, the PAGASA field stations which are strategically distributed throughout the country are also active in the enhancement of public awareness of tropical cyclones and the associated hazards. Field personnel serve as resource lecturers in DPP seminars and maintain close linkages with local officials and disaster managers in their areas of concern.

54. Not to be outdone, the Department of Social Welfare and Development (DSWD) meanwhile implemented several strategies in coping with disasters. It has established a credit line with the National Food Authority (NFA) authorizing provincial DSWD units to withdraw rice form the nearest depository. It likewise strengthened linkage with local government agencies, NGOs, and other civic groups to maximize the utilization of local materials and manpower resources in disaster-response operations. It continued to maintain round-the-clock operations and communication centers at all levels to facilitate the flow of information and networking of disaster-response activities.

55. The spate of recent disasters in the country kept DSWD very much

occupied. It served and extended assistance to 1,043,374 families (5.53M individuals) at a cost of ₱83.5M coming from internal and external funding sources.

56. It conducted several regional Disaster Management Workshops from November 1990 to August 1991, with a total participation of 376 individuals from both the government and non-government institutions. These training modules were sponsored by the UNDP and the British government.

IV. Training

Hong Kong

Venue	Course	Date
Provided by Hong Kong	Initial Training Course for Scientific Assistants	Oct. 1990 - Jan. 1991
U. K.	Scientific Officers' Course in the British Meteorological Office College	Jan. 1991
Beijing, China	Meso-scale Numerical Modeling	Feb. - Mar. 1991
Toronto, Canada	WMO Symposium on "Methods of Meteorological Education and Training Including the Use of New Relevant Technologies"	Oct. 1991
Wageningen, Netherlands	WMO workshop on "Interpretation of NWP Products in terms of Local Weather Phenomena and their Verification"	Jul. - Aug. 1991

Korea 1. Two KMA staffs have trained on numerical modeling and one ha participated in the IDNDR regional symposium. Details are a follows:

Place	Course	Period
Thailand	ESCAP/UNDRO Regional Symposium on the IDNDR	11 - 15 Feb. 1991
Florida State University, USA	Numerical Weather Prediction Modeling	15 Aug. 1991 - 13 Jan. 1992
Japan	Development of Severe Weather Prediction Modeling	2 - 11 Sep. 1991

Malaysia 2. Under the TCDC arrangement, an officer from the Malaysian Meteoro logical Service will be attached to the Maritime Meteorologica Division, Marine Department, Japan Meteorological Agency for period of 3 weeks beginning from 4 October 1991 for the purpose o adapting a coastal wave model for application in the Malaysia region.

Philippines

3. The Second Training Workshop on Improving Cyclone Warning Respons and Mitigation (ICWRM-2), sponsored by the European Community (EEC and organized by the Asian Disaster Preparedness Center (ADPC) i cooperation with PAGASA, DSWD and OCD, was conducted at Subic Zambales in January 1991. The workshop was well attended by loca and foreign participants of various disciplines including meteorolo gists, disaster managers, government officials, engineers, a planners.

4. As a result of the successful ICWRM-2 workshop, an abbreviate

course was conducted in the Bicol region at the request of the local participants, and was personally financed by the Australian workshop consultant, Mr. Bob Southern.

5. DSWD conducted several regional Disaster Management Workshops from November 1990 to August 1991, with a total participation of 376 individuals from both the government and non-government institutions. These training modules were sponsored by the UNDP and the British government.

6. For the year 1991, three Filipinos availed of foreign study grants, while twenty five attended seminars, workshops, and training courses abroad.

Study Grants:

Sponsor	Course	Date/Venue
Irish Government	International Post Graduate in Hydrology	Oct. 1991, Ireland
British Government	Diploma Course in Elec. for Met. Engineers	Oct. 1990 - May 1991, England
Philippine Remote Sensing Project	Masteral Degree in Remote Sensing	Feb. - Dec. 1991, Australia

Training, Workshops and Seminars:

Sponsor	Course	Date/Venue
World Meteorological Organization (WMO)	DDT3-Advance Course in Met. telecommunication	May 1991, India
	Improving Cyclone Warning Response & Mitigation-4	Jul. - Aug. 1991, Thailand
	Reg. Training Seminar on Aero. Forecasting, Briefing Documentation in RAI/RAV	Oct. 1991, Singapore
	Repair, Maintenance and Calibration of Basic Met. Instruments and Eqpt.	Oct. 1991, China
VCP/WMO	Instrument Maintenance Course for Met. Technicians	Apr. - Aug. 1991
UNDP/WMO	Workshop on Tropical Cyclone Forecasting	Oct. 1991, Fiji
	Training Workshop on Agrometeorology	30 Sep. - 11 Oct. 1991
China	Severe Weather Forecasting and Doppler Radar	May 1991

7. Being the Regional Meteorological training Center (RMTC) in Southeast Asia, the Philippines conducted training through the PAGASA and the Department of Meteorology and Oceanography of the University of the Philippines.

Thailand 8. Training, Workshops and Seminars:

Venue	Course	Date
China	RA II Working Group on Hydrology	18 - 22 Oct. 1990
	UN Workshop on Application of Space Techniques to Combat Natural Disaster	23 - 27 Sep. 1991
Japan	Seminar on Promotion of Ozone Layer Protection in Asian Countries	25 Nov. - 2 Dec. 1990
	Information Processing Personnel System Engineer (A) for Senior System Analyst/Designer	9 May - 23 Aug. 1991
	Training Course in Meteorology	15 Aug. - 19 Dec. 1991
Bangkok	Training Course on Improving Cyclone Warning Response and Mitigation	13 - 24 Aug. 1991
India	Workshop on Telecommunications and Meteorological Electronic Instruments (RAS/89/005)	22 Oct. - 9 Nov. 1990
	Third WMO Regional Workshop on Asian/African Monsoon with Emphasis on Training Aspects	2 Jan. - 8 Feb. 1991
Nepal	RA II/RA V Training Seminar on the Presentation and Use of Meteorological Data for Solar Wind Energy	11 - 23 Mar. 1991
Philippines	Training Workshop on Agrometeorology	30 Sep. - 11 Oct. 1991
Singapore	Training Workshop on the Use of NWP Products	29 Oct. - 9 Nov. 1990
	Software Development for Meteorology	1 Sep. - 31 Oct. 1991
U. S. A.	International Post Graduate Course in Environmental Management	3 Sep. - 10 Dec. 1991
U. K.	Instrument (Non-Electronic) Maintenance Course for Meteorological Technicians	15 Apr. - 2 Aug. 1991
U. S. S. R.	Training Course on Hydrological Forecasts of Floods	22 Apr. - 16 May 1991

Viet Nam 9. An engineer-forecaster was nominated by Hydrometeorological Service to participate in the UNDP/WMO Workshop on Tropical Cyclones which was held in Fiji in October 1991.

V. Research

China 1. In 1990, China not only finished the SPECTRUM in cooperation with countries and regions concerned but also organized the domestic experiments, and thus has laid down the basis for the typhoon research work after the field experiments with the great amount of densified observing data received. The themes defined in February 1991 were as follows:

- The influences of structural change of tropical cyclone on its track;
- Diagnosis and analysis on the complication of the track of typhoon 9112;
- Research on the relationship between the multi-layer environmental flow field and the abnormal movement of typhoon;
- The interaction between circulation system in the westerly belt and subtropical high;
- Research on the relation between the structures and the tracks of tropical cyclones;
- Diagnosis and analysis as well as numerical modeling on the influences of the asymmetric structure of typhoon on its abnormal track;
- The interaction between two tropical cyclones and its impact on the track;
- Influence of the topography of Taiwan on movement and structure of tropical cyclones.

2. Presently, all of the data exchanged through SPECTRUM have been distributed to the relevant operational and scientific research departments. All of the research works are being undertaken and the primitive summary report is expected to be finished by August 1991. This is also in preparation for the technical conference on SPECTRUM to be held in Guangzhou in November 1991.

Korea 3. KMA is conducting researches with Meteorological Research Institute and some universities for the numerical prediction of typhoon movement and heavy rain associated with typhoon. It is sponsored by the Ministry of Science and Technology by the special development project. Brief summaries are as follows:

- Numerical prediction of typhoon movement: Testing a Barotropic Model and a Quasi-Lagrangian Model, especially on the improvement with respect to bogusing of typhoon and steering currents at initial state.
- Cumulus parameterization: A research is ongoing for improving cumulus parameterization to simulate more realistic latent heat release in typhoons.

Hong Kong 4. A comparative study of the recurving and non-recurving tropical cyclones during SPECTRUM was undertaken and the preliminary results would be presented in the Technical Conference on SPECTRUM in Guangzhou, China in November 1991.

5. To meet the needs of the engineering community, computer programs were coded and tested to produce wave spectra for waves generated in tropical cyclones.

6. Updating of a climatological dataset of tropical cyclones and associated weather was initiated in 1991.

7. A joint project with a local tertiary institution was started to study the pattern and variation of tropical cyclone activity over the South China Sea.

8. The following research papers were published:

- Technical Note No. 84 "Real-time exchange of digital radar images between Hong Kong and Guangzhou"

- Technical Note (Local) No. 57 "The analysis and prediction of tides at Chi Ma Wan, Lau Wan, Lok On Pai, Tai O, Tsim Bei Tsui and Waglan Island"

- Reprint No. 194 "Reduction of weather-related disasters in southeast Asia and the western Pacific - a response to IDNDR"

- Reprint No. 195 "A case study on the forecasting of rainstorm in Hong Kong in late spring: 2 May 1989"

- Reprint No. 196 "Performance of the Royal Observatory Limited-Area Model (ROLAM) in operational tropical cyclone track forecasting"

- Reprint No. 198 "Marine meteorological information service: the Hong Kong perspective"

- Reprint No. 199 "SPECTRUM: Special Experiment Concerning Typhoon Recurvature and Unusual Movement 1990"

- Reprint No. 207 "Simulation of boundary layer flow in Hong Kong"

Philippines

9. Tropical cyclone researches:

- The effect of El Niño on Tropical Cyclone Formation. This study attempts to determine the effect of El Niño on cyclone formation in the western North Pacific;

- Updating of database for Bagyo '80 (Typhoon Analog) and Amadore 2 (Weighted P+C) Methods of Forecasting Tropical Cyclone Movement;

- Improvement of the Operational Barotropic Model (Alasbar) specifically boundary conditions and initial wind fields;

- Development of Asymmetric model for typhoon surface wind;

- Numerical study on the Topography Effect on Tropical Cyclone Characteristics;

- A Statistical Method of Forecasting Tropical Cyclone Intensity for the Philippines;

- Subjective Diagnostic Analysis of the Troposphere Temperature During

Tropical Cyclone Occurrence;

- Numerical Study of the Effect of Terrain of Northern Luzon on Tropical Cyclones.

10. Weather-related Disaster Research:

- Development of Typhoon Damage Assessment Model;

- Survey on Human Response to Typhoon Warning and Typhoon Risk Mapping;

- Development of Weather-related Disaster Data Base System;

- Rain-induced Landslides in the Philippines. This study intends to develop the concept of mitigation brought about by landslides.

Thailand 11. List of on-going researches:

- Some objective techniques for tropical cyclone prediction over Thailand and neighboring areas are further investigated and formulated. Tropical cyclone climatology over Thailand area of responsibility has been further studied.

- The initialization schemes and boundary conditions for the primitive equation model applied for a limited region in the South China Sea and surrounding area are being studied. The formulation of cumulus parameterization and the large-scale release of latent heat are being investigated for the tropical atmosphere.

- All NWP products received by GTS from ECMF, KWBC (Washington), RJTD (Tokyo) and EGRR (Bracknell) are analyzed and graphically displayed by software developed on IBM-PC/AT for purposes of research and operation of weather forecasts.

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

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

- Thailand collaborated with the TCS and other members of Typhoon Committee in the SPECTRUM. Data of IOPs taken by SPECTRUM as well as TCM-90 were received. The follow-up activities on utilization of SPECTRUM data for tropical cyclone research are being undertaken accordingly.

Viet Nam 12. Experimental calculations are being done on some models for tropical cyclone and flood forecasts. Eight topics for research related to tropical cyclone and flood have been elaborated. A report for the Technical Conference on SPECTRUM to be held in Guangzhou, China is being prepared.

VI. Promotion of the Tropical Cyclone Programmes

Thailand 1.

- Thailand, as well as other members of Typhoon Committee, are undertaking the follow-up activities on utilization of SPECTRUM data for tropical cyclone research.

- Projects of improving both monitoring and warning systems for the vulnerable areas to natural disasters are being prepared to be the national activity under the framework of IDNDR.

- Efforts to monitor, assess, predict and warn all of water-related havocs, such as drought and flooding for the whole country, are contained in the meteorological role in order to reduce their impact on socio-economic activities.

- The information on loss of human lives and damage to properties caused by typhoons, floods and storm surges during 1991 was compiled and assessed. Typhoon Fred (9111) was the first tropical cyclone that intruded Thailand this year.

- Seminar and workshop on mitigation of natural calamity were conducted in Bangkok and attended by various agencies concerned and some experts from the international organizations.

- Meteorological staff participated in different fields of international training courses, some of them were related to weather hazard aspects.

