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Activities of ESCAP cooperative mechanisms on disaster risk reduction

Work of the Typhoon Committee and Panel on Tropical Cyclones

Note by the secretariat

Summary

The Typhoon Committee is an ESCAP-affiliated regional institution and a regional body of the Tropical Cyclone Programme of the World Meteorological Organization (WMO). The Panel on Tropical Cyclones is a regional body jointly established by WMO and ESCAP. The main objectives of the Typhoon Committee and the Panel on Tropical Cyclones are to promote measures to improve tropical cyclone warning systems in the north-western Pacific Ocean, and in the Bay of Bengal and the Arabian Sea, respectively. They develop activities under three substantive components, namely disaster risk reduction, hydrology and meteorology, as well as in the areas of training and research.

The present document summarizes key information from the reports on the forty-third session of the Typhoon Committee and the thirty-eighth session of the Panel on Tropical Cyclones in order to provide an overall picture of the framework of cooperation. The document describes actions which could enhance the effectiveness of collaboration with regard to the management of disaster risk reduction related to typhoons and tropical cyclones, in particular the socio-economic impacts of such disasters. The Committee on Disaster Risk Reduction may wish to provide the Typhoon Committee and the Panel on Tropical Cyclones with guidance on their future actions, particularly with regard to obtaining the support of international organizations and funding sources, and developing partnerships with other organizations.

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I. Typhoon Committee

A. Introduction

1. The Typhoon Committee is an intergovernmental body that was officially established in December 1968 under the auspices of the Economic Commission for Asia and the Far East, the name of which was changed in 1974 to the Economic and Social Commission for Asia and the Pacific (ESCAP), and the World Meteorological Organization (WMO) in order to promote and coordinate the planning and implementation of measures required to minimize the loss of life and material damage caused by typhoons.

2. The Typhoon Committee is composed of 14 members: Cambodia; China; Democratic People's Republic of Korea; Hong Kong, China; Japan; Lao People's Democratic Republic; Macao, China; Malaysia; Philippines; Republic of Korea; Singapore; Thailand; United States of America; and Viet Nam.

3. Four similar institutions were set up to cover all the tropical cyclone basins around the world: the WMO/ESCAP Panel on Tropical Cyclones, the Regional Association I and Regional Association V Tropical Cyclone Committees (covering Africa and the south-western Pacific, respectively) and the Regional Association IV Hurricane Committee (covering North America, Central America and the Caribbean). The Typhoon Committee and the institutions mentioned above are regional bodies of the Tropical Cyclone Programme of WMO, which is tasked with establishing national and regionally coordinated systems to minimize the loss of life and the damage caused by tropical cyclones. The Programme is part of the WMO Weather and Disaster Risk Reduction Services Department.

4. The Typhoon Committee maintains and implements activities and projects under the umbrella of three substantive components: disaster risk reduction, hydrology and meteorology. The disaster risk reduction component was established for the purpose of making effective connections between civil protection services and meteorological and hydrological services so that the time gap could be reduced between the issuance of early warnings and the engagement of rescue brigades. Working groups are supported by the Committee's Advisory Working Group, Training and Research Coordination Group and Resources Mobilization Group, with assistance from the secretariats of the Typhoon Committee, ESCAP and WMO, and other agencies.

5. Annual sessions of the Typhoon Committee are convened by ESCAP and organized by the secretariats of ESCAP, WMO and the Typhoon Committee. At such sessions, the Typhoon Committee reviews the progress made since the previous session, as well as the implementation of its strategic plan and annual operating plan, and makes specific recommendations with a view to reducing the consequences of typhoon-related disasters.

6. The executive body of the Committee was originally known as the Joint Unit on Typhoons, which was located in Bangkok. In 1971, in response to an invitation from the Government of the Philippines, the unit was transferred to Manila and renamed the Typhoon Committee Secretariat. In February 2007, the Secretariat was officially transferred from Manila to Macao, China. The move entailed separate agreements between the Typhoon Committee and the Government of China and the government of Macao, China.

