



ESCAP/WMO
Typhoon Committee



ESCAP/WMO Typhoon Committee 43rd Session Report

JEJU ISLAND, REPUBLIC OF KOREA
17-22 JANUARY 2011



UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

 **WMO**

TABLE OF CONTENTS
Forty-Third Session of Typhoon Committee

PART I – DECISIONS OF THE COMMITTEE	1
PART II – PROCEEDINGS OF THE COMMITTEE	2
I. ORGANIZATION OF THE SESSION	2
Opening of the Session (agenda item 1)	
II. ELECTION OF OFFICERS (agenda item 2)	2
III. ADOPTION OF THE AGENDA (agenda item 3)	3
IV. PARALLEL WORKING SESSIONS OF METEOROLOGICAL, HYDROLOGICAL AND DISASTER RISK AND REDUCTION WORKING GROUPS	3
V. THE COMMITTEE’S ACTIVITIES DURING 2010 (agenda 5)	3
(a) Meteorological Component (agenda item 5.1)	3
(b) Hydrological Component (agenda item 5.2)	9
(c) Disaster Risk Reduction Component (agenda item 5.3)	12
(d) Activities of Training and Research Coordination Group (agenda item 5.4)	14
(e) Activities of the Advisory Working Group (agenda item 5.5)	15
(f) Activities of the Working Group on Resource Mobilization (agenda item 5.6)	15
(g) Activities of the Typhoon Committee Secretariat (agenda item 5.7)	15
VI. REVIEW OF THE 2010 TYPHOON SEASON AND PUBLICATIONS (agenda item 6)	16
VII. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item 7)	16
VIII. PROGRAMME FOR 2011 AND BEYOND (agenda item 8)	18
IX. SUPPORT REQUIRED FOR THE COMMITTEE’S PROGRAMME (agenda item 9)	20
(a) Technical Cooperation	20
(b) Typhoon Committee Trust Fund (TCTF)	21
X. DATE AND PLACE OF THE FORTY-FOURTH SESSION (agenda item 10)	21
XI. SCIENTIFIC LECTURES (agenda item 11)	21
XII. ADOPTION OF THE REPORT (agenda item 12)	21
XIII. CLOSURE OF THE SESSION	21

REPORT OF THE FORTY-THIRD SESSION OF TYPHOON COMMITTEE

Jeju, Republic of Korea
17-22 January 2011

PART I – DECISIONS OF THE COMMITTEE

1. The Committee at its Forty-Third Session decided to:
 - a. Accept the recommendations submitted by Working Group on Meteorology (WGM) as expressed in **paragraph 63**.
 - b. Accept the recommendations submitted by Working Group on Hydrology (WGH) as expressed in **paragraph 88**.
 - c. Accept the recommendations submitted by Working Group on Disaster Risk Reduction (WGDRR) as expressed in **paragraph 97**.
 - d. Accept the recommendation submitted by Training & Research Coordination Group (TRCG) as expressed in **paragraph 104**.
 - e. Approve the reappointment of the TC Secretary, Mr. Olavo Rasquinho for the four-year period from 2011-2014. (**Appendix XIV**).
 - f. Accept the replacement tropical cyclone names for KETSANA, MORAKOT and PARMA by CHAMPI, ATSANI and IN-FA, respectively.
 - g. Request Guam, USA to submit in the next Session the replacement tropical cyclone name for FANAPI in accordance with the Committee procedures.
 - h. Request the actions of AWG as expressed in **paragraph 140**.
 - i. Request the actions of TCS as expressed in **paragraph 141**.
 - j. Accept the recommendations of the AWG as expressed in **paragraph 152**.
 - k. Approve the TC Annual Operating Plan 2011 submitted by Advisory Working Group (AWG) with modifications and details in **Appendix XVIII**.
 - l. Approve the 2011 Budget as presented below, which includes US \$14,000 from carry-over funds: (**Appendix XIX**)

By Group	2010	2010	2011	2010 Carry Over	2011 Total
	Allotment	Spent	Proposed		Including 2010 Carry Overs
TCS	36,000	33,735.68	26,000	0	26,000
TRCG	18,000	13,698.05	20,500	5,000	25,500
WGM	19,000	11,082.08	27,500	0	27,500
WGH	19,000	11,367.79	21,000	5,000	26,000
WGDRR	18,000	7,360.00	19,000	4,000	23,000
AWG	19,000	17,132.69	6,000	0	6,000
TOTAL	129,000	94,376.29	120,000	14,000	134,000

- m. Request action of TCS to finalize the date, place and the host for the 44th Session by March, 2011.

PART II – PROCEEDINGS OF THE COMMITTEE

I. ORGANIZATION OF THE SESSION

2. The Forty-third Session of the ESCAP/WMO Typhoon Committee (TC) was held in Lotus Room, Shilla Jeju Hotel, Seogwipo City, Republic of Korea, from 17 to 22 January 2011.
3. The Session was attended by 95 participants from 11 out of 14 Members of the Typhoon Committee, namely: China; Hong Kong, China; Japan; Macao, China; Malaysia; Philippines; Republic of Korea; Singapore; Thailand; the Socialist Republic of Viet Nam; and the United States of America (USA).
4. The Session was also attended by 4 observers from Russia–Institute of Experimental Meteorology Scientific & Production Association “Typhoon”; from the Asian Disaster Reduction Center; from Thailand–Regional Integrated Multi-Hazard Early Warning System and from Indonesia–Indonesian Agency for Meteorology Climatology and Geophysics (BMKG). Representatives from the Economic and Social Commission for Asia and the Pacific (ESCAP), the World Meteorological Organization (WMO) and Typhoon Committee Secretariat (TCS) also attended the session. The list of participants is given in Appendix I.

Opening of the Session (agenda item 1)

5. The Session was declared open by his Excellency, Dr. Maanee LEE, Minister of Environment of Republic of Korea, at 10:00 am on Monday, 17 January 2011 in the Lotus Room, Shilla Jeju Hotel, in Jeju Island, Republic of Korea in the presence of the Members’ representatives.
6. The following statements were delivered at the opening ceremony:
 - a. The welcome address of Dr Byung-Seong CHUN, Administrator, Korea Meteorological Administration (KMA), Ministry of Environment, Republic of Korea.
 - b. The address of Mr Keun-Min WOO, Governor of Jeju Special Self-Governing Province.
 - c. The address of Mr Yeon Soo PARK, Administrator, National Emergency Management Agency (NEMA), Republic of Korea.
 - d. The address of Dr Seok-Hyeon KIM, Director-General, Han River Flood Control Office, Ministry of Land, Transport and Maritime Affairs (MLTM), Republic of Korea.
 - e. The address of Mr. Olavo RASQUINHO, Secretary of Typhoon Committee in representation of the Chairman of Typhoon Committee.
 - f. The address of Dr. Tokiyoshi TOYA, the representative of the WMO Secretariat.
 - g. The message of Mr. Yuichi ONO, representative of ESCAP secretariat.
 - h. The inauguration address of His Excellency Dr. Maanee LEE, Minister of Environment of Republic of Korea.
7. The above-mentioned statements are given in Appendices II.a, II.b, II.c, II.d, II.e, II.f, II.g and II.h, respectively.
8. Dr. Roman L. KINTANAR Award for Typhoon related Disaster Mitigation was presented to the NOAA-Pacific Region of USA and NEMA of Republic of Korea.
9. The launching of “Assessment Report on Impacts of Climate Change on Tropical Cyclone Frequency and Intensity in the Typhoon Committee Region” was presented by one of the members of the Expert Team to the TC Chair.

II. ELECTION OF OFFICERS (agenda item 2)

10. Dr. Byung-Seong CHUN, Administrator of KMA was elected Chairperson and Mr. Nguyen Dai Khanh, Director, Science Technology and International Cooperation Department, National Hydro-Meteorological Service of Viet Nam was elected Vice-Chairperson of the Committee. Mrs. Hilda LAM, Assistant Director, Hong Kong Observatory (HKO) of Hong Kong, China was elected Chairperson of the Drafting Committee.