Appendix I

List of Participants

The First Joint Session of
the Panel on Tropical Cyclones and The Typhoon Committee
18-27 February 1992
Pattaya, Thailand

PANEL ON TROPICAL CYCLONES

Bangladesh

M.H. Khan CHOWDHURY
Director, Bangladesh Meteorological Department
Hqr. Building, Agargaon
Dhaka - 1207

Emdad HOSSAIN
Director, Cyclone Preparedness Programme
684-86, Mogbazar
Dhaka - 1217

India

S. KUMAR
Deputy Director-General of Meteorology
Regional Meteorological Centre
Colaba, Bombay - 400005
Telex : 011-2760, 011-6047

Maldives

Hassan RIZA
Deputy Director
Department of Meteorology
Male
Fax. (960) 320021

Pakistan

F.M. Qasim MALIK
Director-General, Meteorological Department of Pakistan
A-2, Karachi Airport
Karachi

Sri Lanka

N.A. AMARADASA
Deputy Director
Department of Meteorology
Bauddhaloka Mawatha
Colombo 7

Thailand

Patipat PATVIVATSIRI
Director, Studies and Research Division
Meteorological Department
4353 Sukumvit Road
Bangkok 10260
Telex : 72004 DEPMETE TH

Surin CHAITACHWONG
Assistant Director, Relief Division
Thai Red Cross Society
Henri Dunant Road
Bangkok 10330

Varesuan CHANDRARAMYA
Chief, Special Instrument Sub-Division
Meteorological Instruments Division
Meteorological Department
Bangkok 10260
Telex : 72004 DEPMETE TH

Amorn CHANTANAVIVATE
Chief, Hydrometeorological Analysis and
Forecast Sub-Division, Hydrometeorological Division
Meteorological Department
Bangkok 10260
Telex : 72004 DEPMETE TH

Kalaya CHINATIWORN
Foreign Relations Officer
International Affairs Division
Ministry of Transport and Communications
Rajdamnern Nok Road
Bangkok 10100

Jarun JUKRAVALCHAISRI
Chief, Special Project Section
Rural Health Division
Ministry of Public Health
Bangkok
Fax. (662) 281-5948

Virat KHAO-UPPATUM
Hydraulic Engineer, Operation & Maintenance Division
The Royal Irrigation Department
Bangkok 10300

Prasert MILINTANGUL
Director, Hydrology Division
The Royal Irrigation Department
Samsen Road
Bangkok 10300

Manoj MUKATI
Medical Officer
Relief Division
Thai Red Cross Society
Henri Dunant Road
Bangkok 10330

Thiang PETCHKAEW
Chief, Plan and Project Sub-Division
Disaster Relief Division
Department of Public Welfare
Krung Kasem Road
Bangkok 10100
Fax. (662) 281-5003

Prasit SATHORN
Chief, Drainage System Improvement Sub-Division
Drainage Control Division
Department of Drainage and Sewerage
Bangkok Metropolitan Administration
Mitmaitree Road
Bangkok 10400

Vichai SOMBOON
Chief, Planning and Project Section
Project Management Sub-Division
Technical Division
Department of Drainage and Sewerage
Bangkok Metropolitan Administration
Bangkok

Krisana NA SONGKLA
Chief, Technical-Service Sub-Section
Civil Defence Division
Department of Local Administration
Bangkok

Suparerk TANSRIRATANAWONG
Director, Telecommunication Division
Meteorological Department
4353 Sukumvit Road
Bangkok 10260
Telex : 72004 DEPMETE TH

Anant THENSATHIT
Chief, Weather Forecast Sub-Division
Weather Forecast Division
Meteorological Department
Bangkok 10260
Telex : 72004 DEPMETE TH

Pongsak VATHANA
Head, Medical Co-ordinating Division for Accident and Disaster
Ministry of Public Health
Bangkok

Suthas VEJCHO
Chief, Medical Officer
Office of Permanent Secretory
Ministry of Public Health
Bangkok

Winai YOO-SABAI
Policy and Planning Analysis
Planning Division
Ministry of Transport and communications
Rajdamnern Nok Road
Bangkok 10100

Host Country Secretariat

Dunyapon BISONYABUT
(Conference Officer)
Chief
Planning and Technical Co-operation Sub-division
Studies and Research Division
Meteorological Department
4353 Sukumvit, Bangna
Bangkok 10260
Thailand
Telex : 72004 DEPMETE TH

Technical Support Unit Secretariat

M.H. Khan CHOWDHURY
(Co-ordinator)
Director, Bangladesh Meteorological Department
Hqr. Bldg., Agargaon
Dhaka - 1207
Bangladesh

TYPHOON COMMITTEE

China

MA Henian
Deputy Administrator
State Meteorological Administration (SMA)
46 Baishiqiaolu Road
Beijing
Telex : 20094

CHEN Lianshou
Deputy Director
Chinese Academy of Meteorological Sciences
State Meteorological Administration (SMA)
46 Baishiqiaolu Road
Beijing

LU Jialian
Deputy Director
Department of Weather Prediction and Warning
State Meteorological Administration (SMA)
46 Baishiqiaolu Road
Beijing
Telex : 22094 FDSMA CN

WANG Juemou
Deputy Director
Department of Hydrology
Ministry of Water Resources
Beijing
Telex : 22466 MWREP CN

LI Fengqi
Programme Officer and Interpreter
Foreign Affairs Department
States Meteorological Administration (SMA)
46 Baishiqiaolu Rd.
Beijing
Telex : 22094

Hong Kong

P. SHAM
Director
Royal Observatory Hong Kong
134 A Nathan Rd.
Kowloon

Japan

Takashi NITTA
Director-General
Forecast Department
Japan Meteorological Agency
1-3-4 Otemachi
Chiyoda-ku
Tokyo 100

Fumio TANAKA
Deputy Director
Anti-Disaster Measures Operation Division
Disaster Prevention Bureau
National Land Agency
1-2-2 Kasumigaseki
Chiyoda-ku
Tokyo

Yuichi KATO
Deputy Director
River Division
Hokuriku Regional Construction Bureau
Ministry of Construction
1-3-38 Masago-cho
Niigata City
Niigata Prefecture

Malaysia

P. MARKANDAN
Director-General
Malaysian Meteorological Service
Jalan Sultan,
46667, Petaling Jaya
Telex : MA37243 Fax. (603) 755-0964

Ramli KAMARUDIN
Principal Assistant Secretary
National Security Council
Prime Minister's Department
Jalan Dato'Onn
50502, Kuala Lumpur

POH Thuan Poon
Director of Hydrology
Department of Irrigation & Drainage
Jalan Sultan Salahuddin
Kuala Lumpur

Elias Bin Mohd HASHIM
Deputy Director
Department of social Welfare
Wisma Shen, Jalan Masjid India
Kuala Lumpur

Philippines

Roman KINTANAR
Director
PAGASA
1424 Quezon Avenue
Quezon City

Telex: 66682 WXMLA PN
Fax: (632) 922 92 91
Telephone: (632) 922 80 66

Republic of Korea

Yong-Dai PARK
Administrator
Korea Meteorological Administration
1 Songweol-Dong, Chongro-ku
Seoul

Jung-Boo CHOI
Senior Forecaster
Korea Meteorological Administration
1 Songweol-Dong, Chongro-ku
Seoul

Hankyu PARK
Assistant Director
Disaster Prevention Division
Ministry of Home Affairs
Jugong Apartment 304-411
Haan-dong, Kwangmyung
Kyeonggi Province

LEE Bong Hee
Assistant Director
Chung Ang Government Complex
Ministry of construction
Kwacheon

Thailand

The same list as shown in
Panel on Tropical Cyclones

Viet Nam

Dinh Van LOAN
Director
Hydrometeorological Forecast Department
4 Dang Thai Than Street
Hanoi

Typhoon Committee Secretariat

Roman L. KINTANAR
Co-ordinator
UNDP, P.O.Box 7285
Domestic Airport Office Lock Box 1300
Domestic Road, Pasay City
Metro Manila
Philippines

Gabriel S. MONROY
Meteorologist
PAGASA
1424 Quezon Av., Quezon City
Philippines
Telex : 42021 PAGASA PM
Fax : (632) 922 18 72

Keigo YANAGIYA
Hydrologist
UNDP, P.O.Box 7285
Domestic Airport Office Lock Box 1300
Domestic Road, Pasay City
Metro Manila
Philippines

INTERNATIONAL ORGANIZATIONS

United Nations Economic and Social Commission for Asia and the Pacific (ESCAP

Cengiz ERTUNA
Chief
Water Resources Section
ESCAP, United Nations
Rajdamnern Avenue
Bangkok 10200
Thailand
Telex : 82392 ESCAP TH

Marcia BREWSTER
Economic Affairs Officer
Water Resources Section
ESCAP, United nations Building
Rajdamnern Avenue
Bangkok 10200
Thailand
Telex : 82392 ESCAP TH Fax. (662) 282-9602

World Meteorological Organization (WMO)

J.L. RASMUSSEN
Director
World Weather Watch Department
World Meteorological Organization
41, Giuseppe-Motta
Case postale 2300
CH 1211, Geneva 2
Switzerland

HO Tong Yuen
Director
Regional Office for Asia and the South-west Pacific
WMO, Geneva

R.P. SARKER
Chief
Asia and the South-west Pacific Division
Technical Co-operation Department
WMO, Geneva

Katsuhiro ABE
Chief
Tropical Cyclone Programme Office
World Weather Watch Department
WMO, Geneva

OBSERVERS

Commission for Atmospheric Sciences (CAS)

Russell L. ELSBERRY
Professor of Meteorology
Department of Meteorology (Code MR/Es)
Naval Postgraduate School
Monteray, California 93943
U.S.A.

International Civil Aviation Organization (ICAO)

Edward P. LYSAKOV
Technical Officer, Meteorology
ICAO
252/1 Vipavadee Rangsit Road
Bangkok 10900
Thailand
Telex : 87969 ICAO BKK
Fax. (408) 646-3061

International Federation of Red Cross and Red Crescent Societies (IFRC)

Carl E. NAUCLER
IFRC Regional Delegate for Asia
32, Jalan Nipah
55000 Kuala Lumpur
Malaysia
Telex : MACRES 30188

Germany

Thomas M. LAUDAGE
Embassy of Germany
9 Sathorn Tai Rd.
Bangkok 10120
Thailand

Indonesia

M. Ibnu SAID
Second Secretary and Assistant Permanent Representative of Indonesia to ESCAP
Embassy of Indonesia
600-602 Petchburi Rd.
Bangkok
Thailand

Macau

F.A.S. CRESTEJO
Meteorologist
Department of Forecasting
Fortaleza do Monte
Caixa Postal No.93
Macau

Thailand

Prinya SUDHIKOSES
Scientist, Royal Rainmaking Research
and Development Institute
Kasetsart University Campus, Bangkhen
Bangkok 10900
Telex : 72245 RRDI TH

Rachanewan BENCHABANDIT
Aeronautical Meteorology Division
Air Traffic Control, Bangkok International Airport
Donmuang
Bangkok 10210
Fax: (662) 532 12 55

Kiattisak THANGTRONGSAKOL
Project Analyst, Royal Rainmaking
Research and Development Institute
Kasetsart University Campus, Bangkhen
Bangkok 10900
Fax. 281-1863

Boonsuab THARESARA
Government Officer
Academic Branch
Civil Defence Division
Department of Local Administration, Ministry of Interior
Bangkok 10300

United Nations Office of the Disaster Relief Co-ordinator (UNDRO)

Brian WARD
Director
Asian Disaster Preparedness Centre
P.O. Box 2754
Bangkok 10501
Thailand
Telex : 87276

United Nation Department of Technical Co-operation for Development (UN/DTCD)

Uri GOLANI
Inter-regional Advisor
Water Resources and Hydrogeology
UN/DTCD
Room DC-1-0764 United Nation
New York N.Y. 10017
U.S.A.

75

United States of America / RA IV Hurricane Committee

Jerry D. JARRELL
Deputy Director
US National Hurricane Center
1320 S. Dixie Highway
Coral Gables
Florida 33146

Appendix II

Agenda of the meeting

1. Organization of the session

   1.1 Opening of the joint session
   1.2 Election of officers for the session
   1.3 Adoption of the agenda
   1.4 Establishment of sub-committees
   1.5 Working arrangements for the session

2. Annual publications

   2.1 Typhoon Committee annual review and Typhoon Committee newsletter
   2.2 Panel news

3. Review of the 1991 tropical cyclone/typhoon season

4. National reports on activities and developments during 1991 under the regional cooperation programmes

5. Coordination of activities

   5.1 Coordination within the Tropical Cyclone Programme
   5.2 Coordination of activities common to the Panel and the Typhoon Committee

6. Review of the Tropical Cyclone Operational Plan and the Typhoon Committee Operational Manual.

7. Review of the programmes for 1992 and beyond

7.1 International Decade for Natural Disaster Reduction and other activities

7.2 Coordinated technical plan of the Panel

7.3 Typhoon Committee Regional Cooperation Programme Implementation Plan

8. Support required for the regional cooperation programmes

8.1 Arrangements for the Technical Support Unit

8.2 Arrangements for the Typhoon Committee Secretariat

8.3 Technical Cooperation

9. Election of the Chairmen for the Panel on Tropical Cyclones and the Typhoo Committee

10. Agenda for and date and place of the twentieth session of the Panel o Tropical Cyclones and the twenty-fifth session of the Typhoon Committee

11. Scientific lectures and technical discussions

12. Adoption of the report.

Appendix III

Summary of the 1991 Cyclone Season
based on from the RSMC-tropical cyclones New Delhi report

In 1991, eight cyclonic disturbances formed in the Bay of Bengal, out of which three were tropical cyclones and five were depressions. The first two cyclones formed during the pre-monsoon season (March-May) and crossed Bangladesh coast, while the third one formed during the post-monsoon season (October-December)and crossed Tamilnadu coast in India.

The cyclone of April 1991, which crossed the Bangladesh coast on 29 April near Chittagong, was the most devastating cyclone so far in this centrury. RSMC-tropical cyclones New Delhi issued tropical cyclone advisories to the Bangladesh Meteorological Department at frequent intervals. These advisories were fully utilized by the Bangladesh Meteorological Department along with other sources of information, in issuing timely warnings on this cyclone. The other cyclone which crossed the Bangladesh coast on 2 June 1991 was of moderate intensity. This system helped in the northward progress of southwest monsoon over the northeastern States of India.

The last cyclone of the year 1991 crossed the Tamil nadu coast in India on 15 November 1991 and caused considerable damage to standing crops and properties in the coastal districts of Tamil nadu and south Andhra Pradesh. However, due to timely and adequate warnings issued by the India Meteorological Department and effective action taken by the State Governments, more than 100,000 people from the coastal areas were evacuated to safer places, thus minmizing the loss of life considerably.

The depressions of the southwest monsoon season (June-September) sustained good monsoon activity in the Panel area, whereas the depressions of the post-monsoon season enhanced the winter monsoon activity over peninsular India.

Implementation Plan of the RSMC Tokyo - Typhoon Center

PRODUCT	91	92	93	94	REMARKS
GMS Observation					
GMS S-VISSR					24 times/day (full-disk)
WEFAX					8 times/day (4-sector),
					24 times/day (Image H),
Cloud motion wind					20 times/day (Image I or J)
					4 times/day
Analysis					
SAREP (for tropical cyclone)					4-8 times/day Dvorak intensity (estimation included)
Report of typhoon analysis					4 times/day
Sea surface temperature					10-day mean and its anomaly
Objective analysis					
conventional					FAX
stream line		—			FAX*
Cloud distribution					GPV*
Long-wave radiation					GPV*
Forecast					
Report of typhoon analysis					4 times/day 24 & 48 hrs forecast
Prognostic reasoning					2 times/day
Output of numerical prediction model for typhoon movement					4 times/day up to 60 hrs
NWP products					
conventional					FAX, GPV (Global Model)
stream line					FAX (Global Model: 24 & 48 hrs)
Others					
Best Track					GTS
Annual Report					
Technical note		—			

SUPPORTING ACTIVITY					REMARKS
Data archive					
Monitoring of data exchange					
Product dissemination via GMS			- - -		Under consideration
Development of a numerical model for prediction of intensity of typhoon					

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

Appendix V

Summary of National Reports Covering Review of the 1991 Typhoon Season

Four Typhoons struck southern China in 1991. The most destructive was Amy (9107) which left 100 persons dead, 5,239 injuried and caused destruction of 63,372 houses. Economic losses amounted to $US 465 million. However, the large-scale precipitation brought by Amy alleviated to some extent the drought situation prevailing in some provinces in southern China.

Climatic abnormalities appeared in some areas of China in 1991. In the Yangtze and Huaihe River basins, heavy rainfall occurred during the period from May to July, resulting in extraordinary floods.

Of the ten typhoons that affected Japan, three made landfall over Japan in 1991. In most cases, deaths, injuries and destruction to properties and industries could not be totally eliminated, even by the modern facilities and state-of-the-art disaster preparedness programme of Japan. Records, however, showed that deaths due to tropical cyclones had been drastically and constantly reduced through the years, lending proof to the importance of the overall programme in DPP.