7. Since 2006, the Typhoon Committee has held annual integrated workshops on its three substantive components. At these workshops, discussions are held and recommendations made on measures relevant to those components.

B. Strategic plan

8. In its strategic plan, the Typhoon Committee identified the areas in the region and the activities on which it wished to focus, as well as the goals it intended to achieve in the period 2007-2011, with a view to continuing to produce meaningful results in its focus areas. The development of the strategic plan took into account various international and regional frameworks, protocols and strategic plans pertaining to tropical cyclone-related activities within the region, such as the Millennium Development Goals, the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters,¹ the WMO Long-term Plan, the Hashimoto Action Plan: Compendium of Actions,² the Beijing Declaration on Disaster Reduction in Asia³ and the statute of the Typhoon Committee, as well as the thematic areas addressed by ESCAP.

¹ A/CONF.206/6 and Corr.1, chap. I, resolution 2.

² A/C.2/61/4, annex I.

³ Adopted by the First Asian Ministerial Conference on Disaster Risk Reduction (Beijing, 2005), available from www.gov.cn/misc/2005-09/30/content_73398.

9. The Typhoon Committee has identified seven key result areas for the period 2011-2015:⁴

- (a) Reduced loss of life from typhoon-related disasters;
- (b) Minimized typhoon-related social and economic impacts;
- (c) Enhanced beneficial typhoon-related effects for the betterment of the quality of life;^{5,6}
- (d) Improved typhoon-related disaster risk management in various sectors;
- (e) Strengthened resilience of communities to typhoon-related disasters;
- (f) Improved capacity to generate and provide accurate, timely and understandable information on typhoon-related threats;
- (g) Enhanced typhoon committee effectiveness, efficiency and international collaboration.

10. To support the Strategic Plan 2011-2015,⁷ the Advisory Working Group prepares an annual operating plan, which is approved at each annual session of the Typhoon Committee. Each such plan describes the detailed actions and success indicators which would be employed that year to guide the Committee and its members towards achieving, by 2015, the strategic goals and activities contained in the strategic plan.

C. Components

1. Disaster risk reduction

11. The Working Group on Disaster Prevention and Preparedness is developing the Typhoon Committee Disaster Information System,⁸ which is intended to facilitate timely and efficient access to typhoon-related disaster information through the Internet to extend the effectiveness of multi-hazard early warning systems. It can also serve as a platform for members to share disaster data, knowledge, experiences, good practices and other information related to typhoon disaster risk reduction.

12. With regard to geographic information systems (GIS), the Republic of Korea is developing the Web GIS-based Typhoon Committee Disaster Information System to facilitate timely and efficient access to typhoon-related disaster information; it is being developed as an Internet platform through which members could share disaster data, knowledge, experiences,

⁴ See E/ESCAP/63/32.

⁵ A/CONF.206/6 and Corr.1, chap. I, resolution 2.

⁶ This key results area refers to proactive disaster management actions that can be taken potentially to use typhoon activity to improve the quality of life in certain places. For instance, in a region with severe drought, the construction of reservoirs could enable the excess water of a typhoon to be captured for later use.

⁷ www.typhooncommittee.org/43rd/docs/item8/SP2011v1.pdf.

⁸ For details, see: www.tcdis.org.

good practices and other information. Training in its operation will be provided in 2011.

13. Recent cooperation between Google Inc. and WMO has been aimed at increasing public awareness of active tropical cyclones around the world under the Google Onebox and Google Earth information programmes. Concise information from the Severe Weather Information Centre of WMO is made available through these programmes.⁹ A warning dissemination project was launched in Hong Kong, China, in 2010 through a pilot project of the Centre¹⁰ and community weather stations.

14. An integrated workshop was held in Macao, China, from 4 to 10 September 2010. The fifth and sixth workshops of the Working Group on Disaster Risk Reduction were held in the Republic of Korea, in October 2010 and May 2011, respectively.