III. ADOPTION OF THE AGENDA (agenda item 3)

11. The Committee adopted the agenda as shown in Appendix III.

IV. PARALLEL SESSIONS OF METEOROLOGICAL, HYDROLOGICAL AND DISASTER RISK REDUCTION WORKING GROUPS (agenda item 4)

12. Prior to the plenary session for the Committee, parallel sessions of the three Working Groups on Meteorology, Hydrology and Disaster Risk Reduction were convened on the afternoon of 17 January 2011 in three separate meeting areas to review progress of work during the past year, to identify priorities for cooperation and make recommendations to the Committee.
13. The major outcomes of the parallel sessions of the three Working Groups were reported to the plenary session as given in the following sections.

V. THE COMMITTEE'S ACTIVITIES DURING 2010 (agenda item 5)

(a) Meteorological Component (agenda item 5.1)

14. The Committee took note of the outcome of the parallel session of the WGM, which met on Monday, 17 January 2011. (Appendix IV)
15. The Committee reviewed the activities of Members to implement the TC Strategic Plan and its annual operating plan in relation to Meteorological Component during the past year. (Appendix V)
16. The Committee was pleased that a number of workshops and training courses were held successfully during 2010 and were well attended by TC Members.
17. The Committee noted with pleasure that the assessment report on the impact of climate change on tropical cyclone frequency and intensity variation was finished and published in Typhoon Committee 43rd session. The draft of the second assessment report is ongoing and is planned to be distributed in Typhoon Committee 44th Session.
18. The Committee was informed that National Meteorological Centre (NMC) of China Meteorological Administration (CMA) officially issued 120-hour tropical cyclone track and intensity forecast via GTS since October 2010.
19. The Committee was informed that CMA adjusted the typhoon warning categories at the beginning of 2010, according to the National Meteorological Disasters Emergency Plan.
20. The Committee noted that a new polar orbiting meteorological satellite (FY-3B) was launched on November 5, 2010, and this is the second one of China's Fengyun-3 (FY-3) series. The FY-3B and FY-3A would form a network for monitoring natural disasters and the environment, as well as researching on the environment, climate change and disaster prevention and reduction.
21. The Committee was informed that CMA had established 8 CINRAD radars, 191 shore-based stations, 84 AWSs on islands, 18 buoys, 1 storm surge stations, 6 oil drilling platform-based stations and 4 ship stations, and put into operational use by the end of 2010, which would greatly enhance the coastal ocean observing capability.
22. The Committee was informed that CMA started development of the next generation data broadcast system (CMACast) in 2010. CMACast is a multimedia dissemination system based on second-generation Digital Video Broadcast (DVB-S2) technology with both file and multimedia transmission capability. CMACast disseminate meteorological data to users, including global exchanged observations and products, CMA'S NWP products, as well as FY-2 and FY-3 satellite products, etc.
23. The Committee was informed that CMA established a super ensemble typhoon track prediction system including 139 members from CMA, European Centre for Medium-Range Weather Forecasts (ECMWF), National Centers for Environment Prediction (NCEP), Japan Meteorological Agency (JMA), Korea Meteorological Administration (KMA) and United

Kingdom (UK) Met Office from THORPEX Interactive Grand Global Ensemble (TIGGE) data. This system was put into operation in July 2010.

24. The Committee was informed that Guangzhou Institute of Tropical and Marine Meteorology of CMA improved its regional typhoon model, South China Sea Typhoon Model (SCS-TYM). Based on this SCS-TYM, CMA would like to setup a pilot project “South China Sea Typhoon Forecast” to enhance the collaboration among members and improve typhoon forecast capability.
25. The Committee was informed that CMA have been carried out some special field experiments for tropical cyclone Kompasu (1007) and tropical cyclone Fanapi (1011) by Sonic Anemometer/Thermometer, GPS, mobile wind profiler and AWSs real time data were provided consecutively to weather forecast centers.
26. The Committee was informed that the Tropical Cyclone Information Display and Processing System of Hong Kong China was enhanced with incorporation of the Observatory’s mesoscale non-hydrostatic model (meso-NHM), the ensemble mean track of China Meteorological Administration, UK Met Office and Korea Meteorological Administration, and the overlay of tropical cyclone strike probability information derived from the CMA Ensemble Prediction System (EPS), in addition to ECMWF EPS and JMA One-week EPS.
27. The Committee was informed that the new generation numerical weather prediction (NWP) system of the Hong Kong China has been put into operation since June 2010. The system, named as the Atmospheric Integrated Rapid cycle (AIR) forecast model, was developed with the kind support of JMA based on their Non-hydrostatic Model (NHM). It provides 72 hours and 15 hours of forecasts at horizontal resolution of 10 km and 2 km respectively. AIR forecast model shows improvement in the weather forecasts on both surface and upper levels.
28. The Committee noted that Hong Kong China enhanced its tropical cyclone track information webpage employing Google Map that could help the public to identify more easily the areas affected by tropical cyclones. The Observatory developed an iPhone application to provide individuals with a comprehensive and personalized weather service any time and anywhere. The Observatory also started experimenting with the use of social networking services for the dissemination of weather warnings and information.
29. The Committee was informed that RSMC Tokyo discontinued the dissemination of alphanumeric Satellite Report (SAREP) and Radar Observation (RADOB) via the Global Telecommunication System (GTS) at the end of 2010 according to the migration plan that was agreed at the 41st Session of the Committee. As an alternative, Regional Specialized Meteorological Center (RSMC) Tokyo will continue provision of the information on SAREP at the numerical typhoon prediction website for Members.
30. The Committee was pleased that RSMC Tokyo summarized the results of a questionnaire survey on the present status of Quantitative Precipitation Estimation (QPE)/ Quantitative Precipitation Forecast (QPF) techniques of Members by TCS in July 2010 and reported the results to Members. In addition, the RSMC Tokyo shared its QPE/QPF technique through some workshops in 2010.
31. The Committee expressed its gratitude to RSMC Tokyo, Japan, for its continued tropical cyclone advisory and warning services, as well as maintenance of the numerical typhoon prediction website, and implementation of the annual on-the-job training for typhoon forecasters. The activities of RSMC Tokyo in 2010 and implementation plan for the period of 2010 to 2014 are presented in Appendix VI.
32. The Committee was informed that the Typhoon Committee Operational Manual (TOM) rapporteur would consolidate the inputs on the adaptations/rules/conversion tables used in analysis of each TC forecasting center in the TOM according to the recommendations by the Best Track Consolidation Meeting. Inputs from RSMC Tokyo will be included in 3.1 or 3.2, and those from CMA and HKO will be in 3.3 as an appendix in a similar format to Appendix 3-B respectively. (Appendix VII)
33. The Committee noted that, on 1 July 2010, JMA switched over imaging satellite operations to the Multi-functional Transport Satellite-2 (MTSAT-2) from MTSAT-1R, which now operates as an in-orbit stand-by for MTSAT-2. The specifications of captured imagery and observation timetable remain same as MTSAT-1R.