Three Typhoons -- Caitlin (9109), Gladys (9112) and Mireille (9119) -- seriously affected the Republic of Korea in 1991. In all, 107 people were killed or missing and 78 others were injured. Total damage amounted to $US 635 million. Heavy rainfall and resulting flooding were the principle causes of damage in each case.

Eight of the 29 tropical cyclones in the north-western Pacific Ocean directly crossed the Philippines. Two of the eight which came in close succession inflicted the heaviest damage. Ruth (9123) in October caused 83 deaths, 22 missing and some 3.6 billion pesos worth of properties, while Thelma (9125) in November caused a record loss of 5,080 souls with 1,264 missing and

property damage close to one billion pesos. Yunya (9105) in June provided a rare natural event of passing though the eruption of Mount Pinatubo in Central Luzon, which in itself was the strongest volcanic activity throughout the world for many decades.

Zeke (9106) in July and Fred (9111) in August landed in Viet Nam. The weakened depression stage of Sharon (9101) and Thelma (9125) had also affected Viet Nam. Three floods were recorded. The big flood in the Mekong river and a flash flood in the small river of Son La province caused serious damage. All in all, tropical cyclones and floods combined had caused the death of 245 persons, injuries to 39, destruction to 15,936 houses and partial damage to 314,77[illegible] houses, the loss of 76,741 hectares of crops, flooding of 165,944 hectares of crops, and the wreckage of over 100 boats.

Fred (9111) in August, after passing Viet Nam, made its way to Thailand as a tropical depression. The heavy rain associated with it caused heavy flooding in north-eastern and northern Thailand with estimated loss of $US 84 million.

Appendix VI

Proposed Nomenclature for Surface Wind Speed Gradations for Tropical Cyclones

Based on materials provided and the discussion in plenary, a draft proposal of wind speed gradations was submitted by the representative of the Commission for Atmospheric Sciences (CAS). Having a specific proposal may be useful to focus future discussions at the RSMC's meeting, Regional Meetings and within Member countries.

The representative of CAS felt it would be possible for the research community to agree on such designations, as no existing infrastructure has to be overcome. Once agreement is reached, editors of publications will require concurrence with the designations.

Adoption by the operational community will be more difficult because existing practice/terminology must be changed. Nevertheless, progress toward a globally consistent designation is desirable and requested for the aviation and marine users. It may be useful to make a start at the Joint Session by adopting the draft as a basis for discussion, with responses requested prior to the next meeting.

Proposed Wind Speed Gradations for Tropical Cyclones

Designation	Wind speed range (knots)
Tropical Depression (TD)	Up to 34
Optional: Intense Tropical Depression (ITD)	25 - 34
Tropical Storm (TS)	35 - 63
Optional: Intense Tropical Storm (ITS)	48 - 63
Typhoon (TY)	64 and more
Hurricane (Cat.1 and 2)	
Optional: Intense Typhoon (ITY) or Cat.3 and Cat.4 Hurricane	95 - 129
Optional: Super Typhoon (STY) or Cat.5 Hurricane	130 and more

Note 1 The proposed designations allow for basin requirements for additiona gradations (with consistent use of Intense as the modifier) in the depressio (needed in Panel on Tropical Cyclone region), tropical storm (commonly used i Typhoon Committee region) and typhoon stages. In the latter case, the objectiv is to make the practices in the other areas generally consistent (only thre rather than five categories) with the Saffir-Simpson destruction categories use in Atlantic area. The Director of the Joint Typhoon Warning Center (Guam) ha prepared a modified Saffir-Simpson scale appropriate for the vegetation an construction existing on tropical islands in the typhoon region.

Note 2 The increased gradations reflect the ability of meteorologists t observe winds with finer resolution than the TD, TS and TY categories wou imply. Furthermore, the additional gradations are intended to rais systematically the public awareness of the tropical cyclone threat.

Note 3 The pressure related terminology used by India and other countries is not incorporated, as this proposed gradation is based on winds only.

Note 4 Definition of the intense tropical depression wind speed range differs from values in India, which would seem to apply practically to a value of 30 knots only. In the proposed scale, both 25 and 30 knots values would be included as practical reports in 5 knots intervals. Since this category probably is mainly relevant to mariners, the values might be related to specific wind values associated with the Beaufort scale.

FELLOWSHIP TRAINING REQUIREMENTS

Current priorites for possible support from UNDP project fund and other sources.

COUNTRY	Priorities	Subject	Duration	Desired Venue	No. of trainees
Bangladesh	1.	Advanced Tropical Cyclones Forecasting (NWP) Ph.D	2-3 Years	USA/UK	2
	2.	Storm Surge Forecasting	1 Year	USA/India	2
	3.	Coomputer Software Maintanance and Programming (Post-Graduate Course)	2-3 Years	USA/UK	1
	4.	Rawinsonde Maintanance	1 Year	Japan	3
	5.	Meteorological Equipment Maintanance (telecommunication electronic and conventional) and Calibration Course	6 Months	India/UK/Japan	3
	6.	Course on Disaster Management in AIT	4 Weeks	Thailand	2
	7.	Disaster Management Course in Admn. Staff College Hydrabad	4 Weeks	India	4
	8.	Roving Seminar on Disaster Prepardness	3 Weeks	India	
	9.	Flood Forecasting related to Tropical Cyclones and Flood plain Zoning/Maping	6 Months	USA/Japan/Thailand	2

FELLOWSHIP TRAINING REQUIREMENTS
Current priorites for possible support from UNDP project fund and other sources.

COUNTRY	Priorities	Subject	Duration	Desired Venue	No. of trainees
	10.	Tide and Tidal Surge mathematical Modeling	10 Weeks	USA/UK	1
India	1.	Storm surge prediction	5 Months	USA/Japan	2
	2.	Wave forecasting	4 Months	USA/Japan	2
	3.	Use of radars and satellites for cyclone detection, tracking and estimation of precipitation	4-6 Months	USA/Japan	4
	4.	Advanced techniques and procedures in meteorological telecommunications	6 Months	USA/Japan	1
	5.	Intensity and path prediction of tropical cyclones by dynamical methods	4-6 Months	USA/Japan	1
	6.	Disaster prevention and preparedness	3 Months	Japan/USA/ Australia	2
	7.	Management overview of flood forecasting system-Version 2 A (September 1989)	2 Months	UK/any other country	3
Maldives	1.	AFDOS System maintenance	4 Weeks	China	2

FELLOWSHIP TRAINING REQUIREMENTS
Current priorites for possible support from UNDP project fund and other sources.

COUNTRY	Priorities	Subject	Duration	Desired Venue	No. of trainees
	2.	Synoptic & Aeronautical forecasting	12 Months	Malaysia Singapore Indonesia	2
	3.	Satellite Picture interpretation	2-4 Weeks	USA	2
	4.	Computer Programming & maintenance	6-10 Weeks	Singapore or any other suitable venue	2
Myanmar	1.	Meteorological post-graduate Course/ M.Sc./Ph.D	2-3 Years	UK/USA/Netherlands	1
	2.	Hydrology post-graduate course	1-2 Years	USA/UK/Japan	2
	3.	Group training in meteorology	3-6 Months	USA/UK	3
	4.	Hydrological forecasting	4 Months	USA/UK	1
	5.	Meteorological telecommunication technician	3-6 Months	India	2
	6.	Hydrological technician course	3-6 Months	Pakistan/Nepal	2

FELLOWSHIP TRAINING REQUIREMENTS
Current priorites for possible support from UNDP project fund and other sources.

COUNTRY	Priorities	Subject	Duration	Desired Venue	No. of trainees
Pakistan	1.	Numarical Weather Prediction	6-12 Months	UK/USA	1
	2.	Strom Surge Prediction	3-4 Months	Australia Phillipines	1
	3.	Tropical Meteorology	6-12 Months	UK/USA	1
	4.	Meteorological Telecommunication	3-4 Months	FRG/UK	1
	5.	Remote Recording instruments	4-6 Months	Japan/UK	1
	6.	Operation & Maintenance of Electronic equipment	4-6 Months	Japna/UK	1
Sri Lanka	1.	Post-graduate studies (M.Sc.) in Meteorology,	2 Years	Philippines or any other suitable venue	3
	2.	Training for Class III Meteorological Personnel	4 Months	India/Pakistan/ Philippines	2
	3.	Advanced training for Meteorological Radar Engineer	1 Year	UK	1
	4.	Telecommunication technician	4 Months	India	1

FELLOWSHIP TRAINING REQUIREMENTS
Current priorites for possible support from UNDP project fund and other sources.

COUNTRY	Priorities	Subject	Duration	Desired Venue	No. of trainees
	5.	Instruments technician	4 Months	India	1
	6.	Tropical Cyclone Forecasting	2 Months	USA	1
Thailand	1.	Hydrological forecasting by using numerical medels	4 Months	UK/USA	2
	2.	Disaster analysis & management	4 Months	Japan/Australia	1
	3.	Disaster prevention course	3 Months	Japan/Australia	2
	4.	Numerical weather forecasting	4 Months	USA/UK/Japan	1
	5.	Tropical cyclone forecasting and warning	4 Months	USA/Japan	1

Appendix VIII

REVIEW OF ADVANCEMENTS IN UNMANNED AIRCRAFT TECHNOLOGY WITH POTENTIAL APPLICATION TO TROPICAL CYCLONE RECONNAISSANCE

Russell L Elsberry
Rapporteur for Tropical Cyclones, WMO/CAS Group of Rapporteurs for Tropical Meteorology.

1. Background

Tropical cyclones form over tropical ocean regions that generally have insufficient meteorological soundings for accurate analyses and forecasts of intensification and motion. Thus, many nations, and collectively, the World Meteorological Organization (WMO) have searched for new data sources. New technology related to unmanned aircraft appears to have potential application for atmospheric soundings in the environment of tropical cyclones. This progress report has been compiled from participants in various efforts. The objective in compiling this information is to explore opportunities for international cooperation in the development, testing and application of new observational platforms for tropical cyclone research and prediction.

Some definition of terms may be helpful. Unmanned aircraft (often referred to as drones) have been used for military purposes such as target practice or reconnaissance over hazardous sites. Very advanced (and expensive) unmanned aircraft such as the Boeing Aircraft's Condor are the descendants of such aircraft, which no longer are to be destroyed as a target or to be regarded as expendable. The proposed Aurora Flight Sciences Perseus (to be described below) is an advancement of the technology to long-duration, high-altitude (20 km) flight for in situ observations and deployment of dropwindsondes to observe profiles of meteorological variables.

The use of small (hobby size) aircraft for meteorological soundings is also not a new idea. The Aerosonde to be described below uses new technology to advance this concept to long-duration, high-altitude flight. A common image of a ground controller remotely piloting a hobby aircraft no longer applies. The modern versions are capable of autonomous flight using satellite-based navigation and communication, and using onboard computers for flight controls. Since both autonomous ground vehicles (sometimes referred to as mobile robots) and autonomous undersea vehicles exist, the proper technology may be Autonomous Airborne Vehicles (AAV). That is, the aircraft to be described may have flight tracks and operational sequences that are pre-programmed, or are modified in flight, with onboard control systems that permit either autonomous operation or under the control of the ground operator.

Langford (1991) reviews progress in four key technologies that has created opportunities for a low-cost, scientifically useful unmanned aircraft: (i) computational aerodynamics; (ii) composite structures; (iii) advanced propulsion systems; and (iv) microelectronics. Performance of low-powered, slow-moving aircraft has recently been optimized through numerical simulations of low Reynolds flow for aerodynamic configurations. These codes can be applied to design efficient airfoils for high-altitude performance. The aircraft structure can be constructed from composite materials such as graphite-epoxy. In addition to high strength and stiffness, the advantage of the composite materials is that small aircraft can be manufactured by small teams using inexpensive facilities. Turbocharged engine technology developed in the 1980s may be extended to smaller engines. A two-stage turbocharged engine may be able to achieve elevations of 22 km. Microelectronics are essential for lightweight, low-power, and highly reliable control systems. Navigation with accuracies better than 100 meters soon will be achieved with extremely small Global Positioning Satellite (GPS) system receivers when the GPS is completed in 1993. Thus, advances in technology have produced new opportunities for acquiring meteorological data with autonomous airborne vehicles. Two options that are being actively pursued are discussed below.

2. Perseus

Aurora Flight Sciences and the Harvard Atmosphere Research Project have been developing a light-weight unmanned aircraft called Perseus for atmospheric chemistry measurements (Langford 1991). Requirements for higher altitudes than present manned aircraft, and operations in remote areas such as polar regions, make the AAV an attractive solution. The National Aeronautics and Space Administration (NASA) is funding the development of the first Perseus A, which has a wing span of almost 18 m.

Professor Kerry Emanuel of the Massachusetts Institute of Technology recognized the potential for measurements from Perseus in the environment of tropical cyclones. A modified version (Perseus B) is required to achieve the longer range and endurance while giving up the very high ceiling required of Perseus A. The endurance at various cruising altitudes can be estimated for payloads ranging from 50 to 200 kg. For example, a payload of 50 (200) kg at a cruise altitude of 17 km would have an endurance of 80 (47) hours. The corresponding ranges are estimated to be 27,500 (14,500) km with average speeds of about 90 m/s.

The planned tropical cyclone version would deploy GPS-based dropwindsondes at specific locations to monitor the storm structure and to supplement rawinsondes and other data. Development of the dropwindsondes is being funded by the National Science Foundation. An automatic deployment of a sonde was tested during the first test flight of Perseus during November 1991. Scientific justification for such a deployment of dropwindsondes in terms of an improvement in track predictions based on work by Dr. S. Lord is given in the Appendix.

Aurora Flight Services is seeking funding to complete the development and testing of Perseus B. A feasibility demonstration is proposed in summer 1993 and a complete test is proposed for 1994.

3. Aerosonde

The aerosonde is being developed by a small group of entrepreneurs led by Dr. Tad McGeer (formerly Chief Scientist of Aurora Flight Services) and Prof. Andy von Flotow of Massachusetts
Institute of Technology. Dr. McGeer and Dr. Greg Holland provided the information for this report. More details will be provided by Holland et al. (1992).

The present concept envisions a small (about 3 m) wingspan aircraft that would carry meteorological instruments to report pressure, temperature and humidity while ascending to 16 km and then spiraling back to the surface. Each ascent / descent cycle would require about 4 hours, and about 10-20 cycles would be completed before returning to the base for refueling or refurbishment. Knowledge of the aircraft heading within 2 degrees accuracy would allow wind estimates within 1 m/s by comparing the airspeed and the GPS velocity estimates. An alternate concept for tropical cyclone reconnaissance would be to proceed to selected points in the environment of the storm (or above the eye) and make ascent/descent soundings before returning to base. The maximum speed is 40 m/s at sea level and 70 m/s at 16 km. Consequently, the maximum range is about 8,300 km for a 65 h flight at maximum speed.