2. Hydrology

15. The progress made by, and the future activities of, the hydrological projects of the Typhoon Committee are as follows:

(a) On-the-job training concerning flood forecasting has been carried out since 2008 among members of the Typhoon Committee. Four training courses have been conducted in Malaysia since that year;

(b) A meeting on a cross-cutting project on urban flood risk management, which was held in December 2010, involved the collaboration of three working groups of the Typhoon Committee linked with WMO and ESCAP; the project furnished expertise, guidance and advice on aspects of hydrology and disaster risk reduction in three pilot cities: Hat Yai, Thailand; Metro Manila, the Philippines; and Hanoi, Viet Nam, with support provided by China, Japan and the Republic of Korea;

(c) A half-day seminar on assessment of the socio-economic impacts of flood control measures was conducted by the Republic of Korea in January 2011 to assess the socio-economic impacts of water-related disasters on infrastructure. Japan led the component on hazard mapping for sediment-related disasters;

(d) A questionnaire survey to establish flood disaster preparedness indices was developed and launched in 2010 by the International Centre for Water Hazard and Risk Management (ICHARM) under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO);¹¹

(e) In December 2010, a workshop on space applications to reduce water-related disaster risks in Asia was jointly organized by ESCAP and ICHARM, in partnership with WMO and the Typhoon Committee, and with the support of the Japan Aerospace Exploration Agency and the Asian Development Bank. During the workshop, ICHARM provided the participants with training on the integrated flood analysis system;

⁹ For details, see: <http://severe.worldweather.wmo.int>.

¹⁰ Severe weather warnings in real time may be accessed from: <http://severe.worldweather.org/swidget/swidget.html>.

¹¹ For details, see: www.fdpi.jp/fdpi.

(f) A proposed implementation plan for a project on the assessment of the variability of water resources affected by climate change will be drafted and launched by the Philippines in 2011.

3. Meteorology

16. The Typhoon Committee Working Group on Meteorology has continued to develop a number of projects: (a) Typhoon Information Processing System; (b) quantitative precipitation estimates/quantitative precipitation forecasts; (c) South China Sea typhoon forecast; (d) a website under the North-Western Pacific Tropical Cyclone Ensemble Forecast Project; and (e) a forum on the Internet serving as a real-time communications platform for forecasters and researchers to share real-time observations, forecasts and warning information with regard to typhoons.

17. Typhoon Committee members have recognized as necessary the technology and knowledge transfer of the Typhoon Information Processing System, which facilitates the processing and display of prognostic information for either deterministic or probabilistic forecasts. Since the system is a powerful tool for early warning and only a few members have it, it is expected that the Typhoon Committee will address the needs of its members, particularly those that are less developed, and support them in their efforts to develop such a system.

18. It is planned that training programmes and a workshop on quantitative precipitation estimates/quantitative precipitation forecasts, especially for urban flood risk management, will be held in Japan in 2011 in conjunction with other working groups. To produce storm surge distribution maps and time-series charts, it is necessary to conduct training in the exchange of information on radar data and storm surge models for verification, as well as archive tidal and bathymetric data. Quantitative precipitation estimates/quantitative precipitation forecasts would provide numerical prediction methods for generating models representing states of the atmosphere and for complementing other forecasting methods. The more advanced members of the Typhoon Committee already employ such methods, and some can use the resulting information.

19. The South China Sea typhoon forecast pilot project is aimed at enhancing cooperation among members in the development of skills for forecasting tropical cyclones on the basis of the South China Sea typhoon model developed by China. The next-generation data broadcast system, known as CMACast, is a multimedia dissemination system based on second-generation digital video broadcast technology. The super ensemble typhoon track prediction system will begin operations in July 2011.