34. The Committee noted an increase in accuracy of JMA's tropical cyclone forecasts was achieved by upgrading the typhoon bogus scheme used for initialization of tropical cyclones. In the new bogus scheme, bogus observations are assimilated only at the vicinity of centers of tropical cyclones, reflecting the recent sophistication of data assimilation including introduction of satellite data. Also, the Committee was informed that JMA introduced a new Singular Vector (SV) method used to make initial perturbations of the Typhoon Ensemble Prediction System in May 2010, which improve the reliability of the information.
35. The Committee was pleased that RSMC Tokyo announced the start of provision of storm surge distribution maps to Members at the numerical typhoon prediction website to assist their forecasting of storm surges from the typhoon season in 2011. RSMC Tokyo has developed the prototype of storm surge model suitable for Typhoon Committee (TC) region and is verifying the results of the model. RSMC Tokyo expressed its gratitude to seven TC Members for providing RSMC Tokyo with tidal and bathymetric data, which were used to develop the distribution map. RSMC Tokyo continues to request Members to provide tidal and bathymetric data for further development and verification of the distribution map as well as time-series charts of storm surges which are scheduled to be disseminated in 2012.
36. Following the recommendation of the Best Track Consolidation Meeting in Hong Kong, RSMC Tokyo announced its intention to investigate the difference in Current Intensity (CI) numbers among the warning centers after the exchange of historical best track datasets.
37. The Committee was informed that, RSMC Tokyo is designated as the Regional Centre for Tropical Cyclone Forecasting Support of the Severe Weather Forecasting Demonstration Project (SWFDP) in the WMO RA II region (Asia) to provide typhoon related products.
38. The Committee was pleased that JMA set up the website under the North-western Pacific Tropical Cyclone Ensemble Forecast Project (NWP-TCEFP) of WMO in May 2010. This website provides TC deterministic and ensemble forecast tracks as well as strike probabilities derived from several organizations' TIGGE CXML data¹. It also allows users to compare and verify the ensemble forecasts to improve their TC forecast skill.
39. The Committee noted that JMA has expanded the content of the RSMC Data Serving System (DSS) to include Table-driven Code Form (TDCF) surface and upper observational data since July 2010. It will continue to provide text-based alphanumeric code (TAC) and TDCF observational data in parallel until further notice.
40. The Committee was informed that Macao, China purchased a FY-2E receiving system to replace the existing FY-2C receiving system with an aim to better monitor strength and movement of typhoon.
41. The Committee noted with pleasure that major hardware and software improvements and upgrades were done to the existing conventional radar station network at the Malaysian Meteorological Department (MMD). Upgrades were done on all the existing conventional radar stations to convert them to Doppler radar stations. The Doppler radar stations together with an additional deployment of 108 automatic weather stations throughout the country enable a more accurate representation of positions and intensity of occurring heavy weather events.
42. The Committee noted that Philippines installed a new Automatic Aviation Weather Observation System and a wind profiler, 2 meteorological buoys, Doppler radars, and put new Radiosonde stations into operation.
43. The Committee was informed that a new hi-speed computer system for data integration and Numerical Modeling is installed in Philippines, and forecast and warnings dissemination was improved to issue the hourly tropical cyclone updates.
44. The Committee was informed that the KMA started to operate UK Met Office's Unified Model (UM, N312, 50 levels) for global and regional prediction in May 2010. At the same time, regional version of UM (12km, 38 levels) was also adopted for operations. The 4D-Var system with a 6-hour window is applied to the operation of global UM. As planned, GPS radio occultation (GPS-RO) and Special Sensor Microwave Imager/Sounder (SSM/I/S) were added to

¹ THORPEX Interactive Grand Global Ensemble (TIGGE) database in a unified format, known as Cyclone XML or CXML.

the data assimilation (DA) process at KMA. 5 types of satellite data including Advanced TIROS Operational Vertical Sounder (ATOVS), Infrared Atmospheric Sounding Interferometer (IASI) and Atmospheric Infrared Sounder (AIRS) data are used for direct assimilation. Atmospheric Motion Vector (AMV) and Scatterometer sea wind from Advanced Scatterometer (ASCAT) and European Remote Sensing Satellite (ERS) are used for DA at present.

45. The Committee was informed that KMA continued to improve typhoon initialization of global data assimilation and prediction system (GDAPS). The new typhoon initialization scheme is implemented into the GDPAS in December 2010, and is expected to improve the track forecasts of GDAPS in the typhoon season in 2011.
46. The Committee was informed that the KMA's Ensemble Prediction System has been updated with the Unified Model (UM) in December 2010. The method to generate initial perturbation is the Ensemble Transform Kalman Filter (ETKF), and physical perturbations, such as Random Parameter (RP) and the Stochastic Kinetic Energy Backscatter (SKEB) are added during model simulations. The UM-based Ensemble Prediction System products including typhoon track prediction data (Cyclonic XML) will be provided to TIGGE in the near future.
47. The Committee noted with pleasure that Republic of Korea's first geostationary satellite, Communication, Ocean, and Meteorological Satellite (COMS), was successfully launched from the Arianespace launch site in Kourou, French Guiana, at 21:41 UTC on 26 June. The KMA has also developed a system to produce satellite-based typhoon analysis reports. KMA will be willing to provide COMS data to TC Members that want to receive the COMS data from 2011.
48. The Committee was informed that the Republic of Korea has been conducting a three-year (2009-2012) project "Establishment of an Early Warning and Monitoring System for Disaster Mitigation in Metro Manila" under the sponsorship of the Korea International Cooperation Agency (KOICA), aiming at establishing a weather and flood forecasting model for an early warning and monitoring system at the Marikina-Pasig River basin, mitigating the impact of natural hazards through accurate analysis of real-time data collected from the early warning system, and strengthening the relationship between the Republic of Korea and the Philippines in the field of weather forecast and disaster management.
49. The Committee noted with pleasure that National Typhoon Center (NTC) of KMA tested the extension of typhoon forecast period from 3 days to 5 days in 2010. KMA plans to put it into operations in 2011.
50. The Committee was informed that KMA invited two typhoon experts from the Thai Meteorological Department (TMD) and the National Hydro-Meteorological Service (NHMS) of Viet Nam from September to November in 2010 to participate in a training course on typhoon forecasting and joint research.
51. The Committee was informed that KMA and CMA organized the third Joint Workshop on Tropical Cyclones in Jeju, Republic of Korea, on 20-23 December 2010. A total of 50 experts participated in this workshop and 18 papers were presented at the workshop on a wide range of topics such as typhoon-related forecasting technology, prediction in the upcoming year, modeling, and analysis of observations. The workshop reached a consensus on supporting the research and developing in the areas of numerical modeling, automatic weather station data, radar, satellite data, and typhoon best track data.
52. The Committee noted that Meteorological Service Division (MSD) of Singapore is currently in the process of implementing a comprehensive On-Line Weather Monitoring Network. The system, when completed, will consist of a total of 64 weather stations transmitting data in real-time back to a Central Processing System for processing and display. The data from the network is currently used to support operational forecasting, weather assessments (of heavy rain and strong wind events) as well as for the purpose of flood and other monitoring and research purposes.
53. The Committee was informed that MSD will also be installing a new 2.4m X/L-band satellite reception system to receive data from the NOAA and EOS Terra and Aqua satellites as well as the new FY3 and the NPOESS² Preparatory Project (NPP) of National Aeronautics and Space

² The National Polar-orbiting Operational Environmental Satellite System (NPOESS)
TC 43 FINAL REPORT

- Administration (NASA) and National Aeronautics and Space Administration (NOAA). The new system is planned to be commissioned in mid 2011.
54. The Committee noted with pleasure the improvements in the radar network in Thailand, three C-band Doppler Radars which started the installations in the South of Thailand in 2010. Totally, there are 25 weather radars in the Thai Meteorological Department (TMD)'s precipitation monitoring network.
55. The Committee was informed that the Indian Institute of Technology (IIT) Storm Surge Model was adopted in TMD's storm surge forecasting, with 1 km resolution bathymetry data interpolated from the ETOPO1³. The maximum storm surge height map along the coastal areas of the Gulf of Thailand for each tropical storm category/strength has been produced. However, TMD will also be appreciated to accept and introduce the RSMC-Tokyo Storm Surge Model into the TMD storm surge forecasting of the country.
56. The Committee noted that TMD makes effort to carry out the Meteorological Telecommunication Data Storing and Recording Project, which was started in 2009, and is expected to complete by the end of 2011. The completion of this project will also lead to the increase in potential of TMD to be the Regional Telecommunication Hub (RTH) Bangkok WMO Information System (WIS) portal in the South East Asia region.
57. The Committee was informed that 15 automatic rainfall stations in Ha Noi city were set up and operated from October 2010 in Viet Nam.
58. The Committee was informed that during tropical cyclone season in 2010, RSMC Honolulu began providing specific probabilities of development (10%, 20%, 30%, etc.) rather than a three categorical outlook.
59. The Committee was informed that WMO "The Observing System Research and Predictability Experiment" (THORPEX) Pacific Asian Regional Campaign (T-PARC) continued this past year with the TCS10/ITOP (Impact of Typhoons on the Ocean in the Pacific Ocean) field experiment that was held in the western North Pacific between 20 August and 20 October 2010.
60. The Committee was informed that the US is participating in the WMO RA-V (South-West Pacific) Severe Weather Forecasting Demonstration and Disaster risk reduction Project (SWFDDP) for the South Pacific Islands.
61. The Committee noted further activities of the Members which are listed out in the Appendix V (Annex I).