As indicated in the introduction, miniaturization of the flight control computer, navigation and communication is an essential element of the Aerosonde plan. These three components are expected to contribute about 800 gm to the total instrumentation package of 1,360 gm, with an additional 300 gm for the generator and battery. It is these small weights that permit the airframe to be so small. The empty and fueled weights would be 5.7 kg and 12.1 kg respectively. Three key developments are necessary in designing the power plant for the Aerosonde. First, the engine must be modified to obtain reliable operation for at least 100 h. Second, the engine efficiency must be improved to reduce fuel consumption and allow such long flights with reasonable fuel weights. Third, a variable-ratio compressor must be developed to permit operation to an elevation of 16 km. This compressor will be coupled with a heat exchanger for aftercooling and an exhaust expander for power recovery, which will improve the powerplant efficiency at high altitude.

Four operational issues must be addressed as part of planning for Aerosonde. The foremost issue is the risk of colliding with other aircraft, which depends on how busy the air space is. Operation in most populated areas would require close coordination with air traffic controllers. The precise location capability of the GPS navigation system allows warnings to other air traffic. A second issue is operation in hazardous weather, especially ice, hail and lightning. Although it may be possible to detect icing conditions with the onboard temperature and humidity sensors, hail and lightning from cumulonimbus clouds will be more difficult to avoid. For the Aerosonde to be economically feasible, the unit price must be kept low because some losses due to weather hazards are inevitable. Similarly, equipment failures will occur. Where possible, backup systems will be included. Perhaps the most crucial failure would be loss of navigation or communication so that the risk of collision is raised. Some automatic shutdown of the engine with a controlled glide to the surface must be an option. Finally, route and altitude planning will be an important requirement to assure a safe return to the base. Preflight planning and continued updating of the plan with the observed winds and the GPS location must be a part of the software coding effort.

Descriptions of the Aerosonde have been provided to several national weather services, and the strongest response has been in the Australian Bureau of Meteorology. The Bureau has defined a set of progressively more difficult missions that might be met as engineering tasks are accomplished. For example, the Phase 1 goal would be an aircraft capable of reconnaissance in cold fronts off the southern coast of Australia. A relatively simple engine might be adequate to achieve a ceiling of 3 km, a cruising speed of 25 m/s, and an endurance of 1.5 days. Thus, the Aerosonde would operate within 500 km of the coast and after encountering the cold front would travel along it to report the location and strength of the front. Another early application might be boundary layer soundings in significant air-sea interaction regions. In both cases, the Aerosonde would operated over the sea at low elevations where air traffic controls are not required.

Complete atmospheric sounding capability to 16 km and tropical cyclone reconnaissance are planned in Phase 2 of the development. The turbocharging and increased endurance of the powerplant will be the key engineering tasks in this phase. Moreover, the avionics design and the development and integration of rather sophisticated software are also important tasks. The goal is to have a full performance Aerosonde by late 1993.

One possible application of Aerosonde in Australia is to replace rawinsonde teams in remote regions or on islands. Atmosphere soundings would be made between the surface and 16 km while ascending and descending (4 h cycle time). Given a preliminary production cost of $10,000, the Aerosonde would have to make at least 10 flights while achieving 12 soundings per flight for the cost per sounding to be less than $100 per sounding. This is considered to be the break-even price for expendables to replace rawinsondes and does not consider salary, shipping and resupply aspects.

Detailed plans of a tropical cyclone reconnaissance mission for the Aerosonde are not available. In a data-sparse region such as the ocean areas off Western Australia, Aerosondes that could provide off-shore soundings as the tropical cyclone moves southward along the coast may be economically viable. Only a few degrees change in storm heading can mean the difference between a strike on the coast and an offshore path of the destructive wind region. It is possible that a few Aerosondes could provide enough additional information that would allow a confident warning that might save millions of dollars in unnecessary preparedness actions or in avoiding damage by timely preparations.

4. Possible international cooperation

This brief review has addressed only two of the groups who have proposed to apply autonomous airborne vehicles (unmanned aircraft) for tropical cyclone reconnaissance. The planning and development in these activities has proceeded to the point where significant funding is required to achieve the proposed goals. Thus, commitments are being sought in several countries.

A U.S. committee under Dr. Steve Lord of the National Meteorological center has been appointed to study possible hurricane reconnaissance applications. Dr. Lord has prepared a data-impact study based on the insertion of omega dropwindsondes in the operational global prediction model (see Annex)

The WMO Commission on Atmosphere Sciences (CAS) has formed an international committee under Dr. Russell L Elsberry, Rapporteur for Tropical Cyclones of the Group of Rapporteurs for Tropical Meteorology Research. This committee will explore possible international cooperation in the development, testing and application of AAV to tropical cyclone reconnaissance. The WMO has also established a liaison with the International Council of Scientific Unions (ICSU) to share information and jointly promote activities. One joint effort might be an initiative to improve tropical cyclone reconnaissance in conjunction with the International Decade for Natural Disaster Reduction.

Individuals interested in this topic are encouraged to express their interest in becoming Corresponding Members of the WMO/CAS international committee.

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McGeer, T., 1991: Autonomous aerosondes for meteorological measurements in remote areas. Tech. Report, Aurora Flight Sciences, Manassas, Virginia 22111

Annex to Appendix VIII

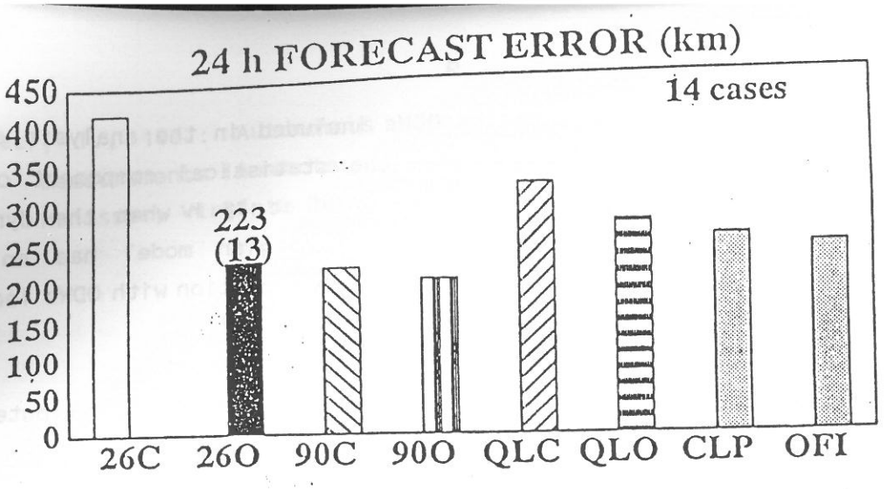
"Hurricane track forecasts using NMC's global forecast model and omega dropwindsonde data" (from Steve Lord)

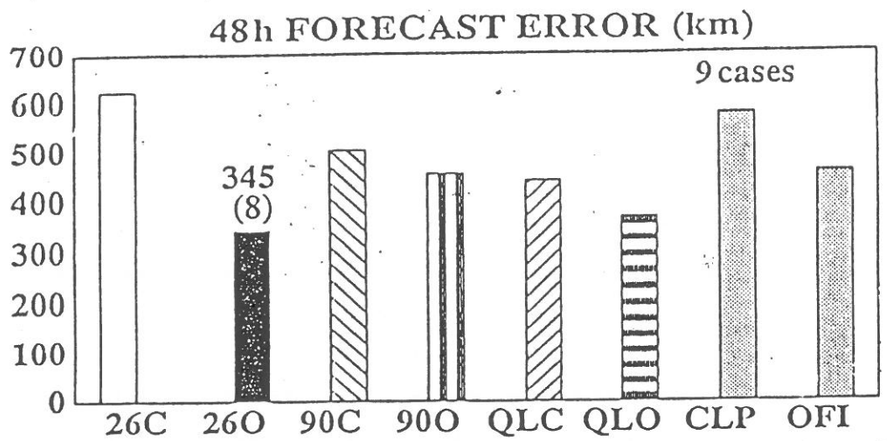
The objective of this study was to test whether the inclusion of omega dropwindsondes (ODW) alone would improve the analysis fields used to make hurricane track predictions with three models: (i) NMC global model with triangular 126 horizontal resolution and 18 levels in the vertical; (ii) National Hurricane Center NHC-90 statistical-dynamical model; and (iii) NMC quasi-Lagrangian model, which is a limited-area model for hurricane forecasting. These models are referred to in Fig.1 as 26 C (control) and 26 O (with ODWs); 90 C and 90 O; and QLC and QLO respectively. The Control is the track forecasts with the operational Global Data Assimilation System without any reconnaissance aircraft or dropwinsonde data. The dropwindsondes provide wind, temperature and moisture every 50 mb from about 400 mb to the surface, where a pressure is reported as well. Fourteen cases from the Hurricane Research Division Synoptic Flow Experiment were available for this test.

The reports of this test (Fig.1) generally indicate that the inclusion of the ODWs leads to an analysis that improves all three track forecasts at 24, 48 and 72 h relative to the Control. Some of the improvement from the ODWs is due to a reduction of the initial hurricane position errors from 133 km to 82 km. By 24 h, the T126 model has smaller errors than CLIPER or the official National Hurricane Center forecast errors, even though the storm in the global model began in the wrong place. Striking improvements relative to the Control indicated for the T126 global model must also be due to a better definition of the environmental wind field. Only four cases are included in the verification sample at 72 h, so the improvement relative to CLIPER and official forecasts is probably not significant.

The NHC-90 track errors with the ODWs included in the analysis are not reduced in early forecast intervals when the statistical component of this technique dominates. Some improvement is noted at 48 h when the dynamical component has more influence. The quasi-Lagrangian model has an early improvement, perhaps due to the better initial storm position with ODWs included, and also has improved forecasts at 48 h.

The conclusion from this limited test is that the ODWs contribute to an improved analysis in the region of hurricanes that then results in reduced track prediction errors from the dynamical models. This demonstration provides a basis for justifying the use of AAV to acquire similar dropwinsonde observations around hurricane in the future.





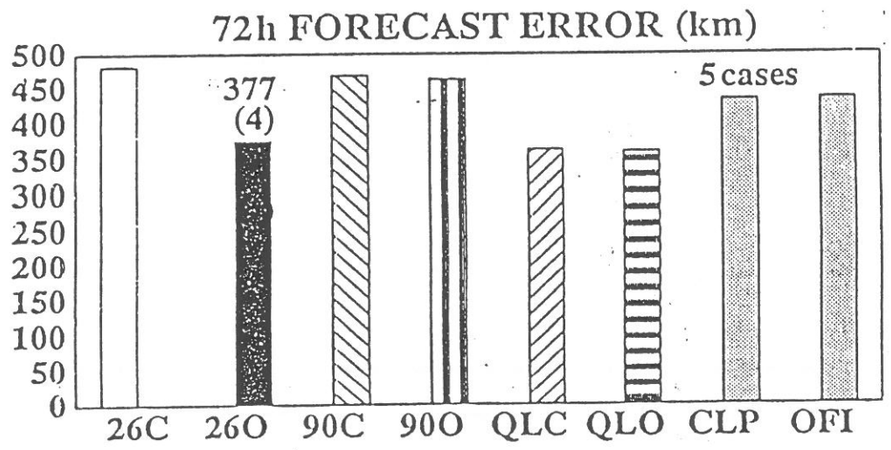


Fig. 1 Forecast errors (km) for Control (C) experiment and with inclusion of Omega Dropwindsondes (O) in the analyses (see text for explanation of symbols and further description; provided by Steve Lord)

Appendix IX

Amendments to Tropical Cyclone Operational Plan

Page I-3, Section 1.2.4. should read:

1.2.4 Terms related to the warning and warning system

i) Tropical cyclone season or cyclone season
ii) Tropical cyclone advisories
iii) Tropical cyclone information bulletin
iv) Satellite information
v) (Cyclone Alert)*
vi) (Cyclone Warning)*
vii) Visual storm signal
viii) Squally wind
ix) Gale wind
x) High sea bulletin
xi) Coastal weather bulletin
xii) Bulletin or cyclone warning bulletin

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* Term used nationally in Bangladesh, India and Pakistan.

Page III-15, first paragraph, should read:

As soon as a tropical cyclone is observed over the Panel region, RSMC-tropical cyclones New Delhi will issue a satellite bulletin based on INSAT-1D pictures every three hours. Information from this bulletin will be included in the tropical cyclone advisories which will be issued from RSMC-tropical cyclones New Delhi three to four times a day when a tropical cyclone is in the Panel region.

Page V-2, Section 5.4 should read:

5.4 List of important telephone numbers and addresses connected with tropical cyclone warnings in the Panel countries

A list containing addresses of the tropical cyclone warning centres of the Panel countries, together with their telephone numbers, is given in Annex V-A.

Amendments to the Typhoon Committee Operational Manual - Meteorological Component

Page	Line	Present	Amendments
1	8	typhoons/tropical cyclones	tropical cyclones
2	1	synoptic scale atmospheric situation	atmospheric situation
3	3	uncertainty of the centre position	confidence in the centre position
5	22	Uncertainty of the centre position: Degree of uncertainty of	Confidence in the centre position: Degree of cinfidence in 《 move before page 3, line 37: Cyclone 》
	35	direction of movement	speed of movement
6	1	Uncertainty of the centre position	Confidence in the centre position
	10	in knots;	in knots (kt), metres per second (m/s) or kilometres per hour (km/h);
	11	Uncertainty of the centre position	Confidence in the centre position
7	38	tropical cyclone over TS	tropical cyclone of TS intensity or higher
8			《 add the following after line 18 》 Sea surface observations are made by the Voluntary Observing Ships which are recruited by the Members in accordance with the WMO Voluntary Ship's Scheme. These are generally carried out every three hours and transmitted over the GTS.
	32 ~ 35	A list of the radar stations and a map of the radar network in the Typhoon Committee region are given in Table 2.1 and Figure 2.1, respectively. Information on meteorological radars of the Typhoon Committee Members is shown in Appendices 2-D and 2-E.	Distribution of the radar stations and detailed information on the radar equipments of the Typhoon Committee Members are given in Appendices 2-D and 2-E.
9		Fig. 2.1 Radar network in Typhoon Committee region	《Appendix 2-D》 Distribution of the radar stations in Typoon Committee region 《 replace by Annex 2 》
10		Table 2.1 List of radar stations in the Typhoon Committee region	《 delete 》
11			《 add the following after line 9 》 A list of satellite imagery receiving facilities at meteorological Centres of the Typhoon Committee Members is given in Appendix 2-G.

Page	Line	Present	Amendments
12		Fig. 2.2 Satellite cloud imagery receiving facilities at meteorological centres in the Typhoon Committee region	《 delete 》
13		Table 2.2 Satellite cloud imagery receiving facilities of the Typhoon Committee Members	《Appendix 2-G》 Satellite imagery receiving facilities of Typhoon Committee Members 《 replace by Annex 3 》
14	9	ASDAR (Aircraft to Satellite Data Relay)	AMDAR (Aircraft Meteorological Data Relay)
15	16 ~ 17	, additional satellite imageries and aircraft reconnaissance reports	《 delete 》
16	24 ~ 25	Description of product Forecast time (hour) transmission Form of Area	Description of product Forecast time (hour) Form of transmission Area
17	4	in Table 3.2	in Appendix 3-A
	7	high resolution (110 km) synoptic scale	high resolution synoptic scale
	10	typhoon model of 50 km horizontal	typhoon model of higher horizontal
	11	for predicting the 60-hour movement	for predicting movement
	32	shown in Appendix 3-A.	shown in Appendix 3-B.
	37	given in Appendix 3-B.	given in Appendix 3-C.
18		Table 3.2: Outline of RSMC Tokyo prediction models	《Appendix 3-A, p.1 》 Outline of RSMC Tokyo prediction models
19			《Appendix 3-A, p.2 》
20	27	see examples below	see examples in Appendix 4-A
	35	The issuance times of the advisories will be decided later.	《 delete 》
21		Examples of Advisories	《Appendix 4-A》 Examples of advisories issued from RSMC Tokyo - Typhoon Center 《 replace by Annex 4, p.1 and p.2 》
22			
23	1 ~ 12		
	21	shown in Appendix 4-A.	shown in Appendix 4-B.