20. The website for the North-Western Pacific Tropical Cyclone Ensemble Forecast Project of WMO was created by Japan in May 2010. That website provides the Typhoon Committee with deterministic and ensemble forecast tracks, as well as strike probabilities derived from a specialized database¹² set up by several organizations; it enables users to

¹² The THORPEX Interactive Grand Global Ensemble database is available in a unified format, known as Cyclone XML, or CXML. THORPEX is a 10-year international research and development programme aimed at accelerating improvements in the accuracy of one-day to two-week high-impact weather forecasts for the benefit of society, the economy and the environment.

compare and verify the ensemble forecasts in order to improve their forecasting skills.

D. Training and research

21. A concept note on knowledge-based resource management has been developed by the Training and Research Coordination Group for members of the Typhoon Committee. In 2009, that group formulated the work plan for the period 2010-2013, which affords a sound basis for implementation activities. Guidelines for future activities will include the establishment of a training and research portal.

22. Research and training activities will focus on forecasting and warning (meteorology), flood forecasting and water management applications (hydrology) and impacts (disaster risk reduction).

23. A roving seminar, held in Ubon Ratchathani, Thailand, in November 2010, was hosted by the Meteorological Department of Thailand. In 2011, the roving seminar will be hosted by Malaysia with financial support from the Typhoon Committee Trust Fund.

24. Other activities carried out in 2010 were the following: (a) research fellowship programmes hosted by China, the Republic of Korea, and Hong Kong, China; (b) training attachment for forecasters from Singapore and Hong Kong, China, which was supported by Regional Specialized Meteorological Centre, Tokyo; and (c) a capacity-building initiative carried out continuously in 2010 with support from the Japan Meteorological Agency and the Tropical Cyclone Programme of WMO.

25. The Typhoon Committee Secretariat published both the twenty-second issue of the *ESCAP/WMO Typhoon Committee Newsletter* and the *Typhoon Committee Annual Review* in January 2010, disseminating them to members, including ESCAP and WMO, in electronic format (CD-ROM).

26. The Regional Specialized Meteorological Centre, Tokyo – the Typhoon Centre published *Technical Review No. 12* in March 2010 and the *Annual Report on the Activities of the RSMC Tokyo – Typhoon Centre in 2009* in December 2010.¹³

27. The Assessment Report on Tropical Cyclone Frequency and Intensity in the Typhoon Committee Region and the Report on Mountainous Flash Flood Forecast System Manual were published as part of a series of technical publications.

II. Panel on Tropical Cyclones

A. Introduction

28. The Panel on Tropical Cyclones, a regional body that was jointly established by WMO and ESCAP in 1973, is associated with the Tropical Cyclone Programme of WMO. The thirty-eighth session of the Panel was held in New Delhi from 21 to 25 February 2011.

¹³ For details, see www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/annualreport.html.

29. The main objectives of the Panel on Tropical Cyclones are to promote measures to improve the warning systems for tropical cyclones in the Bay of Bengal and the Arabian Sea and disseminate technical information on operations to mitigate the socio-economic impacts of tropical cyclone-related disasters. The Panel develops activities under three substantive components: disaster prevention and preparedness, hydrology and meteorology, as well as training and research.

B. Components

1. Disaster prevention and preparedness

30. Details of the national organizations, plans and programme implementation of member countries of the Panel on Tropical Cyclones are described below.

31. In 2010, the Department of Meteorology and Hydrology of Myanmar issued early warnings from its Multi-Hazard Early Warning Centre, developed the Myanmar Action Plan on Disaster Risk Reduction 2009-2015, implemented both its disaster management training programme and its public education and awareness programme and published six articles on weather phenomena and the behaviour of storms.

32. The National Committee for Civil Defence of Oman is the government unit responsible for disaster preparedness and response in that country. The national plan for disaster management was activated during tropical cyclone Phet. The directives of the Government are to improve the national plan in order to establish a fully equipped emergency management centre and build up-to-date databases for civil establishments, roads, physical features and geographic information systems.