Conclusions of WGM:

62. On the basis of the information provided by Members and findings of the integrated workshop in Macao, China in September 2010 as well as Parallel Session of WGM, the following conclusions were reached:
- a. Members made important progress in the implementation of the TC Strategic Plan and Annual Operating Plan under Meteorological Component during the past year.
 - b. The assessment report on the impact of climate change on tropical cyclone frequency and intensity variation was completed and presented in TC 43rd Session. The second assessment report on track and impact is ongoing and its draft will be presented to TC 44th Session.
 - c. The recommendations of Best Track Consolidation Meeting should be followed up.
 - d. The improvements in storm surge forecasting skill and warning services for urban area provide a good foundation for the project on Urban Flood Risk Management in TC Region.
 - e. There is a need to facilitate Typhoon Information Processing System (TIPS) technology and knowledge transfer among Members.

³ ETOPO1 is a 1 arc-minute global relief model of Earth's surface that integrates land topography and ocean bathymetry
TC 43 FINAL REPORT

- f. The web-based typhoon forum is helpful as a real time communication platform for forecasters and researchers of the TC community.
- g. Exchange of radar data among Members is important for improving QPE and QPF capability.
- h. WGM supports China's implementation of a pilot project "South China Sea Typhoon Forecast", and invites all interested Members to participate to improve the cooperation among Members in developing tropical cyclone forecasting skills.
- i. It was agreed to publish an international journal "Tropical Cyclone Research and Review" with focus on tropical cyclone issues and topics, including operational forecast and scientific research, hydrological effects and disaster risk reduction.

Recommendations of WGM:

63. On the basis of the information provided by Members and the outcomes of the WGM parallel session and the "Integrated Workshop on Urban Flood Risk Management in a Changing Climate: Sustainable and Adaptation Challenges" that was held on 06-10 September 2010, in Macao, China, the following recommendations were proposed to the Session of the Committee:
- a. To continue the assessment process on tropical cyclone activity (track and scope) and climate change with recommended members including Ying Ming (Shanghai Typhoon Institute - STI/CMA) as the team leader, Tsz-Cheung LEE (HKO), Hirotaka KAMAHORI (Meteorological Research Institute-MRI/JMA), Tom KNUTSON (Geophysical Fluid Dynamics Laboratory-GFDL/NOAA), Chunho CHO (CRD/NIMR/KMA), with LEONG Weng Kun (Macao, China) as coordinator, and to confer the letter of appointment by Typhoon Committee after the 43rd Session.
 - b. To allocate US \$27,500 from TCTF to support the WGM activities in 2011.
 - c. To hold a workshop on storm surge in cooperation with WMO for Urban Flood Risk Management (UFRM).
 - d. To request RSMC Tokyo to conduct training on the storm surge model for UFRM during the annual TC attachment training, to produce storm surge distribution maps in 2011, to develop time-series charts of storm surges and report the evaluation in 44th session, and request Members to provide tidal and bathymetric data archive to RSMC Tokyo for verification of the time-series charts.
 - e. To further improve QPE/QPF techniques of TC Members and to request RSMC Tokyo to have QPE/QPF trainings during the annual TC attachment training and conduct an one day QPE/QPF workshop in conjunction with 6th Integrated Workshop (IWS) to be held in Viet Nam in 2011 with the participation of the three WGs, and to publish the QPE/QPF techniques in the RSMC Tokyo Technical Review.
 - f. To further develop the project TIPS considering its importance in promoting the exchange of experiences among Members and improving TC forecast technique of all the Members.
 - g. To upgrade the super-ensemble forecast system on tropical cyclone (NWP-TCEFP), including operational test, verification and evaluation. Members are encouraged to give their feedbacks to NWP-TCEFP.
 - h. To further improve the effectiveness of the on-line typhoon forum and to share additional real-time observation, forecast and warning information by Members using the forum.
 - i. To develop the regional radar network through establishment of composite maps project with the collaboration with radar experts.
 - j. To promote the application of achievements of the Typhoon Landfall Forecast Demonstration Project among Members, and upgrade the verification system by expanding the evaluating techniques.

- k. To establish the editorial committee and office to publish a science and technology journal (Tropical Cyclone Research and Review) for the Committee and request TCS to apply for an International Standard Serial Number (ISSN) for the Journal, for both print and online version.
- l. To organize a workshop in cooperation with WMO/DRR/ Public Weather Services (PWS) media on the theme of “Effective Warning”.
- m. To encourage the development of high resolution typhoon model for enhancing the forecast capability of gale and quantitative precipitation in Typhoon Committee region (especially in South China Sea).
- n. To strengthen the cooperation with WGH and WGD RR towards evaluation of tropical cyclone impact (including disaster and benefit) and risk management.
- o. To enhance the collaboration with TRCG towards the exchange and training of latest progress and techniques related to tropical cyclone research and operational forecast, as well as the effectiveness of typhoon operational warning system.
- p. To investigate methods to improve the timing of upgrading/downgrading of tropical cyclone intensity particularly upgrading the tropical depression and study improvement of real-time observations exchange between RSMC Tokyo and Members and submit a proposal to the 44th Session.
- q. To exchange historical best track datasets including CI numbers for inter-comparison.
- r. To implement a pilot project “South China Sea Typhoon Forecast” at initiation of CMA and encourage all interested Members to participate to improve the cooperation among Members in developing tropical cyclone forecasting skills.
- s. To appoint Mr. Masashi Kunitsugu (Japan) as the TOM Rapporteur.
- t. To request Mr. Masashi Kunitsugu (Japan) to consolidate the inputs of technical procedures for best-track analysis of the centers for inclusion in TOM.
- u. To re-appoint Mr. Lei Xiaotu (China) as Chair of WGM; to appoint Mr. Nathaniel Servando (Philippines) and Ms. Che Gayah ISMAIL (Malaysia) as Vice-Chairs of WGM.

(b) Hydrological Component (agenda item 5.2)

- 64. The Committee took note of the outcome of the parallel session of the WGH, which met on Monday afternoon, 17 January 2011 in Appendix VIII.
- 65. The Committee reviewed the activities of the Members related to the implementation of the TC Strategic Plan and its annual operating plan for the hydrological component during the past year. Details can be found in the Appendix IX.
- 66. The Committee was informed that WGH completed the project on On-the-Job Training (OJT) on Flood Forecasting for TC members in 2010 and remaining five projects will continue in 2011.
- 67. The Committee was informed on the progresses and future activities of the projects: (1) OJT on Flood Forecasting between TC Members led by Malaysia; (2) UFRM in TC region, led by China; (3) Assessment System of Flood Control Measures on Socio-economic Impacts, led by Republic of Korea; (4) Hazard Mapping for Sediment-related Disasters, led by Japan; (5) Establishment of Flood Disaster Preparedness Indices (FDPI), led by Japan; (6) Use of satellite-based information for reducing water-related disaster risks, driven by ESCAP.
- 68. The Committee was pleased to note the successful achievements of the OJT in Malaysia: four training courses were conducted by Department of Irrigation and Drainage (DID) of Malaysia since 2008 and total of 11 participants from China, Lao PDR, Philippines, Thailand, Viet Nam, respectively. The Committee expressed its great appreciation to Malaysian Government for the contribution to TC activities.