Page	Line	Present	Amendments
23	24	listed in Appendix 4-B,	listed in Appendix 4-C,
29	27	Regular monitoring at the RSMC Tokyo - Typhoon Center will be made	Regular monitoring at the RSMC Tokyo - Typhoon Center should be made
	30 ~ 31	The items of regular monitoring and the output format of the monitoring are shown in Appendix 6-B.	The procedure of regular monitoring is shown in Appendix 6-B.
	37	the example below	the example in Appendix 6-C
30	1 ~ 24		《Appendix 6-C》
	28	Appendix 6-C.	Appendix 6-D.
	30	shown in Appendix 6-D.	shown in Appendix 6-E.

WMO/ESCAP PANEL ON TROPICAL CYCLONES
PROGRAMME AND IMPLEMENTATION PLAN

I. METEOROLOGICAL COMPONENT

1.1 METEOROLOGICAL OBSERVING SYSTEM

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.1.1 Maintaining the required observing stations and observational programmes listed in the Tropical Cyclone Operational Plan		Members	National	Continuous activity
1.1.2 Strengthening the network of surface and upper-air land stations				
1.1.2.1 Establishment of simple stations in coastal areas to provide hourly wind and pressure observations when a cyclone is within about 300 km of the station		Members	National	

I. METEOROLOGICAL COMPONENT

1.1 METEOROLOGICAL OBSERVING SYSTEM (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.1.3 Mobile ships				
*1.1.3.1 In consultation with shipping concerns, installation of automatic meteorological stations on board ship as DCPs for the collection of data and subsequent transmission by satellite to the warning centres through the GTS		Members	National	To relieve busy personnel on board and overcome difficulties encountered at shore stations India: Done Bangladesh: Existing
1.1.3.2 Ensuring the availability of adequate equipment and personnel at the coastal radio stations for appropriate communication from ship-to-shore and to improve liaison between meteorological services and these coastal radio stations		Members operating coastal radio stations	National	

* During 1992-1993 items with an asterisk to be given priority attention

I. METEOROLOGICAL COMPONENT

1.1 METEOROLOGICAL OBSERVING SYSTEM (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.1.3.3 Designation of Port Meteorological Officers to look into matters relating to (a) observations from mobile ship stations and (b) forecasts for shipping, and to improve feedback and contacts which would be beneficial to both the meteorological services and to the sea-going community		Members	National	
1.1.3.4 Establishment of coastal earch stations (CESs) in the Panel area to improve the availability of ships' reports from the adjacent ocean areas, in particular:				
* - Coastal Earth Station near Bombay (Arvi)		India	National	Will become operational by mid-1992
- Coastal Earth Station at Colombo		Sri Lanka	National	
1.1.4 Automatic weather stations				
1.1.4.1 Establishment of simple automatic weather stations on islands and reefs in the Bay of Bengal and the Arabian Sea		Members	National	Need measure only a few parameters, particularly atmospheric pressure and wind speed and direction

* During 1992-1993 items with an asterisk to be given priority attention

I. METEOROLOGICAL COMPONENT

1.1 METEOROLOGICAL OBSERVING SYSTEM (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.1.4.2 Deploying anchored and drifting buoys for obtaining surface observations from the high seas, in particular				
* - anchored buoys near Bombay		India	National	No firm programme
1.1.5 Cyclone detection radar stations				
1.1.5.1 Implementation, replacement or making operational the following cyclone detection radar stations:				
- Coxs Bazar *		Bangladesh		*Reliable communication link between Coxs Bazar and Dhaka and Keppepara and Dhaka to be established
- Keppepara *				
- Yangon (21°20'N, 92°17'E)		Myanmar	National and external assistance where needed	
- Karachi (24°54'N, 67°08'E)**		Pakistan		**Implemented in 1990
- Trincomalee (08°35'N, 81°15'E)		Sri Lanka		
- Chantaburi		Thailand	National and external assistance	10 cm Doppler proposed
- Bangkok				
- Phuket (08°07', 98°19'E)				
- Khon Kaen				
*1.1.5.2 Review of the operational and maintenance status of the storm warning radar stations and plan for the replacement of obsolete equipment		Members concerned	National and external assistance where needed	

* During 1992-1993 items with an asterisk to be given priority attention

1.1 METEOROLOGICAL OBSERVING SYSTEM (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.1.5.3 Replacement of existing 5.6 cm equipment by 10 cm storm warning radars and to fill the gap at Yangon		Members concerned	National and external assistance where needed	
1.1.6 Meteorological satellites				
*1.1.6.1 Updating, where required, of the equipment used for reception of data from polar-orbiting and geostationary satellites		Members	National and external assistance where needed	
*1.1.6.2 Obtain information on the plans and specifications of geostationary satellites which are expected to be placed in orbit and endeavour to make the best possible use of data from these satellites		Members and TSU	National	With advice of WMO where appropriate

* During 1992-1993 items with an asterisk to be given priority attention

I. METEOROLOGICAL COMPONENT

1.2 METEOROLOGICAL TELECOMMUNICATION SYSTEM

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
*1.2.1 Provision of suitable telecommunication facilities for the collection at NMCs of all observational data from stations in the basic synoptic network as well as from special stations set up for cyclone watch, in accordance with the requirements of WWW (i.e. 95% of reports to reach the collecting centre within 15 minutes of the observing stations' filing time)		Members	National	Members to take urgent action where required
*1.2.2 Promotion of the use of SSB radio-communication between coastal observing stations including radar stations and cyclone warning centres and national (or regional) data collection centres		Members	National	
1.2.3 Assignment of high priority to reliable operation and upgrading or, where appropriate, establishment of GTS links under their responsibilities. Plans for upgrading of the GTS circuits in the Panel area as follows:				

* During 1992-1993 items with an asterisk to be given priority attention

1.2 METEOROLOGICAL TELECOMMUNICATION SYSTEM (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
- Yangon-New Delhi 50 baud, satellite		Myanmar and India		Proposed
- Bangkok-New Delhi 75 baud, satellite		Thailand and India		No plan at present
- Dhaka-New Delhi 2400 bps, satellite		Bangladesh	National	Upgrading proposed and under implementation
- Karachi-New Delhi 300 baud satellite		Pakistan		(1)
- Male-New Delhi 75 baud satellite		Maldives		
- Bangkok-Yangon 50 baud, satellite*		Thailand and Myanmar	National and external assistance	Upgrading proposed
-Colombo-New Delhi 100 baud, satellite		Sri Lanka and India	National	*Implemented in 1990
				(2)

(1) No plan at present. Pakistan has requested upgrade to 300 baud. India has no objection to request.

(2) No plan at present, but India has no objection, request is made by Sri Lanka.

I. METEOROLOGICAL COMPONENT

1.3 REGIONAL COMPUTER NETWORK

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.3.1	**Establishment of a Regional Computer Network in the Panel area in accordance with the co-ordinated plans agreed upon by the Panel**		Members	National and external assistance	
1.3.2	**Installation of micro-computer hardware and appropriate software at national meteorological centres**				
	- Dhaka**		Bangladesh	National, UNDP and VCP	Phase I
	- Karachi**		Pakistan		
	- Colombo **		Sri Lanka		
	- Malé ***		Maldives		Phase II
	- Yangon ***		Myanmar		
1.3.3	Maintenance of RCN - Spair parts - fellowships - experts/consultants services				
1.3.4	Application of RCN to tropical cylone forecasting services - training activities - experts/consultants services - fellowships				
1.3.5	Support to the AFDOS system software (National, UNDP and VCP)				
1.3.6	Supply software under SHARE for use of existing VAX compatible computers, for which training is needed - RSMC, New Delhi		India	National and external assistance	**Implemented in 1990 ***Implemented in 1991

I. METEOROLOGICAL COMPONENT

1.4 STORM SURGE

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.4.1	**Feasibility studies on the installation of stations for the measurement and/or recording of surges and as far as possible wave heights on the coastal belts most vulnerable to inundation by sea water in tropical cyclones and preparation of a phased implementation plan for their installation**		Members	National	
1.4.2	**Installation of stations which, as determined from 1.4.1 above, seem to be most desirable**		Members	National and external assistance where needed	
1.4.3	**Promotion of better liaison between national meteorological services and other national organizations operating tide recorder stations**		Members		
1.4.4	**Installation, maintenance and operation of high gust anemometers along coastal areas subject to storm surge, in particular, along the most cyclone-prone segments of the coasts and near the mouths of rivers around the Bay of Bengal and other similar areas (see also 1.1.2.2)**		Members	National and external assistance where needed	

I. METEOROLOGICAL COMPONENT

1.4 STORM SURGE (Cont'd)

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.4.5	Collection of historical data on storm surges together with the relevant meteorological paramters (pressure drop, radius of maximum wind, speed and track at landfall) of the cyclone causing these surges		Members	National	
1.4.6	Establishment of operational storm surge forecasting and warning services as soon as possible, initially with relatively simple but effective techniques such as empirical formulae but preferably monograms based on the SPLASH model		Members not yet having storm surge warning services	National and external assistance where needed	Assistance may be sought through TCDC and from UNDP
1.4.7	Planning of installation of operational storm surge forecasting systems based on numerical models to be run on personal computers or larger computers. Where possible, such models to be capable of routeing the surge inland and forecasting estuarine inundation		All Members with potential major storm surge problems	National and external assistance where needed	External assistance required for Bangladesh
1.4.8	Provision of storm surge warnings in plain language, preferably pre-written or in standard format, designed to achieve a high level of comprehensibility and response by the general public		National Meteorological Services of members	National	Continuous

I. METEOROLOGICAL COMPONENT

1.4 STORM SURGE (Cont'd)

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
1.4.9	Continuation of storm surge model development, both for simple models to give storm surge at the coast, and for models to predict routeing of the surge inland, estuarine inundation and river/sea interaction		Members able to do so	National	
1.4.10	Continuation of experimentation with combinations of tropical cyclone models and hydro/dynamic water movement models with a view to further improving storm surge models		Members able to do so	National	
1.4.11	Assignment of high priority to training of personnel in storm surge modelling and forecasting, through attachments to advanced centres within and outside the region		Members	National and external assistance where needed	Assistance may be sought through TCDC and from UNDP
*1.4.12	Implementation of the storm surge project		Members	National, UNDP, WMO, ESCAP and IOC	See Attachment

* During 1992-1993 items with an asterisk to be given priority attention

I. METEOROLOGICAL COMPONENT

1.5 TROPICAL CYCLONE OPERATIONAL PLAN

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
*1.5.1	Review the Tropical Cyclone Operational Plan for the Bay of Bengal and the Arabian Sea at regular intervals to enable its amendment to take account of improvements in observational systems, cyclone forecasting techniques and warning capabilities		Members	National	

* During 1992-1993 items with an asterisk to be given priority attention

II. HYDROLOGICAL COMPONENT

2.1 DATA COLLECTION NETWORK FOR FLOOD FORECASTING

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.1.1 Rainfall stations						
	Initial 1/1/87	Additions planned 1987-1992				
Non-recording Recording Telemetering	44 200 4	#		Bangladesh	National	#Telemetery data are being analyzed in comparison with radar estimate
Non-recording Recording Telemetering	10 15 -	49 - -		Myanmar	- ditto -	
Non-recording Recording Telemetering	259 55 -		- 15 15 10 5 - - 2 2 2 1 - - 1 1 1 1 -	India	- ditto -	1,307 stations 370 stations (in areas under the effect of tropical cyclones)
Non-recording Recording Telemetering	- 10 40			Pakistan	- ditto -	No change
Non-recording Recording Telemetering	- - 2	- - 2		Sri Lanka	- ditto -	Completed

II. HYDROLOGICAL COMPONENT

2.1 DATA COLLECTION NETWORK FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.1.1 Rainfall stations						
	Initial 1/1/87	Additions planned 1987-1992				
Non-recording	18	94	———	Thailand	- ditto -	Under implementation
Recording	11	13	———			Under implementation
Telemetering	-					

II. HYDROLOGICAL COMPONENT

2.1 DATA COLLECTION NETWORK FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.1.2 Evaporation stations						
	Initial 1/1/87	Additions planned 1987-1992				
Pans	-	-		Bangladesh	National	
Indirect methods	5					
Pans	22	7	———	Myanmar	National	
Indirect methods	-					
Pans	-		- - 1 1 1 -	India	National	To be provided by India
Indirect methods	-		- - - - - -			
Pans	24	-		Pakistan	National	No change
Indirect methods	-					
Pans	1	-		Sri Lanka	National	
Indirect methods	-					
Pans	9	3	———	Thailand	National	No change
Indirect methods	-					

II. HYDROLOGICAL COMPONENT

2.1 DATA COLLECTION NETWORK FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.1.3 Water level stations						
	Initial 1/1/87	Additions planned 1987-1992				
Non-recording	45	#		Bangladesh	National	# The plan has not yet taken any formal shape. However, it is anticipated that if the use of already unsteady flow simulation model proves successful for flood forecasting in flood plain areas beyond the major river system, then the next few years will see rapid growth of telemetery networks within the country.
Recording	16	#				
Telemetering	4	#				
Non-recording	68	16	——	Myarmar	- ditto -	
Recording	23	8	——			
Telemetering	-	-				
Non-recording	66		- 15 10 5 - -	India	- ditto -	
Recording	66		- - 1 2 1 -			
Telemetering	-		- - 1 1 - -			
Non-recording	-			Pakistan	- ditto -	
Recording	29					
Telemetering	28					
Non-recording	-	-		Sri Lanka	- ditto -	
Recording	-	-				
Telemetering	3	-				
Non-recording	5	4	——	Thailand	- ditto -	1 installed
Recording	-	-				
Telemetering	-					

2.1 DATA COLLECTION NETWORK FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.1.4 Discharge stations						
	Initial 1/1/87	Additions planned 1987-1992				
Non-recording	15	#		Bangladesh	National	# Expansion of use for low-flow forecasting
Recording	-	#				
Telemetering	-	#				
Non-recording	31	2	——	Myanmar	National	
Recording	-	-				
Telemetering	-	1	——			
Non-recording	63		- 2 2 - - -	India	National	
Recording	-		- - - - - -			
Telemetering	-		- - - - - -			
Non-recording	-			Pakistan	National	No change
Recording	3					
Telemetering						
Non-recording	-	-		Sri Lanka	National	Completed
Recording	-	-				
Telemetering	1	1				
Non-recording	4	5	——	Thailand	National	No change
Recording	4	5	——			No change
Telemetering	-					