33. Most of the deaths due to the severe flooding that occurred in Pakistan in 2010 were caused by flash floods in the northern part of the country, especially in Khyber Pakhtunkhwa Province. Following that disaster, the National Disaster Management Authority prepared a national disaster management plan covering the period 2011-2021, which encompasses all aspects of disaster management policies, strategies and actions, and is meant to be used as a long-term, holistic policy document for national disaster risk management and for implementation of action programmes during the 10-year cycle of the plan. A project on a seismograph network was implemented for the purpose of strengthening the national seismic monitoring network in Pakistan.

34. The Ministry of Disaster Management and Human Rights has been in charge of disaster management in Sri Lanka since April 2010. Its Disaster Management Centre is the leading State agency for disaster management; it implements and coordinates national and subnational programmes to reduce disaster risks. It has developed disaster hazard maps, disaster preparedness and response plans, community-based disaster management projects and awareness programmes. Three drills conducted during the year assessed the tsunami-warning communications system and public preparations. When a disaster occurs, the Emergency Operations Centre, which is part of the Disaster Management Centre, takes early response action immediately, and the National Disaster Relief Services Centre carries out relief measures. The budget for flood relief was increased by 20 per cent in 2010 compared with the level of previous years.

35. In Thailand, the Department of Disaster Prevention and Mitigation, as the primary intermediary agency for disaster management, implements programmes and policies, formulates operational guidelines, establishes criteria on disaster management and conducts training activities in conjunction with local and international organizations. Thailand recently focused on (a) preparedness activities in order to reduce vulnerability impacts and increase resilience in disaster-prone areas and (b) activities for the general public using community-based disaster risk management approaches. The Department has initiated various other projects, such as the “One Tambon (subdistrict) One Search and Rescue Team”, “Mr. Disaster Warning” and Civil Defence Volunteers. Nationwide, it has trained more than 1 million villagers and local officers. As the chair of the Panel’s Working Group on Disaster Prevention and Preparedness, the Department hosted the working group meeting that finalized the annual operations plan in Bangkok and the National Crisis Management Exercise 2010 in Chanthaburi Province in August 2010.

2. Hydrology

36. The projects currently being implemented under the hydrological component are: (a) improvement of the institutional capacity of the WMO Regional Association II (Asia) Strategic Plan for National Hydrological Services; (b) the WMO Flood Forecasting Initiative and related capabilities; (c) surface and underground water resource assessment; (d) hydrological utilization technology regarding climate variability; and (e) the sharing of regional hydrological information.

37. The WMO Flood Forecasting Initiative has made progress in flash flood guidance systems in the region. A comparison of national forecasting models will be carried out and a framework for assessing the service delivery capabilities of hydrological services in terms of flood forecasting will be developed in 2011.

38. The Associated Programme on Flood Management, which is a joint initiative of WMO and the Global Water Partnership, promotes the concept of integrated flood management; that programme and the Coastal Inundation Forecasting Demonstration Project have been developed to improve flood forecasting and management.

39. In 2010, the Working Group on Hydrology of the Panel on Tropical Cyclones cooperated with the Typhoon Committee in the areas of: (a) urban flood risk management; (b) forecasting and warning of flash floods, debris flows and landslides; (c) variability assessment of water resources in changing climates; and (d) drought monitoring and forecasting using space-based information.

40. The Maldives Meteorological Service, which is the national organization authorized to issue advisories and warnings of disasters in Maldives, has established standard operating procedures for disasters, a national multi-hazard early warning system, a high-resolution satellite image-receiving system, Doppler weather radar and an information network on the issue of rising sea levels. The country’s National Multi-Hazard Early Warning Centre conducts public and student awareness programmes and disseminates weather warnings, as well as earthquake and tsunami warnings.