69. The Committee was pleased to note that AWG and UFRM Task Force (TF), as the coordination body, have been given substantial responsibility of managing the cross cutting project of UFRM since TC 42nd Session.
70. The Committee noted with pleasure that China compiled the report of good practice on UFRM with strong support and cooperation from the focal points of WGH, WGM and WGDRR in China, Japan and Republic of Korea.
71. The Committee noted with appreciation that the ICT and DRR Division of ESCAP gave strong support to UFRM in 2010: (1) organized the TC UFRM expert meeting; (2) contracted the project consultant to push forward this cross cutting project. The Committee also noted with pleasure that ESCAP expressed its willingness to explore the possibility to: (a) assess the consultancy report; (b) organize a meeting on UFRM pilot study in July or August 2011 and (c) continue to contact donors for resources mobilization.
72. The Committee was pleased to note that the UFRM TF Mission was implemented successfully and fruitfully in December 2010 in 3 pilot cities: HatYai, Thailand; Metro Manila, Philippines and Hanoi, Viet Nam. The Committee expressed its appreciation to Thailand, Philippines, Viet Nam and Ministry of Water Resources (MWR) of China for their strong support and cooperation.
73. The Committee noted that the training and cooperation are required by three pilot cities for UFRM pilot study in three main areas: QPE/QPF, flood forecasting using QPE/QPF and inundation mapping.
74. The Committee noted with appreciation that the ESCAP contracted the consultant of UFRM project Prof. Xiaotao Cheng, from China Institute of Water Resources and Hydropower Research (IWHR). He submitted the draft consultancy report as a preliminary guidance material of implementation of pilot study for discussion at the 43rd Session.
75. The Committee noted with appreciation that the MLTM together with the Korea Institute of Construction Technology (KICT) funded and convened a half-day seminar on the project “Assessment System of Flood Control Measures on Socio-economic Impacts” for WGH participants prior to the 43rd Session and MLTM/KICT will seek the possibility of linking this project with UFRM pilot study.
76. The Committee noted with appreciation that the National Institute for Land and Infrastructure Management (NILIM) and SABO Technical Center of Japan organized field-training course on hazard mapping of sediment-related disasters for Members in September 2010 with support from Macao, China; TCS and the Zhuhai Meteorological Bureau of China. It is also noted that NILIM and SABO Center decided to organize a training course on sediment disaster prediction and warning for Members in 2011.
77. The committee was informed that International Centre for Water Hazard and Risk Management (ICHARM) developed a questionnaire survey for FDPI and launched the web site at <http://www.fdpi.jp/fdpi/>. Members are encouraged to respond to the questionnaire.
78. The Committee noted with pleasure that the workshop on “Space Application to Reduce Water-related Disaster Risk in Asia (SARWDR)” was jointly organized by ESCAP and ICHARM in partnership with WMO and TC, and with support by the Japan Aerospace Exploration Agency (JAXA) and the Asian Development Bank (ADB) in December 2010.
79. The Committee noted with appreciation that ICHARM delivered its training on the Integrated Flood Analysis System (IFAS) at workshop of SARWDR for participants from Members.
80. The Committee was informed that the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) of Philippines will draft an implementation plan proposal for the project on Assessment of the Variability of Water Resources Impacted by Climate Change and launch this project officially in 2011.
81. The Committee noted with appreciation that MLTM together with KICT, the Ministry of Land, Infrastructure, Transport and Tourism of Japan (MLIT) together with the Infrastructure Development Institute – Japan (IDI) provided funding support to WGH participants to participate in the 5th TC integrated workshop. MLTM/KICT and MLIT/IDI will consider supporting the hydrologists of Members for participation of TC integrated workshop in future.

82. The Committee was pleased to note that the efforts were made to enhance cooperation between the two working groups on hydrology of WMO Regional Association II (RA II) and the Committee in past years. The Committee was informed that WGH of the Committee sent its representative to take part in the WMO RA II WGH Meeting in November 2010. Based on the proposal of TC representative, the RA II WGH identified the closest linkages of a) UFRM and flash flood/debris flow/landslide prediction/warning under the RA II theme of Disaster Mitigation – Implementation of the WMO Flood Forecasting Initiative including Flash Flood Forecasting Capabilities and b) assessment of the variability of water resources in a changing climate under the RA II theme of Water Resources Assessment, Availability and Use (surface water and ground water).
83. The Committee noted the achievements on the School Hydrological Information Network (SHINE) program and a community-based flood warning system in the Philippines, which may be shared with the Members.
84. The Committee noted with pleasure the cooperation on operational flood forecasting system between China and Thailand.
85. The Committee noted with pleasure that WGH is actively involved in the WMO-organized workshops on QPE/QPF and tropical cyclone in 2010 with funding support from WMO. The Committee also noted the importance of the cooperation between hydrology and meteorology.
86. The Committee was informed that the WGH Chairperson Mr. Toshio OKAZUMI and vice Chairperson Dr. HONG Il-Pyo will retire from their positions. The Committee noted with appreciation their great contribution and constructive work to WGH activities and to commitment to continually support TC activities, particularly WGH at their new positions.

Conclusions of WGH:

87. On the basis of the information provided by Members and findings of the integrated workshop in Macao, China in September 2010 as well as Parallel Session of WGH, the following conclusions were reached:
 - a. The collaboration of 3 working groups, AWG and TF and close linkage with WMO and ESCAP are vital to the success of the project UFRM.
 - b. The training and cooperation on QPE/QPF, hydrological/hydraulic modeling and inundation mapping are important for the UFRM.
 - c. The UFRM should be extended one or more years considering that the project is very important and has many different tasks to complete even though substantial progress has been achieved in past years.
 - d. The close collaboration with the WMO RA II Working Group on Hydrological Forecasts and Assessments and RA V Working Group on Hydrological Services in several themes of common interest provides significant benefits to the Committee.

Recommendations of WGH:

88. On the basis of the information provided by Members and the outcomes of the WGH parallel session and integrated workshop in Macao in September 2010, the WGH made the following recommendations:
 - a. To appoint Mr. Minoru KAMOTO, Japan as WGH Chair, and appoint Dr. Yang-Soo KIM, Republic of Korea and to re-appoint Mr. LIU Zhiyu, China as Vice Chairs of WGH, respectively.
 - b. To allocate US\$26,000 from TCTF in total for supporting overall WGH activities for 2011 calendar year.
 - c. To assign to TF Members the responsibility of providing expertise guidance and advice to UFRM implementation: the Chair of WGM Mr. Xiaotu LEI and Director of RSMC Mr. Masashi KUNITSU to take care of meteorological aspect; Chair and Vice-Chairs of

WGH Mr. Minoru KAMOTO, Dr. Zhiyu LIU and Dr. Yang-soo KIM to take care of hydrological aspect; Chair and representatives of WGDRR, Dr. Sang Man JEONG, Dr. Tae Sung CHEONG and Ms. Hilda LAM to take care of DRR aspect; and to request WGM, WGH and WGDRR to consider how to combine their activities with and contribute to the TC cross-cutting project of UFRM.

- d. To call on Members to provide training and expertise on QPE/QPF, hydrological/hydraulic modeling and inundation mapping for UFRM pilot project as in-kind contribution.
- e. To request TF through TCS to issue invitation letters to the Members to provide the experts for training and assistance for UFRM pilot project.
- f. To request the Members of Pilot Cities to explore mobilization the self-funding support for the pilot studies.
- g. To request TCS to include a request for Kuala Lumpur to be one of pilot cities in the UFRM project in the letter of appreciation regarding OJT to the Director General of the DID Malaysia.
- h. To request strong collaboration of 3 working groups, AWG and TF and close linkage with WMO and ESCAP to push forward the project UFRM.
- i. To request the ICT and DRR Division of ESCAP to fund and organize a meeting in July or August 2011 to review the consultancy, to discuss the implementation of pilot study and the preparation of the final guidelines of the UFRM project.
- j. To set up the channel to link the TC cross-cutting project of UFRM with the agencies of City-Net and ISDR.
- k. To request ESCAP Secretariat to consider developing simplified awareness and capacity-building materials and handbooks suitable for decision makers and non-scientists on the possibilities offered by satellite applications for disaster risk reduction and damage assessment, as well as simplified technical materials for technical staff in developing countries.
- l. To request ICHARM to consider conducting training course for interested Members on IFAS.
- m. To appoint the hydrologist of TCS Mr. Jinping LIU as the liaison of WMO RA II and RA V WGHs for the Committee.

(c) Disaster Risk Reduction Component (agenda item 5.3)

89. The Committee took note of the report of the Parallel Session of the WGDRR, details of which are presented in Appendix X. In the report Macao, China; USA; Hong Kong, China; China; ADRC (Asia Disaster Reduction Center); Philippines and Japan presented their efforts on DRR.
90. The Committee reviewed the activities of the TC Members, UNESCAP, WMO and other collaborating organizations, during the past year, details of which are presented in Appendix XI. Activities within the DRR component among the Members included the following:
 - a. Progress on WEB-GIS based Typhoon Committee Disaster Information System (WGTCDIS) project.
 - b. The 5th WGDRR Workshop in Incheon, Republic of Korea during 25-26 October 2010.
 - c. Integrated Workshop during 6-10 September 2010 in Macao, China.
 - d. Publication of the report on Flash Flood Forecasting System.
91. The Committee was informed that twenty-three representatives from Members and international organizations attended the 5th WGDRR Workshop that was held in Incheon during 25-26 October 2010. During the meeting, the group agreed to provide inputs to the WEB-GIS based

TCDIS (WGTCDIS) by early February 2011. The participants also discussed vision and future activities of WGTCDIS.