II. HYDROLOGICAL COMPONENT

2.1 DATA COLLECTION NETWORK FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.1.5 Other data sources						
	Initial 1/1/87	Additions planned 1987-1992				
Radar Satellite	3 1	2	——	Bangladesh	National	No change
Radar Satellite	– 1	– –		Myanmar	National	+: Completed
Radar Satellite	1 (5.4 cm) (Qpm) 1## (at Lahore)	1 (10 cm) (Qpm) 2+	——	Pakistan	National	No change ##The satellite data are being used by PMD for estimating rainfall in the Indus Basin
Radar Satellite	– –	– –		Sri Lanka	National	### Rainfall data provided by radar are currently used as inputs to the storage function method
Radar Satellite	8### 1	4 –	——	Thailand	National	2 additional already installed

II. HYDROLOGICAL COMPONENT

2.2 DATA TRANSMISSION SYSTEMS FOR FLOOD FORECASTING

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
Number of stations transmitting data through	Initial 1/1/87	Additions planned 1987-1992				# SSB may be replaced on improvement of NDS telephone
Telephone Telegraph SSB Radio (VHF or UHF) Others	5 3 24 2	 8	——	Bangladesh	National	
Telephone Telegraph SSB Radio (VHF or UHF) Others	12 24 7 – 52	7 13 12 – 3	—— —— —— ——	Myanmar	National	
Telephone Telegraph SSB Radio (VHF or UHF) Others (H/T)	– – 111 –		– – – – – – – – – – – – – – – – – – – 20 25 25 – – – – – – – –	India	National	
Telephone Telegraph SSB Radio (VHF or UHF) Others	– 33 ## –	##		Pakistan	National	## to be provided later

II. HYDROLOGICAL COMPONENT

2.2 DATA TRANSMISSION SYSTEMS FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
Number of stations transmitting data through	Initial 1/1/87	Additions planned 1987-1992				# SSB may be replaced on improvement of NDS telephone
Telephone	-	-		Sri Lanka	National	## Daily rainfall data at all district rainfall stations are transmitted through teletype systems
Telegraph	-	-				
SSB	-	-				
Radio (VHF or UHF)	5	-				
Others	1	-				
Telephone	-	-		Thailand	National	
Telegraph	1	-				
SSB	6	5	——			No change
Radio (VHF or UHF)	-	6	——			No change
Others	18##	6	——			Under implementation

2.3 DATA PROCESSING AND STORAGE SYSTEMS FOR FLOOD FORECASTING

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.3.1 Data processing and storage						
Percentage of data that have been processed and stored	Initial 1/1/87	Additions planned 1987-1992				
Precipitation	200			Bangladesh	National	
Evaporation	5					
Water level						
Discharge						
Precipitation	20	80	——	Myanmar	National	
Evaporation	25	-				
Water level	25	59	——			
Discharge	-	33	——			
Precipitation	1	35%		India	National	5 IBM compatible PC 286 and 1 PC 386 were installed during 1989. A further 7 IBM compatible PC 286 and 1 PC 386 are proposed during 1990-1994
Evaporation	-					
Water level	3					
Discharge	1					
Precipitation				Pakistan	National	Under implementation
Evaporation (Data maintained on						
Water level registers only)						
Discharge						

II. HYDROLOGICAL COMPONENT

2.3 DATA PROCESSING AND STORAGE SYSTEMS FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.3.1 Data processing and storage						
Percentage of data that have been processed and stored	Initial 1/1/87	Additions planned 1987-1992				
Precipitation	10	90	10	Sri Lanka	National	Under implementation
Evaporation	-	10	10			Under implementation
Water level	10	10	10			Under implementation
Discharge	-	-				
Precipitation	75	25	——	Thailand	National	Under implementation
Evaporation	75	25	——			
Water level	75	25	——			
Discharge	75	25	——			

II. HYDROLOGICAL COMPONENT

2.3 DATA PROCESSING AND STORAGE SYSTEMS FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	CURRENT STATUS/ COMMENTS
2.3.2 Publication and archival of data in computerized form						
Percentage of data that have been processed and stored	Initial 1/1/87	Additions planned 1987-1992				
Precipitation	200			Bangladesh	National	Bangladesh: 4 Radio-shack 80s, Plotter and digitizer
Evaporation	5					
Water level	90					
Discharge	90					
Precipitation	20	80	——	Myanmar	National	Myanmar: PDP 11/34 further expanded
Evaporation	-	25	——			
Water level	-	84	——			
Discharge	-	32	——			
Precipitation	-			India	National	**Not published in computerized form India: WIPRO Z650 and additional planned NEC-1000
Evaporation	-					
Water level	100**					
Discharge	100**					
Precipitation	-			Pakistan	National	## To be provided later
Evaporation	-					
Water level	-	##				
Discharge	-					

II. HYDROLOGICAL COMPONENT

2.3 DATA PROCESSING AND STORAGE SYSTEMS FOR FLOOD FORECASTING (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
2.3.2 Publication and archival of data in computerized form						
Percentage of data that have been processed and stored	Initial 1/1/87	Additions planned 1987-1992				
Precipitation	10	90	10	Sri Lanka	National	Under implementation. Sri Lanka: Computer not yet installed. Thailand: IBM-34, 96K* (*a TANDY-80 Model is currently used for real-time operational flood forecasting)
Evaporation	-	10	10			
Water level	10	10	10			
Discharge	-	-				
Precipitation	50	50		Thailand	National	
Evaporation	75	25				
Water level	75	25				
Discharge	75	25				

II. HYDROLOGICAL COMPONENT

2.4 FLOOD RISK ASSESSMENT

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
Areas for which flood risk is assessed	Initial 1/1/87	Additions planned 1987-1992				
Name of basin or river system, basin area (km) and population				Bangladesh	National	*Flood depth-maps had been prepared and named as High Flood, Medium Flood and Low Flood. The scale of the map is 1:500,000
Area and scale of available flood risk maps	3 flood depth-maps*					
Name of basin or river system, basin area (km) and population	-	Prome-Sheredang area. Maximum 35555 ha		Myanmar	National	
Area and scale of available flood risk maps		1:126,720				

II. HYDROLOGICAL COMPONENT

2.4 FLOOD RISK ASSESSMENT (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
Areas for which flood risk is assessed	Initial 1/1/87	Additions planned 1987-1992				
Name of basin or river system, basin area (km) and population	Nil	Nil		India	National	
Area and scale of available flood risk maps	Nil	Nil				
Name of basin or river system, basin area (km) and population	Indus, Jhelum, Chenab, Ravi and Stulej Punjab Province	Nil#		Pakistan	National	# Under process of being improved
Area and scale of available flood risk maps		Nil#				
Name of basin or river system, basin area (km) and population		-		Sri Lanka	National	
Area and scale of available flood risk maps		-				

II. HYDROLOGICAL COMPONENT

2.4 FLOOD RISK ASSESSMENT (Cont'd)

TASKS			TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
Areas for which flood risk is assessed	Initial 1/1/87	Additions planned 1987-1992				
Name of basin or river system, basin area (km) and population	Eastern suburban Bangkok area, Chao Phraya river, 14,000 km 1,500,000 people			Thailand	National	**Contour maps of 1:200,000 scale for flood-risk in the eastern sub-urban Bangkok area which is located on the low delta plain of the Chao Phraya river
Area and scale of available flood risk maps	**					

3.1 DISASTER PREVENTION AND PREPAREDNESS

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
Introduction The objectives of the Panel on Tropical Cyclones as these relate to co-ordinated systems for the mitigation of the effects of tropical cyclones are intended to be consistent with general principles of disaster prevention and preparedness adopted by national authorities for disaster management relating to most natural hazards. The objectives listed below, however, refer to those specific aspects of prevention and preparedness which may be considered as particular responsibilities of national meteorological and hydrological services deploying their specialist skills in tropical cyclone meteorology and hydrology such as the issue of warnings and information concerning meteorological and hydrological hazards and of disaster preparedness personnel. In the application of these skills and responsibilities it is stressed that maximum interface with the users of warnings and information is essential for the design and operation of effectively organized community response systems, required to meet the threat and landfall of tropical cyclones				

III. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 DISASTER PREVENTION AND PREPAREDNESS (Cont'd)

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
3.1.1	Development of and maintaining an appropriate organizational framework, including a focal point for authorized decision-making, at national, state and district levels to make full use of tropical cyclone meteorological and hydrological warning and information services on behalf of the community and users		Members	National	
3.1.2	Development of properly designed tropical cyclone forecasting and warning systems, in conjunction with the requirements of government disaster management and emergency authorities, voluntary agencies and general users, to take full advantage of current and new technological advances in the monitoring and prediction of tropical cyclones and their effects		Members	National and external assistance where needed	With advice and assistance of WMO, ESCAP when appropriate
3.1.3	Ensuring that tropical cyclone warnings are simple so that they are easily understood and meaningful and effective to the common people		Members	National	
3.1.4	Evolving a standard cyclone warning system within the Panel countries		Panel and Members	National	With advice and assistance of WMO if needed

3.1 DISASTER PREVENTION AND PREPAREDNESS (Cont'd)

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
3.1.5	Establishment and maintaining of appropriate warning dissemination arrangements, including establishment of country-wide wireless and telecommunication networks in conjunction with governments and other agencies, including the media, to enable the timely dissemination and reception of warnings and recommended community response actions, by all sections of the community, including those living in remote areas and settlements, on islands and fishermen		Members	National	With advice and assistance of UNDRO/IFRC needed
3.1.6	Formulation and implementation, in conjunction with governmental and non-governmental agencies, of educational programmes designed to improve community awareness of the nature and severe effects of tropical cyclones and of the organizaiton of tropical cyclone warning systems and preparedness arrangements		Members	National	With assistance of UNDRO, IFRC WMO where needed
3.1.7	Organization of specialized seminars and training for government and other agencies responsible for decision-making during the threat and landfall of tropical cyclones, which explain limitations in the likely accuracy of forecasts and warnings, the significance of lead-times in the development of tropical cyclone effects such as hurricane-force winds, gales and storm surge flooding		Members	National/and External resources	To enable the allocation of the human and physical resources needed in preparedness actions to be realistic and effective. With advice of WMO, ESCAP, UNDRO, IFRC as needed

III. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 DISASTER PREVENTION AND PREPAREDNESS (Cont'd)

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
3.1.8	Design and conduct of tropical cyclone and flood simulation and practical exercises, pre-cyclone season precautions, tests of timely reception of warnings and post-cyclone season reviews		Members	National	With advice of WMO, ESCAP, UNDRO, IFRC and other agencies, where needed
3.1.9	Measurement of cyclone effects such as the magnitude of storm surges and anomalous tides during tropical cyclones		Members	National	With advice of ESCAP and WMO, if needed. Collaboration at the national level is required
3.1.10	Assessment of the occurrence and intensity of tropical cyclones, and their effects, such as storm surge and and flooding, and carrying out risk evaluation and vulnerability studies required for the protection of the community		Members	National and external resources	With advice and assistance of WMO and ESCAP. Collaboration among and assistance of government authorities, planners and users, as well as appropriate climatological data are needed

III. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 DISASTER PREVENTION AND PREPAREDNESS (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
3.1.11 Conduct of inter-disciplinary studies and investigations of the physical effects to tropical cyclones, social research into human response factors related to warning and preparedness measures, and the socio-economic impact of tropical cyclones		Members	National	With advice of UNDRO, IFRC and others
3.1.12 Reporting on and sharing experience in the above aspects at sessions of the Panel, or in Panel seminars or publications, in order to encourage the maximum effectiveness of regional preparedness for tropical cyclones		Members,	National, UNDRO, IFRC WMO, ESCAP and other sources	Efforts be undertaken to report and share experiences between TC and PTC
3.1.13 Building cyclone shelters at strategic places and cyclone resistant houses with indigenous materials for the protection of the community		Members	National and other sources	With advice of ESCAP, UNDRO, IFRC if needed
3.1.14 Making available in vulnerable areas warehouses for the stockpiling of relief supplies and housing materials		Members	National	With advice of UNDRO, IFRC, if needed
3.1.15 Including the subject of cyclone warnings and human response in school curricula		Members	National	With advice of UNDRO, IFRC WMO, if needed

III. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 DISASTER PREVENTION AND PREPAREDNESS (Cont'd)

TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
3.1.16 Promotion of community participation as an important component of disaster preparedness and ensuring effective community involvement in all phases of counter-disaster response for its protection, welfare and development		Members	National	With advice of UNDRO, IFRC if needed

IV. TRAINING COMPONENT

4.1 TRAINING

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
4.1.1	Assessment of current and expected future needs for the training of specialized staff to man the warning systems at all levels under the following headings:		Members	National and external assistance	
	(a) those capable of being met through training facilities already available in member countries, and	2 2 2 1 - -	India		
	(b) those for which assistance from external sources is needed	2 1 - - - - 2 1 - - - -	India India		For MOFFS Version For DHI Scheme
4.1.2	Taking of appropriate steps to organize training programmes at 4.1.1(a) above		Members	National	
4.1.3	Seeking assistance for training at 4.1.1(b) above		Members, Panel	Bilateral arrangements, TCDC, UNDP, WMO, ESCAP and others	India: 3 fellowships required under DHI Scheme; 3 fellowships required under MOFFS
4.1.4	Arrangement of seminars or workshops on specific topics of particular interest for cyclone prediction and warning purposes, priority being given in the first instance to techniques for the interpretation of satellite data and storm surge prediction		Panel, Members	UNDP and National	With assistance of WMO

V. RESEARCH COMPONENT

5.1 RESEARCH

	TASKS	TIMESCALE 91 92 93 94 95 96	BY WHOM	RESOURCES	COMMENTS
5.1.1	Exchange of information on research activities as well as on source of data available for research carried out in the Panel countries when requested		Members, through Panel and directly	Members	
5.1.2	Formulation of proposals on a continuous basis for joint research activities for consideration by the Panel to avoid duplication of effort and tomake the best use of available resources and skills		Members	National	With advice of WMO and ESCAP if required
5.1.3	Arrangements for exchange visits of staff between appropriate national research centres		Members	National and external assistance if needed	
5.1.4	Survey of existing models and utilization in operational mode		Members	National and external assistance if needed	

Storm surge project

1. Long-term objective

The objective of the project is to increase the national expertise and capacity of the member countries of the Panel (Bangladesh, India, Maldives, Myanmar, Pakistan, Sri Lanka and Thailand) in respect of the prediction, simulation and evaluation of storm surges associated with the occurrence of tropical cyclones in the Bay of Bengal and the Arabian Sea.

2. Specific short-term objectives

(a) to collect and compile extensive storm surge data sets (involving both historical and real-time surge data), appropriate for use in risk evaluation, surge simulation and real-time forecasting in each of the countries of the region;

(b) to choose and implement a storm surge model, develop a forecast strategy and undertake technology transfer (including specialized education and training) appropriate to the requirements of each member country;

(c) to improve local communication facilities both for relevant real-time data collection and for real-time surge product dissemination;

(d) to assist in facilitating, as much as possible, appropriate co-ordination with individual member countries amongst organizations having the responsibility for all aspects of the surge forecast and warning problem.