41. In Myanmar, even though 4 flood warnings and 14 flood bulletins were issued in 2010, less flooding occurred in that year than in some previous years. Inland floods and landslides, which occurred following heavy rain in June, caused 76 deaths and adversely affected 29 wards and villages in Buthidaung township near the country's western coast. The flooding of urban areas in central Myanmar was caused by heavy rainfall in October. The country's Department of Meteorology and Hydrology has developed a flood hazard analysis method and simulated floods using the integrated flood analysis system for the upper parts of the three main rivers. It also worked on the development of a river catalogue and flood hazard map in 2010.

42. Oman measures all hydrological parameters through monitoring stations. Coastal areas of Oman were exposed to exceptionally heavy rainfall caused by tropical cyclone Phet. The highest annual discharge rate since 1997 was recorded in the coastal area of Quryat: flood volumes there during 2010 were three times the annual average.

43. Pakistan suffered from historically severe flooding during the 2010 monsoon season. The first heavy rainfall started in late July in the northern part of the country, especially in Khyber Pakhtunkhwa Province and adjoining areas; the heavy rain caused severe flash floods and extremely high riverine flooding. The second wave of heavy rain started in early August and caused the Indus River basin and its tributaries to overflow. (A few days before these events, the Pakistan Meteorological Department reportedly issued weather forecasts warning of the coming precipitation.) The second wave of flooding aggravated the situation, as fields had already been flooded in the provinces of Balochistan, Khyber Pakhtunkhwa, Punjab and Sindh. Eventually, the flood waters from both storms merged below the Taunsa Barrage on the Indus River in Punjab Province and created havoc in the surrounding areas and further downstream.

44. The Irrigation Department of Sri Lanka is the agency mandated to monitor floods and issue warnings and advisories in that country; it also maintains river gauging stations nationwide. It currently provides computer-generated hydrological data for development projects in the northern and eastern areas of the country. Sri Lanka is also implementing a project to improve dam safety under which its existing hydrometeorological stations, including new stations with automatic sensors and communications facilities, would be upgraded.

45. In Thailand, the Office of Hydrology and Water Management of the Royal Irrigation Department compiles meteorological and hydrological data and formulates flood management plans. Its Water Watch and Monitoring System for Warning Centre carries out the monitoring of flood situations on a 24-hour basis. The Department also collaborates with related organizations to plan flood prevention and local flood protection systems have been set up in economic zones where floods may occur.

3. Meteorology

46. The total number of monthly CLIMAT TEMP¹⁴ reports transmitted on the Global Telecommunications System showed a slight increase in

¹⁴ The code for reporting monthly values of meteorological parameters from land-based weather stations and for reporting monthly aerological means from such stations.

2010, while deficiencies in the coverage of surface and upper-air data in the region were caused by financial difficulties.

47. The Aircraft Meteorological Data Relay programme of WMO, which uses commercial aircraft to collect meteorological data, is aimed at improving upper-air data on a regional basis. Myanmar installed a meteorological satellite reception and data processing system in January 2011; the data are sent to weather-forecasting stations through the Internet.¹⁵

48. Oman will install five S-band dual-polarization Doppler weather radar units in 2012.

49. The Pakistan Meteorological Department has been using a high-resolution regional model as an operational model for making numerical weather predictions since 2007.¹⁶

50. In Sri Lanka, the country's data and information exchange system is able to provide warnings with an alarm when there is the potential of a tsunami occurring. Its digital meteorological data dissemination system is currently in operation, and efforts are being made to continue it beyond 2011. Ship observations are received through the Global Telecommunications System; however, the reception of reports from aircraft is poor.

51. Thailand will install a new radio station in Yangon, Myanmar; thus, the total number of such stations in that country will be five in 2011. Three C-band Doppler radar units are being installed and a satellite signal receiving station will become operational in 2011. A map depicting maximum storm surge height along coastal areas of the Gulf of Thailand has been produced, and a meteorological data-receiving/disseminating network of the Global Telecommunications System will be utilized for issuing warnings of severe weather and disasters in 2011.