92. The Committee noted the need to have closer interaction among WGM, WGH, and WGDRR Members to collect disaster information needed to extend WGTCDIS and to calibrate and validate WGTCDIS effectively.
93. The Committee was informed of some ongoing initiatives of WMO for the development and implementation of early warning system projects in collaboration with UN and international partners, such as United Nations Development Programme (UNDP), International Federation of Red Cross and Red Crescent Societies (IFRC), International Strategy for Disaster Reduction (ISDR) and World Bank.
94. The Committee noted that progress was made in the project on warning dissemination. Hong Kong, China implemented the function to disseminate warnings through the Severe Weather Information Center (SWIC) which was named SWidget (<http://severe.worldweather.org/swidget/swidget.html>) and launched in 2010 with warnings from Hong Kong, China; Macao, China; Guam, USA; Republic of Korea and Singapore.
95. The Committee was informed that the current WGDRR Chair, Mr. Waon-Ho YI will retire from his position. The Committee noted with appreciation his great contribution and constructive work to WGDRR activities.

Conclusions of WGDRR:

96. On the basis of the information provided by the Members and findings of the parallel session on WGDRR, the following conclusions were reached:
 - a. The WGDRR recognized the importance of the outcomes of the Integrated Workshop on urban flood risk management considering climate change, as the basis for future activities on WGTCDIS.
 - b. The future activities of WGDRR should include joint activities with WGM and WGH and economic impacts assessment considering climate change.
 - c. The expert mission to 6 TC Members namely Lao PDR; Thailand; Philippines; Cambodia; USA and Japan will be conducted in 2011 to introduce WGTCDIS and provide training on the operation of WGTCDIS.
 - d. The 6th WGDRR Workshop will be held in Seoul, Republic of Korea on May 2011.
 - e. NIDP will establish database for disaster information and hardware to continue the maintenance for WGTCDIS in 2011.
 - f. Hong Kong, China had made preparation for the installation of a station for the Pilot project of Community Weather Stations in 2010 and WGDRR will continue to identify an appropriate site and local recipient organization in an interested Member to take the project forward in 2011.
 - g. After reviewing the video on the community weather station project prepared by Hong Kong, China, the WGDRR considered YouTube video as a useful means to promote public weather and climate awareness.

Recommendations of WGDRR:

97. On the basis of the information provided by the Members and deliberations, the WGDRR made the following recommendations:
 - a. To appoint Dr. Sangman JEONG from the National Institute for Disaster Prevention; the National Emergency Management Agency of the Republic of Korea and Dr. Hilda LAM from Hong Kong Observatory, Hong Kong, China as Chair and Vice Chair of the WGDRR respectively.

- b. To allocate US\$ 23,000 budget of TCTF in 2011 for supporting WGDRR activities including supporting community based weather station pilot project, three TC Members to collect typhoon disaster information to extend the WGTCDIS and participation in next TC Integrated Workshop.
- c. To enhance the ongoing project on WGTCDIS to serve as a portal site for sharing disaster risk reduction technologies and information among TC Members.
- d. To extend WGTCDIS for Multi-Hazard Early Warning Systems in conjunction with other WGs and to promote its linkage with systems in other WGs.
- e. To send two expert missions on the WGTCDIS to 6 TC Members namely Lao PDR; Thailand; Philippines; Cambodia; USA and Japan in 2011.
- f. To support the publications of typhoon brochure of TC Members and the organization of public education events to raise public awareness on DRR jointly with WMO DRR and PWS Programs and UN/ISDR, as well as WGM and WGH, and consider if these would need to be added during the expert mission.
- g. To organize the 6th WGDRR Workshop in Republic of Korea during May 2011.
- h. To extend the project on the real-time transmission of severe weather warnings using SWidget in SWIC to a couple of interested Members in 2011.
- i. To set up automatic weather stations for the community based weather station projects in 2 interested Members.
- j. To request the Committee to endorse further collaboration with WMO through participation of the Chair of WGDRR in activities of WMO RA II and RA V working groups related to DRR.
- k. To strengthen regional cooperation of NMHSs with the disaster risk management agencies from national to local levels in multi-hazard warning systems.

(d) Training and Research Coordination Group (agenda item 5.4)

- 98. The Committee took note of the report given in Appendix XII prepared by the Chair of Training and Research Coordination Group (TRCG).
- 99. The Committee expressed its appreciation to TMD for hosting the Roving Seminar in Ubon Ratachani, Thailand in November 2010. The Committee also appreciated the support provided by the three resource persons for the Roving Seminar from Hong Kong Observatory, Peking University and University of Guam.
- 100. The Committee thanked China; Hong Kong, China and Republic of Korea for hosting research fellowship programmes in 2010.
- 101. The Committee took note of the successful training attachment of forecasters from Hong Kong, China and Singapore to RSMC Tokyo in July 2010, and thanked JMA and WMO TCP for continuously supporting this capacity-building initiative.

CONCLUSIONS of TRCG:

- 102. The 4-year work plan formulated in the 1st TRCG Planning Meeting in 2009 continued to provide a sound basis for implementing training and research activities of TC.
- 103. There is a need to continue to work closely with other working groups when implementing the research and training initiatives in the 4-year work plan 2010-2013.

RECOMMENDATIONS of TRCG:

- 104. On the basis of the conclusions reached by the deliberation of Members, the Committee made the following recommendations:

- a. To re-establish TRCG with the re-appointment of Mr. Edwin S.T. LAI (Hong Kong, China) and the appointment of Mr. Roger EDSON (USA) as Chair and Vice Chair of TRCG, respectively.
- b. To request Members to confirm their respective focal points as members of TRCG and the inclusion of the list of focal points from WGH and WGD RR for further follow-up on TRCG issues, and to update the list of resource persons as appropriate.
- c. To request TRCG to seek inputs from WGM, WGH and WGD RR and others on planned training and research activities within the Region and provide a consolidated list to all Members.
- d. To encourage Members to support participation of TRCG members in TRCG-related meetings/activities as far as possible so that good continuity in TRCG work can be maintained.
- e. To request Members to offer or take part in research fellowship programs on the themes including TIPS, EPS, QPE/QPF and consensus forecasts.
- f. To endorse the proposed TRCG AOP for 2011, including the organization of a roving seminar under the support of Typhoon Committee Trust Fund, with Malaysia offering to host the seminar in 2011.
- g. To request TRCG to review and evaluate TRCG activities on Research Fellowship Scheme and Roving Seminars in previous years and incorporate the outcome of the review in future plans.

(e) Activities of AWG (agenda item 5.5)

105. Reported in Agenda item 8.

(f) Activities of Resource Mobilization Group (agenda item 5.6)

106. The Committee was informed there were no activities associated with the RMG in 2010.
107. The Committee recommended the activities on resource mobilization be highlighted in future TCS reports.

(g) Activities of Typhoon Committee Secretariat (agenda item 5.7)

108. The Committee took note of the report given in Appendix XIII prepared by the Secretary of the Typhoon Committee and the proposal of Macao, China for the reappointment of the Secretary of TC, presented in Appendix XIV.
109. The Committee thanked the Government of Macao, China for its continued support to provide headquarters and endowment fund for TCS operation and for the revision of the agreement between Macao, China and the TC regarding administrative and financial aspects. It is noted that this revision was signed by TC Chair and the representative of the Government of Macao, China.
110. The Committee expressed its appreciation to Government of Macao, China for the secondment of a meteorologist, Mr. LEONG Kai Hong, Derek and its offer to continue that secondment until the end of the second four-year period that the TCS will remain in Macao, China.
111. The Committee expressed its appreciation to the Government of China for the secondment of a hydrologist, Mr. Jinping LIU to TCS for a second four-year period.
112. The Committee appreciated the excellent efforts of TCS in support of the activities of the Committee.
113. The Committee expressed appreciation for the kind offer from the Philippines Typhoon Committee Foundation Inc., of providing financial support for Dr. Roman L. Kintanar Award in 2010 and beyond.