3. Management

The management of the project to be carried out by the Panel with the assistance of the WMO Secretariat and the TSU.

4. Project elements

The storm surge project in the region will involve the elaboration of, and assistance in, the following project elements which are directed towards achieving the expressed project objectives.

(a) the collection and compilation of both historical and real-time storm surge data;

(b) the choice and implementation of appropriate storm surge model and the development of a forecast strategy;

(c) risk evaluation and surge simulation studies;

(d) improvement in local communication facilities;

(e) appropriate technology transfer, including in particular education and training of personnel involved in surge forecasting.

5. Implementation

5.1 The implementation of these elements should be undertaken under the general direction of the Panel, as much as possible by member countries with the technical assistance of WMO, and financial assistance, where needed and appropriate, through the WMO/VCP and UNDP sources. In particular, individual countries assessments of their own needs and requirements are critical to the further implementation of the project, specific activities relevant to the implementation of these elements are elaborated further in the following paragraphs:

(a) In general, the collection and compilation of storm surge data into case histories and other data sets relevant to surge simulation, modelling and forecasting is the responsibility of individual member countries. Nevertheless, assistance may be required both in the organization and planning required for the compilation of comprehensive case histories for future surge events, and also in the arduous and complex task of researching available historical storm surge data. In the first case, the recent Chittagong workshop proved a successful and valuable mechanism for, inter alia, the stimulation of interest in, and the discussion of techniques for the compilation of storm surge case history files. It is proposed that further workshops should be held within the project, as appropriate, covering this and other aspects of the storm surge forecast problem. With regard to historical data collection, limited expert assistance in initiating specific national projects may be provided if requested.

(b) It is understood that storm surge model development in general, and expertise in this field in the region in particular, are relatively well advanced (see, for example, the report on TCP Project No. 7 "Present techniques of tropical storm surge prediction", published as Report No. 13 in the series Marine Science Affairs). What may be required for this regional project is then assistance in the choice and operational implementation of one of the many available models which is appropriate to the circumstances and requirements of each country or area. In addition, the model chosen for implementation should be well adapted to the overall forecast strategy to be adopted by each country. In view of the existing regional expertise, such an assistance might be provided on a mutual aid basis by other Panel members. Finally, it should be noted that the WMO Commission for Marine Meteorology Working Group on Marine Meteorological Services, at its recent fourth session (Geneva, September 1985), offered to assist in the implementation of this storm surge project whenever possible and requested. Such assistance might be most appropriate within this element.

(c) Risk evaluation and surge simulation studies are essential elements in planning for future storm surge events and in evaluating the accuracy and effectiveness of surge forecast models. At the same time, they can only be undertaken on the basis of sufficient quantities of surge data, coupled with at least a quasi-operational surge model. Therefore, in the context of this project, implementation of this element must follow the previous two. At the same time, considerable expertise now exists in this field, both in other cyclone-prone areas of the world and also possibly within this region. Therefore, assistance with this element, to be provided on a request basis, might involve the secondment of (an) expert(s) to collaborate with national authorities in undertaking such studies.

(d) The improvement in local communications facilities is clearly important to all aspects of the tropical cyclone programme in the region, not just to this storm surge project. Therefore, implementation of this element may be undertaken as part of the general improvements being undertaken within the overall programme. In particular, the planned regional computer network will represent an important contribution to the further implementation of the storm surge project since it will support the installation and operation of high-quality surge forecast models, as well as the rapid collection, processing and exchange of relevant data and products. At the same time, consideration should be given to the implementation within each country of communication networks, if possible using as many alterntive means as possible appropriate to individual circumstances, to enable the effective distribution of storm surge warnings and related information under all circumstances. Expert advice and assistance may be appropriate in this regard.

(e) Perhaps the most important element of the project involves technology transfer and specialized education and training relevant to storm surge forecasting, since it is by this means that the trained personnel may be made available to properly exploit the techniques and technology generated through the other project elements. Activities in this regard should include some or all of the following:

(i) the provision of fellowships specifically for the training of meteorologists and technicians at institutions, either in the region or elsewhere, in all aspects of the activities under this project;

(ii) the continuation of workshops and seminars in the region on all aspects of the storm surge project;

(iii) on-the-job training of meteorologists, technicians and support staff involved in storm surge data collection, forecasting, information dissemination, etc.;

(iv) the introduction and/or expansion of specialized education and training within existing institutions in the region in marine meteorology and physical oceanography. A recommendation in this regard was made by the recent Chittagong workshop while similar suggestions of a more general nature have also been made by the WMO Commission for Marine Meteorology.

5.2 Further elaboration of these elements and proposals for their implementation can only be made following a more complete assessment of individual national needs and requirements. In such an assessment the opinions of the countries concerned as to their own needs and capabilities is critical. Similarly, the active involvement of all countries in the implementation of all project elements is essential for its success.

5.3 One final activity which is not listed as one of the project elements, but which might be seen as an appropriate culmination to the project, is a possible regional cyclonic storm and storm surge operational experiment. It is envisaged that such an experiment might be conducted with similar (though more limited) objectives, organization and execution to the successful TOPEX project. Clearly such an activity could only occur following the successful achievement of all the basic objectives of the project.

6. Time-line chart (timetable for the implementation of activities under the project)

The time-line chart given in Appendix 8, Attachment, pages 5 and 6 contain activities and a schedule for their implementation. It also indicates a possible assignment of responsibility for the activities, source of funding and other information for general guidance in the implementation of the project.

	Activity	Timescale 1990 91 92 93 94	Responsibility	Funding	Remarks
1.	Further elaboration of project activities in response to countries' needs and requests for assistance .	----------	WMO/Panel	--	--
2.	Storm surge seminars/workshops	---- ---- ----	WMO/Members	UNDP	
3.	Compilation of storm surge data files or case histories .	----------	Members	National	Ongoing activity
4.	Compilation of historical surge data sets	----------	Members/WMO	National/ UNDP/WMO	Possible expert secondments to assist Initiation of activity .
5.	Compilation and review of surge models and revie../ formulation of forecast strategies with special emphasis on P.C. based system .	----------	Members/WMO/ Panel	National/ WMO/UNDP	Compilation of storm surge models may be undertaken as a TCP sub-project . Other activities may be undertaken with the assistance of CHM W/G on MMS
6.	Review of models giving coastal inundation and estuarine flooding	----------	Members/WMO/ Panel	National/ WMO/UNDP	
7.	Expert missions to assist in model Implementation	----------	WMO/Members	UNDP/VCP	On request from Members
8.	Risk evaluation and surge simulation studies	----------	Members/WMO	UNDP/National/ VCP	Expert missions or studies on request from Members

	Activity	Timescale 1990 91 92 93 94	Responsibility	Funding	Remarks
9.	Regional Computer network	Phase I Phase II	WMO/Members	National/UNDP/ VCP	Ongoing Implemen tion .
10.	Local communications networks for dissemination of storm surge warning and other information .	----------	Members/WMO	National/UNDP	Expert missions advise,on reques
11.	Expansion of specialized education and training regionally	----------	Members/WMO	National/UNDP/ VCP	Use existing ins tutions if possi
12.	Provision of fellowships for specialized training	----------	WMO	UNDP/VCP	Continuous
13.	Expert missions for on the-job training	----------	WMO	UNDP/VCP/WMO	On request
14.	Insertion of operational storm surge activities in Tropical Cyclone Operational plan	------	WMO/Panel/members	Members	
15.	Possible regional cyclonic storm and storm surge operational experiment	----------	WMO/Members	National/VCP	
16.	Improvement of observational set up including tide gauges, high gust anemometer	----------	WMO/Members	National/VCP	

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

1. METEOROLOGICAL COMPONENT

1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES

	TASKS	TIME SCALE				BY WHOM	RESOURCES	REMARKS
		91	92	93	94			
1.1.1	Maintaining services specified in the Operational Manual, including intensified observations (surface, upper-air and radars)	———				Members	National	Continuous activities
1.1.2	Provision of automated observation facilities and real-time telemetry of meteorological parameters, e.g., winds, rainfall, pressure, etc., by replacing with automatic instruments	———				- ditto -	- ditto -	
1.1.3	Establishment of AMeDAS, ASDAR, anemometer, tide gauge and water recorder networks	———				- ditto -	- ditto -	
1.1.4	Expansion of observational programme:							
	- 98223 Laoag (Philippines) at 12 GMT Radiosonde/Radiowind	———				Philippines	National and external assistance	
1.1.5	Replacement/Upgrading of old radars in Malaysia and Philippines	———	———	———	———	Malaysia, Philippines	- ditto -	
1.1.6	VINH (48845)		———	———	———	Viet Nam	- ditto -	To replace 48900 (Ho Chi Minh)
1.1.7	Establishment of new weather radars:							
	- Pusan (Republic of Korea)					Republic of Korea	National	Completed in December 1990
	- Donghae (Republic of Korea)	—				- ditto -	- ditto -	Completed in April 1991
	- Kunsan (Republic of Korea)	———	———			- ditto -	- ditto -	
	- Da Nang (Viet Nam)	———	———	———		National and external assistance		
	- Vientiane (Lao People's Democratic Republic)		———	———	———	Lao People's Democratic Republic	External assistance	

1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES (cont'd.)

TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
- Bangkok (Thailand)					Thailand	National	
- Surin (Thailand)					- ditto -	- ditto -	
- Surat Thani (Thailand)					- ditto -	- ditto -	
- Phitsanulok (Thailand)					- ditto -	- ditto -	Completed in June 1991
- Sakon Nakhon (Thailand)					- ditto -	- ditto -	
- Ubon Ratchathani (Thailand)					- ditto -	- ditto -	
- Rayong (Thailand)					- ditto -	- ditto -	
- Khon Kaen (Thailand)					- ditto -	- ditto -	
- Chantburi (Thailand)					- ditto -	- ditto -	Coming in 1992
- Chiang Rai (Thailand)					- ditto -	- ditto -	
1.1.8 Establishment/Upgrading of satellite equipment (GMS/TIROS-N)							
- Hanoi (Viet Nam)					Viet Nam	External assistance	
- Vientiane (LAO PDR)					LAO PDR	- ditto -	
- Chiang Mai (Thailand)					Thailand	National	
- Ubon Ratchathani (Thailand)					- ditto -	- ditto -	
- Songkhla (Thailand)					- ditto -	- ditto -	
- Phuket (Thailand)					- ditto -	- ditto -	
1.1.9 Establishment of a WWW data user system for the reception of FAX and GPV data via GMS (see Appendix)					Members	National	
					LAO PDR	External assistance	

1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES (cont'd.)

TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
1.1.10 Establishment of the operational systems with micro-computers to operate forecasting and marine meteorological warning services in fifteen Meteorological Offices in coastal region in China.					China	National	

1.2. SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES

TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
1.2.1* Maintaining (a) services and facilities for the real-time exchange of data and products:	——	——	——	——	Members	National	Continuous activities
(b) monitoring of data exchange	——	——	——	——	RTHs Bangkok Beijing and Tokyo	Members concerned	- ditto -
		——	——	——	RTHs Bangkok Vientiane-Hanoi Bangkok-Vientiane-HoChiMinh		
1.2.2 Improvement of facilities and their operation as necessary for the rapid and reliable collection and distribution of the required observational and processed information.							
1.2.2.1 Establishment of regional telecommunication links							
- Bangkok-Hanoi	——	——	——	——	Thailand and Viet Nam	National and External assistance	Implemented in 1991
- Bangkok-Cambodia		——	——	——	Thailand and Cambodia	- ditto -	
- Bangkok-Beijing		——	——	——	Thailand and China	- ditto -	Under technical discussion
- Bangkok-Vientiane	——	——	——	——	Thailand and Lao PDR	External assistance	
1.2.2.2 Improvement of data completeness and quality, including use of real-time and non-real time monitoring results for this purpose.	——	——	——	——	Members	National	

*During 1992 items with an asterisk to be given priority attention.

1.2. SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES (cont'd.)

TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
1.2.2.3 Review of existing arrangements for dissemination of typhoon warnings with a view to introducing improvements where necessary.	——	——	——	——	Members	National	
1.2.2.4 Improvement of national data collection and re-transmission to associated RTHs:							Continuous activities
- Lao People's Democratic Republic	——	——	——	——	Lao PDR	External assistance	- ditto -
- Philippines	——	——	——	——	Philippines	National and bilateral support	
- Viet Nam	——	——			Viet Nam	External assistance	
- Upgrading of telecommunication circuit linking Hanoi-Bangkok from 75 bauds to 100 or 200 bauds.		——	——	——	Viet Nam	National and external assistance	
- Establishment of telecommunication circuit linking Hanoi-Beijing with 2400 bauds.		——	——	——	Viet Nam	- ditto -	

.3 REQUIREMENTS SPECIFICALLY FOR TROPICAL CYCLONE FORECASTING AND WARNING

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
.3.1*	Continuing provision and dissemination of processed information, advisories and other products needed by TC Members for their forecasting and warning systems, archival of information on typhoon data in accordance with the TC Operational Manual	———	———	———	———	RSMC, Tokyo	Japan	Continuous activity
1.3.2	Exchange of forecasts including products of different objective methods in accordance with the TC Operational Manual	———	———	———	———	Members	National	- ditto -
1.3.3*	Enhancement of co-operation in typhoon monitoring, forecasting and warning	———	———	———	———	- ditto -	- ditto -	- ditto -
1.3.4	Establishment of a regional computer network					Members	National and external assistance	
1.3.5	Installation of a computer processing system with a view to integrating satellite radar and rainfall data so as to provide spatial distribution of rainfall amount over a large region	———				- ditto -	- ditto -	TCDC, Technical Consultancy and assistance from external sources would be required
1.3.6	Setting up of electronic equipment maintenance and repair workshops	———	———	———	———	- ditto -	National and External assistance including TCDC	
1.3.7	Promotion of development at the interface between the Meteorological warning services and the users of warnings for increasing the impact and effectiveness of these services	———	———	———	———	- ditto -	National and external assistance in conjuction with IDNDR	

*During 1992 items with an asterisk to be given priority attention.