C. Training and research

52. In 2010, Myanmar conducted a course on the integrated flood analysis system and carried out a short-term programme on the improvement of tropical storm forecasting and warning.

53. Since 2008, Pakistan has been extending training facilities to the national meteorological and hydrological services of neighbouring developing and least developed countries in order to help them develop their capacities in these areas. In 2010, a course was conducted at the Institute of Meteorology and Geophysics in Karachi; the fourth such course is scheduled to be held in 2011.

D. Other activities

54. Following the disastrous floods in Pakistan in 2010, WMO and ESCAP, in conjunction with UNESCO carried out a fact-finding and needs assessment mission in November. The recommendations of the mission were, among other things, that essential hydrological and meteorological

¹⁵ For details, see: www.moezala.gov.mm.

¹⁶ For details, see: www.pakmet.com.pk.

infrastructure should be restored, and capacities for meeting short-term (within a year), medium-term (2-3 years) and long-term (5-10 years) needs should be strengthened. More specifically the main components of the such work would involve: (a) restoration of the damaged meteorological and hydrological observational network; (b) establishment of localized flash flood warning systems for small rivers and streams and regional flood forecasting centres; (c) strengthening of the radar network; (d) improvement of hydrological/flood forecasting and numerical weather prediction models; and (e) capacity development.

55. The basic principles of the Tropical Cyclone Programme of WMO are as follows: (a) to enhance support measures for tropical cyclone forecasters; (b) to transfer the results of research and development into operational forecasting; (c) to establish storm surge watch schemes and strengthen the storm surge warning capabilities of the national meteorological and hydrological services of WMO members; and (d) to continue to give high priority to capacity-building.

56. The publication entitled *Global Guide to Tropical Cyclone Forecasting* will provide comprehensive Web-based guidance on tropical cyclone forecasting once it has been fully updated.

57. The WMO Tropical Cyclone Forecaster Website,¹⁷ which is still under construction, is being developed to provide an accessible source of forecast tools and analytical data. A model of the high-resolution ensemble forecast system applicable to track forecasting is available from the website of the Regional Specialized Meteorological Centre of Pakistan. Moreover, the Pakistan Meteorological Department has started to provide probabilistic forecasts of tropical cyclones for disaster management.

58. WMO is collaborating with the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) to mobilize resources and implement joint capacity-building projects for the national meteorological and hydrological services of WMO members and other stakeholders. A WMO-RIMES joint project proposal on reducing the risks of tsunamis, storm surges, large waves and other natural hazards in low-elevation coastal zones was approved in 2010 under the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries.

59. The Indian Institute of Technology Delhi has experimented with river/ocean-coupled models modified to allow a simulated storm surge to flow inland.

60. Two issues (Nos. 29 and 30) of the biennial newsletter *Panel News* have been published, and No. 31 is scheduled for publication.

E. Operational plan

61. As a cross-cutting activity, the Panel will organize an ad hoc group to assess climate change impacts on tropical cyclones in the region, and develop a work space for sharing information through the Panel website.

¹⁷ For details, see: www.wmo.int/pages/prog/www/tcp/TCF/TCF-Main.html.

F. Trust fund

62. The Panel endorsed the use of \$6,000 from the Panel on Tropical Cyclones Trust Fund to cover per diem expenses for participants to attend attachment training at the Regional Specialized Meteorological Centre in New Delhi in 2011. Additionally, \$4,000 has been approved to cover some of the operating expenses of the Panel on Tropical Cyclones Secretariat, including the costs incurred in printing *Panel News* and running the Panel's website. Payment of \$3,000 from the Trust Fund was also approved for supporting Panel participation in the eighth session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System, in Melbourne, Australia, from 3 to 6 May 2011.

III. Issues for consideration by the Committee

63. The Committee may wish to provide the Typhoon Committee and the Panel on Tropical Cyclones with further guidance on planning their future course of action, particularly with regard to obtaining the support of international organizations and funding sources, and developing partnerships with other organizations.