114. The Committee thanked the Macao Foundation for the financial support to the activities of TC namely to the Field Training Hazard Mapping of Sediment-related Disaster and to the Integrated Workshop on Urban Flood Risk Management in a Changing Climate: Sustainable and Adaptation Challenges, which were held in Zhuhai and Macao, China.
115. The Committee thanked the Government of Macao, China for hosting the ESCAP/WMO Typhoon Committee Integrated Workshop on 6-10 September 2010. The Workshop provided the opportunity to review the progress of the various activities endorsed by the Committee at its 42nd Session.

VI. REVIEW OF THE 2010 TYPHOON SEASON AND PUBLICATIONS (agenda item 6)

116. The Committee noted that in the western North Pacific, 14 named tropical cyclones (TCs) formed in 2010, seven of which reached typhoon (TY) intensity. The total is the least since 1951, breaking the previous record of 16 in 1998.
117. After the formation of Omais (1001) in March, tropical cyclones activities were generally weak through the year. No named TCs formed from April to June. This is the fourth time since 1951 with 1973, 1975 and 1998. From November to December, no named TCs formed. This is the first time since 1951.
118. Only five named TCs formed south of 20°N and east of 120°E which is less than the 30-year average of 16.1, because of the weak convective activity in eastern tropical areas. The mean latitude and longitude of genesis position in 2010 was 18.9°N and 127.1°E, showing significant deviation to the west from that of 30-year average (16.2°N and 136.9°E).
119. In July, two named TCs formed around the Philippines and moved westward in the South China Sea. Conson (1002) caused damage in China, the Philippines and Viet Nam.
120. Out of the nine named TCs formed from August to September, eight formed west of longitude 135 degrees east excluding Malakas (1012). Dianmu (1004), Kompas (1007) and Malou (1009) formed south of Okinawa and moved northward in the East China Sea. Among them, Kompas caused damage in the Korean Peninsula. Mindulle (1005) formed in the South China Sea and then moved westward causing damage to Viet Nam. Fanapi (1011) formed south of Okinawa and then moved westward causing damage in China.
121. In October, two named TCs formed east of the Philippines. Megi (1013) developed intensively attaining a central pressure of less than 900 hPa. After hitting the Philippines, it turned northward in the South China Sea causing damage in China.
122. The Committee took note with appreciation the review of the 2010 typhoon season provided by the RSMC Tokyo-Typhoon Center as given in Appendix XV.

Publications

123. The Committee took note that the TCS published the 22nd issue of the Typhoon Committee Newsletter in January 2010 and the 2009 Typhoon Committee Annual Review (TCAR) in January 2010 and disseminated them to the Members, ESCAP and WMO in electronic (CD-ROM) format.
124. The Committee noted with appreciation that the RSMC Tokyo – Typhoon Center published the “Technical Review No.12” in March 2010 and the “Annual Report on the Activities of the RSMC Tokyo – Typhoon Center in 2009” in December 2010. These are available on the Web page of JMA/RSMC Tokyo at <http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/annualreport.html>.
125. The Committee took note on the coordination by TCS of two publications under the series of technical publications of TC, “Assessment Report on Tropical Cyclones Frequency and Intensity in the TC Region” (TC/TD 0001) and the WGD RR publication “Report on Mountainous Flash Flood Forecast System Manual” (TC/TD 0002).

VII. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item 7)

126. The Committee was informed by the WMO Secretariat of the basic principles of the Tropical Cyclone Programme (TCP) in the implementation of the Programme's activities as follows;
- a. To enhance support measures for TC forecasters; e.g., update of the "Global Guide to Tropical Cyclone Forecasting" and its linkage to the "Tropical Cyclone Forecaster's website".
 - b. To transfer R&D results into operational forecasting through promoting the collaboration between operational forecasters and researchers.
 - c. To establish Storm Surge Watch Schemes (SSWSs) and strengthen the storm-surge warning capabilities of National Meteorological and Hydrological Services (NMHSs).
 - d. To continue to put high priority on capacity building.
127. The Committee noted with pleasure that, in the implementation of the global SSWS, Japan's plan to contribute to SSWS through production and dissemination of the storm-surge distribution map in 2011 and the time-series chart in 2012 in the Typhoon Committee region. In that regard, the Committee welcomed the TCP's plan to organize a storm surge workshop for the Committee Members in October 2011 in Macao, China.
128. The Committee was informed that the various international forums were organized by TCP in cooperation with the World Weather Watch Programme (WWRP) of WMO such as the Second International Workshop on Typhoon Landfall Processes (IWTCLP-II; Oct 2009, Shanghai, China), the Third International Conference on QPE/QPF & Hydrology (Oct 2010, Nanjing, China) and the Seventh International Workshop on Tropical Cyclones (IWTC-VII; Nov 2010, La Reunion). These forums promoted interaction between forecasters and researchers and thus contributed significantly to the application of research achievements to operational forecasting.
129. Typhoon Landfall Forecast Demonstration Project (TLFDP) and the NW Pacific Tropical Cyclones Ensemble Forecast Project (NW-P/TCEFP) are the tangible outcomes of IWTCLP-II, which were launched jointly by TCP and WWRP in 2009 targeting at the Members of the Typhoon Committee. The Committee was pleased to note that the both projects had been implemented successfully. TLFDP developed the systems for real-time verification and monitoring/display of forecast products and will open a project website for the Committee Members. NW-P/TCEFP has recently improved its project website which was established at JMA/MRI in the middle of 2010. The Committee was informed that TCP would conduct a survey of the project for further improvement of the website and examination of the utility of the ensemble forecast products envisaging the implementation into operations of the TCEFP in the future. To that effect, the Committee emphasized the necessity of further strengthening the linkage between those projects and the Committee's activities.
130. The Committee noted that update of the Global Guide to Tropical Cyclone Forecasting will be completed by the middle of 2011. It will provide comprehensive guidance on tropical cyclone forecasting from a multi-hazard point of view. The new Guide will be web-based with a view to timely update and easier access. In addition, the WMO Tropical Cyclone Forecaster Website has been developed to provide a readily accessible source of forecast tools and analytical data necessary for operational forecasting. These two information sources will be linked with the TCP Website to serve as a comprehensive source of information/material/data that is expected to be of great value to operational forecasters. The Committee requested WMO/TCP to make readily available the various materials used in the training courses and workshops organized by TCP and other tropical cyclone bodies at those web sites.
131. The Committee noted with satisfaction that the study on suitable conversion factors between the wind speeds of different time ranges was completed and its outcome was distributed as a WMO Technical Document (WMO/TD-No.1555) to the Committee Members in October 2010. The TOM rapporteur proposed to include a summary of the study in the 2011 version of TOM as a guideline for the conversion of wind speeds.
132. The Committee was informed that development of WMO Severe Weather Forecasting Demonstration Project (SWFDP) in Southeast Asia is in progress for improving severe weather forecasting and warning services in developing countries in this region including Cambodia, Lao PDR, Thailand and Viet Nam. SWFDP also aims to improve lead-time of warnings and interaction of NMHSs with users. The Committee took particular note that in the project, CMA,

JMA and KMA serve as global centers to provide numerical weather prediction products, NHMS of Viet Nam as regional forecast support center to provide regional forecast guidance, RSMC Tokyo as regional center for typhoon forecast support and HKO as regional center for training and technical support.