2. HYDROLOGICAL COMPONENT

2.1 FLOOD FORECASTING AND WARNING

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
2.1.1	Installation and operation networks of observing stations required for flood forecasting systems	———	———	———	———	Members	National	Continuous activity
	- Installation of telemetering systems complemented by radar-raingauges and satellite systems for important cities and other densely populated areas prone to flash floods	———	———	———	———	China	- ditto -	
	- Integration and use of data from existing meteorological and hydrological observing stations operated by various agencies	———	———	———	———	China	- ditto -	
		———	———			Malaysia	- ditto -	
	- Improvement of means of transmission to reduce data collection time					China	- ditto -	
	- Development of an on-line system					China	- ditto -	
	- Development of hydrometric stations on urban drainage	——				Hong Kong	- ditto -	
2.1.2	Establishment and operation of flood forecasting and warning systems:	———	———	———	———	Members	National	Continuous activity
	- Nam Ngum and Se Bang Hieng basins (Lao People's Democratic Republic)					Lao PDR	- ditto -	Includes real-time data collection and hydrological modelling
	- Pasak River Basin (Thailand)	———	———			Thailand	- ditto -	
	- One river basin (Viet Nam - to be selected by Viet Nam)	———	———	———		Viet Nam	- ditto -	
	- Application of computer-based mathematical models to study the hydrology of urban zones	———	———	———		Hong Kong	- ditto -	In cooperation with ESCAP

.1 Flood Forecasting and warning (cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
	- Extension of flood forecasting services to other basins subject to flooding especially in medium scale catchment	———	———	———		Malaysia, Republic of Korea Thailand	National National & bilateral support	
	- Development of forecasting of the location and intensity of rainfall in densely populated areas which are subject to flash floods (e.g., Metro Manila)	———	———	———		Philippines	National JICA	
	- Increased use of existing radar raingauges for providing OPF data					Philippines	National	
2.1.3	Establishment of flood forecasting and warning systems for dam operations	———				Philippines, Malaysia & Interested Members	Members concerned and external assistance	Faulty dam operation aggravates flooding downstream
2.1.4	Establishment of flood forecasting and warning systems for inundation from storm surges	———	———	———		Members concerned	Members concerned & external assistance including TCDC	Includes interaction of river floods and storm surges
2.1.5	Monitoring of and reporting on performance of existing flood forecasting systems	———	———	———		Members	National & external assistance including TCDC and with support of TCS and WMO	Coordinated by WMO, using MOFFS

2.1 Flood Forecasting and Warning (cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
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	———	———	———		Philippines Malaysia Thailand	National - ditto - - ditto -	
	- Improvement of currently used model on the Han River basin	———				Republic of Korea	- ditto -	
	- Improvement of existing flood forecasting systems for the rivers Hong and Thai Binh using micro-computers	———				Viet Nam		
2.1.7	Implementation of recommendations of mission by experts to provide technical guidance on items 2.1.1 to 2.1.6	———	———	———		Members concerned	External assistance, Missions to be organized by WMO and ESCAP	Using, where appropriate, technology available through HOMS
2.1.8	Exchange of technical visits among flood forecasters	———	———	———		Members	National, external assistance	Coordinated by WMO
2.1.9	Development and application of guidance on hydrological technology models for tropical cyclone regions	———	———	———		Members	External assistance WMO	On the basis of OHP (HOMS)

2.1 Flood Forecasting and Warning (cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
2.1.10	Development and use of improved techniques for Quantitative Precipitation Forecast (QPF) taking advantage of data provided by satellite and radar	——	——	——	——	Members	Members and external assistance	WMO to assist in development and promulgation of improved techniques
	- Development and application of QPF derived from radar raingauges and satellites to issue flash flood warnings in densely populated small river basins	——	——	——		Malaysia	National and external assistance	WMO to assist in development and promulgation of the. techniques
	- Development of QPF and its application to flood forecasting in central region	——				Viet Nam	National & external assistance	

2.2 COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
2.2.1	Establishment of pilot area for comprehensive flood loss prevention and management					Members	Bilateral multilateral support if available	Detailed programme will be established by respective Members
2.2.2	Investigation and survey including: a) Determination of flood-prone areas subject to heavy damages; b) Determination of magnitude and corresponding frequency of floods in each flood-prone area; c) Assessment of potential flood damage in each area for various flood magnitudes; d) Preparation of flood risk maps.		——	——	——	Members	National	ESCAP & WMO to assist in organizing investigations and surveys
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
2.2.4	Implementation of selected aspects of comprehensive flood loss prevention and management plans	——	——	——			- ditto -	- ditto -
2.2.5	Mission of experts to provide technical guidance to Members on items 2.2.1 to 2.2.4 above					Members	UNDP*, TCDC & bilateral, multilateral support, if available	With assistance of ESCAP & WMO

*There is no commitment for further UNDP support beyond the current project which terminates in 1991.

2.2 Comprehensive Flood Loss Prevention and Management (cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
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		———			- ditto -	National and external assistance (sub-contract under regional project)	- ditto -
2.2.8	Storm surge prediction and risk analysis		———			- ditto -	National and external assistance	- ditto -
2.2.9	Improvement of dam water release operation system		———			- ditto -	- ditto -	With assistance of TCS, ESCAP and WMO

3. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 PUBLIC AWARENESS

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
3.1.1*	Improvement of public awareness on typhoon and flood threat and preparedness coupled with studies of human response to warnings	———				Members	National and external assistance in conjuction with IDNDR	With advice and assistance of UNDRO/IFRC/WMO and other agencies concerned
3.1.2	Production of materials (audio-visual aids, pamphlets and booklets) related to public information and education	———				- ditto -	National and external assistance	Work under the WMO TCP projects 12 and 14 is also relevant

*During 1992 items with an anterisk to be given priority attention.

3.2 DISASTER MANAGEMENT

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
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 co-ordination and co-operation between departments and agencies involved in DPP activities					- ditto -	National	
3.2.3	Improvement in the timely dissemination of warnings of typhoons, floods and storm surges with particular attention to remote areas					- ditto	- ditto -	
3.2.4	Improvement of communication systems for warning dissemination and relief operation.					- ditto -	Bilateral or multilateral support if available	
3.2.5	Improvement of damage assessment and reporting					- ditto -	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					- ditto -	External assistance	With guidance from international agencies such as UNDRO, IFRC, ESCAP and WMO
3.2.7	Conducting case studies of response to major disasters					- ditto -	External assistance	With advice from UNDRO, IFRC and WMO

3.2 Disaster Management (Cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
3.2.8	Compilation of annual information on loss of life and damage caused by typhoons, floods and storm surges including damage to houses, public facilities, agricultural products, and so on					Members	External assistance	With advice from UNDRO in cooperation with ESCAP
3.2.9	Archiving of damage caused by natural disasters					TCS	Members	From 1986 onwards or earlier if possible
3.2.10	Where appropriate, implementing the recommendations of joint missions and seminars to evaluate DPP procedures and to provide advice on local problems					Members	Bilateral or multilateral support if available	
3.2.11	Establishment of disaster research and training institute					- ditto -	- ditto -	
3.2.12*	Production of material related to public information and education on the Typhoon Committee activities, particularly storm warning and DPP					- ditto -	External assistance	With support of ESCAP, WMO and TCS
3.2.13	Story of the Typhoon Committee					TCS	- ditto -	- ditto -
3.2.14	Establishment of a Philippine training and research centre for disaster prevention and preparedness, through consultancy services where appropriate					Philippines	- ditto -	With advice from UNDRO

*External assistance in conjunction with IDNDR

. TRAINING COMPONENT

.1 METEOROLOGY

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
1.1.1	Training on engineering application of tropical cyclone climatological data					Members	External assistance	Conferences seminars & oversees training programmes, including roving missions & arrangements
4.1.2	Training on applications of radar and satellite data in tropical cyclone tracking, forecasting and very short-range precipitation forecasts					- ditto -	- ditto -	
4.1.3	Training in calibration, maintenance and repair of electronic meteorological instrumentation					- ditto -	National and external assistance	Coordinated by WMO
4.1.4	Training on utilization of software for integrating satellite/radar/rainfall data					- ditto -	Short-term fellowships with external support	- ditto -
4.1.5	Training on quantitative precipitation forecast (QPF) models					- ditto -	- ditto -	- ditto -
4.1.6	Training of personnel through fellowships on tropical cyclone forecasting					- ditto -	UNDP, WMO and other international organizations concerned	- ditto -
4.1.7	Training on:					- ditto -	- ditto -	Courses and seminars organized by WMO and Members
	- meteorology							
	- electronics							
	- Training course on the analysis and forecast of tropical cyclones					China	National and external assistance	As a result of roving seminar to some TC member countries on TCDC and typhoon forecasting matters.

4.1 Meteorology (cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
4.1.8	Continuation of group training courses					Japan	JICA	Japan International Cooperation Agency (JICA)
4.1.9	Exchange of forecaster(s) between tropical cyclone forecasting and warning centres					Members	External assistance	Through TCDC arrangements
4.1.10	Training on observing technology					- ditto -	External support	Seminars
4.1.11	Exchange of meteorological experts between Members other than 4.1.9 above					- ditto -	Bilateral or TCDC arrangements	
4.1.12	Training on storm surge and wave prediction					- ditto	Short-term fellowships with external support	
4.1.13	Training in message-switching, wave forecasting, numerical weather prediction and cloud physics, through attachments					- ditto -	External assistance	TCDC arrangements
4.1.14*	Training of personnel through fellowships on maintenance of electronic meteorological and hydrological equipment					- ditto -	- ditto -	For both meteorological and hydrological equipment

*During 1992 items with an asterisk to be given priority attention.

.2 HYDROLOGY

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
4.2.1	Training on repair and maintenance of electronic equipment used in flood forecasting and warning	———				Members	WMO, UNDP* & other sources	Roving seminars organized by WMO
4.2.2	Training on advanced techniques for flood forecasting and warning and associated storms, including hardware and software	———				- ditto -	- ditto -	Courses and seminars organized by WMO
4.2.3	Training in hydrology with emphasis on flood forecasting	———				- ditto -	- ditto -	- ditto -
4.2.4	Training on personnel through fellowships on flood loss prevention	———				- ditto -	- ditto -	- ditto -
4.2.5	Training on appropriate topics relating to flood loss prevention and management	———				- ditto -	ESCAP, UNDP* and other sources	Seminar organized by ESCAP
4.2.6	Group training courses on river engineering	———				Japan	Japan International Cooperation Agency (JICA)	At the request of TC
4.2.7	Exchanges of flood forecasting experts	———				Members	WMO, UNDP* & other sources	TCDC arrangements

*For UNDP next programme cycle.

4.3 DISASTER PREVENTION AND PREPAREDNESS

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
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	———				- ditto -	- ditto -	- ditto -
4.3.3	Training in DPP	———				- ditto -	External assistance	Regional seminars organized by TCS with help of UNDRO, IFRC, ESCAP and WMO
4.3.4	Exchange of information on the socio-economic impact of disaster	———				- ditto -	UNDRO, IFRC	Seminars organized by UNDRO IFRC and ESCAP
4.3.5	Training on disaster vulnerability and risk assessment	———				- ditto -	- ditto -	Courses and seminars organized by UNDRO, IFRC and ESCAP
4.3.6	Group training courses on technology for disaster prevention	———				Japan	Japan International Cooperation Agency (JICA)	Continuation
4.3.7	Exchange of DPP personnel	———				UNDRO, LRCS, TCS & ESCAP	UNDRO, IFRC ESCAP & other sources	TCDC arrangement organized by UNDRO, IFRC, TCS & ESCAP.
4.3.8	Emergency health management after natural disasters in Thailand	———				Thailand IFRC	National	Organized by relief organizations and Thai Red Cross Society
4.3.9	First aid training and disaster preparedness in Thailand	———				Thailand IFRC	- ditto -	- ditto -

. RESEARCH COMPONENT

.1 METEOROLOGY

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
.1.1	General Studies on:							
.1.1.1	Methods of typhoon location and accuracy	———				Members or regionally coordinated programme	National	
5.1.1.2	Typhoon development mechanism and forecasting	———				- ditto -	- ditto -	
5.1.1.3	Disastrous weather associated with typhoons	———				- ditto -	- ditto -	
5.1.1.4	Forecasting of precipitation by use of new approaches or techniques such as interactive techniques for integrating satellite, radar and other information	———				- ditto -	- ditto -	
5.1.1.5	Influences of meso- and micro-scale systems on typhoon characteristics	———				- ditto -	- ditto -	
5.1.1.6	Interaction between typhoons and the environmental circulation	———				- ditto -	- ditto -	
5.1.1.7	Possibility of extended track forecasting methods	———				- ditto -	- ditto -	
5.1.1.8	Evaluation and improvement of present objective forecasting methods	———				- ditto -	- ditto -	
5.1.1.9	Sensitivity of objective methods to initial data distribution and quality	———				- ditto -	- ditto -	
5.1.1.10	Typhoon climatology in relation with anomalies in regional circulation	———				- ditto -	- ditto -	
5.1.1.11	Forecasting storm surge and heavy rainfall (see also 5.2.6)	———				- ditto -	- ditto -	
5.1.1.12	Cooperative research in China	—				China	National and external	Gathering of experts to work in China research facilities

5.1 Meteorology (Cont'd.)

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
5.1.2	Utilization of TOPEX data set (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modelling, with the aim of improving existing methods of predicting formation, development and steering	———				Members or regionally coordinated programme	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 north western Pacific and East Asia with software exchanges between Members	———				RSMC, Tokyo	Japan	According to the procedure described in TOM
5.1.2.2	Development of an operational NWP model for typhoon movement and development	———				Members or regionally coordinated programme	National	
5.1.2.3	Irregular tropical cyclone behavior such as sudden turning of tracks, sudden increase/decrease of intensity, rainfall and storm surge	———				- ditto -	- ditto -	
5.1.2.4	Air-sea interactions associated with the occurrence of typhoons, with emphasis on wave and storm surge generation	———				- ditto -	- ditto -	
5.1.2.5	Utilization of SPECTRUM, TCM-90 and TYPHOON-90 data	———				Members	- ditto -	
5.1.2.6	Study on typhoon-related wind climatology in Hong Kong and China	———				China, Hong Kong	National	To be published in the TCP series
5.1.2.7	Second technical conference on SPECTRUM		—			China	National and external	

5.2 HYDROLOGY

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
5.2	Studies for development or improving techniques for:							
5.2.1	Comprehensive flood loss prevention and management					National or regionally coordinated programme	National	In cooperation with ESCAP
5.2.2	Flood risk analysis, including flood risk mapping					- ditto -	- ditto -	- ditto -
5.2.3	Flood run-off models appropriate for the region					- ditto -	- ditto -	- ditto -
5.2.4	Application of meteorological inputs to flood forecasting					- ditto -	- ditto -	- ditto -
5.2.5	Comparison of the performance of the different models, using the post-TOPEX data set					- ditto -	- ditto -	- ditto -
5.2.6	Forecasting floods caused by the combined effects of storm surges, heavy rainfall and stream flow (see also 5.5.11)					- ditto -	- ditto -	- ditto -
5.2.7	Flash flood forecasting					Members	- ditto -	
5.2.8	Study of effects of deforestation, urbanization and changing land use on the hydrology of the catchment and on the intensity of floods					China, Philippines Malaysia	- ditto -	In cooperation with ESCAP
5.2.9	Study of economic and social benifits and evaluation from hydrological forecasting					National or regionally coordinated program	National	- ditto -

5.3 DISASTER PREVENTION AND PREPAREDNESS

	TASKS	TIME SCALE 91	92	93	94	BY WHOM	RESOURCES	REMARKS
5.3.1	Studies on socio-economic impact of typhoon and flood disasters					Members	National	With advice and possible support of UNDRO/IFRC/ESCAP/WMO
5.3.2	Vulnerability and risk assessment of disaster-prone areas					- ditto -	- ditto -	- ditto -
5.3.3	Socio-economic implication of availability and quality of typhoon and flood forecasts and warnings					- ditto -	- ditto -	- ditto -
5.3.4	Disaster impact modelling					- ditto -	- ditto -	- ditto -