133. The Committee was pleased to note that Dr LIU Jinping of TCS represented the Committee in the meeting of the WMO/RA II Working Group of Hydrology which was held in Seoul, Republic of Korea from 23 to 26 November 2010. The meeting identified possible joint activities between the WGHs of the Committee and WMO/RA II including for the management of urban floods and flash floods.
134. Prof R. Elsberry presented a summary and selected recommendations from IWTC-VII. He commended the Typhoon Committee for their existing activities in meteorology, hydrology, and disaster risk reduction that are contained in the IWTC-VII recommendations. He proposed that the Committee Members take a leading role in addressing recommendations to enhance capability in tropical cyclone-related QPE/QPF, and to contribute to the development over the next four years of a capacity for intra-seasonal (10-30 day) forecasts of tropical cyclone activity.
135. Prof R. Elsberry presented a summary of the tropical cyclone-related presentations at the Third WMO International Conference on QPE/QPF and Hydrology and suggested the Members interested in QPE/QPF consider the conference presentations on meso-scale, radar data assimilation, numerical modeling, and new object-based verification techniques that may be helpful.
136. Hong Kong, China informed the Committee about a recent cooperation between Google and WMO to increase the public's awareness of active tropical cyclones around the world under the Google Onebox and Google Earth projects. Specifically, whenever a Google user searches for tropical cyclone information, the Google Onebox/Earth will provide concise information from WMO's Severe Weather Information Centre (SWIC) at the top of the search results. However, due to a lack of standardized format of the TC advisory messages issued by the RSMCs and TCWCs, Google instead proposed a format for WMO to follow. Hong Kong, China also emphasized that standardization of the TC advisory messages from RSMC/TCWC should be pursued by WMO with priority, in response to the evolving need of the public for authoritative weather information and warnings.
137. In this connection, WMO Secretariat expressed the promotion of harmonization and standardization in forecasting procedures and warning services on a global basis is increasingly important and thus requires necessary actions of TCP to be addressed. In that context, TCP plans to present this issue to the TC RSMCs/TCWCs Technical Coordination Meeting to be held in 2012 as a high-priority agenda.

VIII. PROGRAMME FOR 2011 AND BEYOND (agenda item 8)

138. The Committee noted with pleasure the attendance and participation of the representative of Indonesia and encouraged continuing participation as well as membership in the Committee.
139. The Committee noted requests from the Members to replace the tropical cyclone names FANAPI.
140. The Committee requested the AWG to:
 - a. Review the format and content of the future AOP and to submit an integrated proposal to the 44th Session.
 - b. Coordinate with Members, Working Groups and Secretariats to review the purpose and format of the written and oral Member Reports and make necessary recommendation to the 44th Session.
 - c. Coordinate with Members, TRCG, Working Groups and Secretariats to review, investigate, and implement methods and procedures to evaluate the effectiveness of training and workshops and present findings and recommendations at 44th Session.
 - d. Review and evaluate the operations and activities of the Typhoon Committee for enhanced efficiency and effectiveness and report back to 44th Session with recommendations and proposals taking into account the needs of Members.

- e. Explore the specification of in-kind contribution for each TC Trust Fund project and report findings to the 44th Session to encourage external fund raising.
 - f. In consultation with TCS, study the possibility the discontinuation of the TCAR and change the newsletter to be published twice a year and report to the 44th Session.
 - g. Provide the topic of the Integrated Workshop in 2011, no later than March, for Members to consider.
 - h. Harmonize the expenditures documented by WMO and TCS and incorporate into the documents presented by AWG.
 - i. To review the organization of the Session Meeting including the consideration of setting out one day for technical portion of the Session.
141. The Committee requested TCS to:
- a. Coordinate the provision of documents on TC Website for future Sessions 1 month before.
 - b. Provide the official basic documents of the Committee on TC Website, including the Strategic Plan, Session Reports and rules and procedures in an easy identifiable way.

Advisory Working Group (AWG)

142. The Committee was informed of the activities of the AWG in 2010. (Appendix XVI).
143. The Committee noted with satisfaction the status of the 2010 AOP. The final results for WGM: WGM 8 Objectives, 14 Success Indicators, 12 Success Indicators met (meeting and workshop not held); WGH 6 Objectives, 23 Success Indicators. 14 Success Indicators met (9 in 3 areas started); WGDRR 8 Objectives, 9 Success Indicators, 8 Success Indicators met (sending expert team); TRCG 3 Objectives, 3 Success Indicators, 3 Success Indicators met.
144. The Committee was informed that the AWG reviewed the 2010 AOP and prepared the proposed 2011 AOP, 2011 Budget and initial ideas for an updated Strategic Plan. The AWG effectively used the time available at the 5th IWS and thus didn't require the "Small Meeting" usually held in December in Macao, China.
145. The Committee noted with pleasure the progress of the AWG in the coordination with all of the TC Members and expressed its appreciation to the AWG for its excellent efforts and activities contained in the "Report of the Advisory Working Group Activities During 2010".
146. The Committee noted important continued progress since the introduction of the strategic planning and management approach to the regional cooperation program of the Committee and the instrumental role of the AWG, ESCAP, WMO, and TCS in the establishment of a firm foundation for goal-oriented performance. In this context, it is important that the Committee continues to benefit from the assistance and support of the ESCAP and WMO as well as the enhanced roles of the TCS.
147. The Committee was informed of the status of the 2010 Typhoon Committee Annual Operating Plan (AOP), the proposed AOP for 2011, and the budget for 2011 (Appendix XVII To XIX). AWG and TCS provided additional clarification on the 2011 AOP and the 2011 Budget for the Committee's consideration, upon requests by Members.
148. In respect of development of draft 2011-2015 Strategic Plan presented by the AWG, after Committee discussion it was decided that the current plan (2007-2011) will continue to be effective until the approval at the 44th Session of an updated 2012-2016 Strategic Plan with additional Associated Activities and increased focus.
149. The Committee discussed the date for 2011 Integrated Workshop because the TC Sessions are now held in January rather than November as previously and September can still be an active tropical cyclone period. The Committee decided to hold the Integrated Workshop in November 2011 and expressed its appreciation the kind offer from Viet Nam to host the Integrated Workshop. (Appendix XXI)

150. The Committee expressed its sincere appreciation to the AWG Chair, AWG Vice-Chair, and AWG members for their work in formulating and coordinating the 2011 annual operating plan and the 2011 budget.
151. The Committee expressed sincere appreciation to Mr. James Weyman AWG Vice-Chair, for his significant contribution to the development of the Committee activities, in particular for his key role played in the development of the Strategic Plan and enhancing the effectiveness and efficiency of the Committee in the past 11 years.

Recommendations of the AWG

152. The AWG proposed the following recommendations to the Committee:
 - a. To approve the objectives and success indicators contained in the 2011 AOP.
 - b. To approve the proposed 2011 budget of US\$120,000 with \$14,000 USD carry over funds from 2010 in Appendix XIX.
 - c. To approve the proposed changes to the Dr Roman L Kintanar Award selection procedures presented by the AWG in Appendix XXII.
 - d. To request the senior representative of the Singapore Meteorological Agency to fill the role as chair of the AWG with the retirement of Singapore Director General.
 - e. To endorse the action of the 40th Session to appoint Ms Genevieve Miller, currently Secretary of AWG, as the new Vice Chair of the AWG as Mr James Weyman leaves the position.

IX. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (agenda item 9)

(a) Technical Cooperation

153. The Committee was informed of the technical cooperation activities of WMO and ESCAP in support of the programmes of the Typhoon Committee carried out in 2010, including the WMO Voluntary Cooperation Programme (VCP), Emergency Assistance Fund scheme and Technical Cooperation among Developing Countries (TCDC) activities, and expressed its appreciation to WMO, ESCAP and collaborating partners for providing assistance to Members of the Typhoon Committee.
154. The Committee noted that, under a WB/ISDR/WMO regional disaster risk management and adaptation programme, assessment of the capacities, gaps and needs of NMHSs and evaluation of requirements of disaster risk management agencies and stakeholders has been completed for countries in Southeast Asia including Cambodia, Lao People's Democratic Republic, Philippines and Viet Nam. The finalization of the assessment reports and organization of a regional meeting with partners and stakeholders are planned in 2011.
155. It also noted that, in 2010, China; Japan; and the Republic of Korea continued to provide cash contributions to the VCP(F), and China; Hong Kong, China; Japan; the Republic of Korea; and the USA provided equipment, expert services and fellowships. The VCP(F) support was provided to support the requests for expert services for Cambodia and DPRK. In view of the VCP potential in support of activities of the Typhoon Committee, the Committee encouraged Members to further actively participate in the VCP activities. The Committee was also informed that bilateral assistance was provided by Japan to Lao PDR to improve meteorological services and by China for the upgrade of FengYunCast receiving systems for 14 countries including six Members of the Committee. The Committee noted that CMACast, the new generation of satellite based data broadcasting system is under construction and China will provide free update service for users of the FengYunCast System in the Committee.
156. Within the framework of the TCDC, China organized the International Training Seminar on South-South Cooperation on Weather and Climate in November 2010 in Nanjing Regional Training Centre. Seven members (Cambodia, China, Japan, Lao PDR, Malaysia, Republic of Korea and Thailand) of the Committee participated in the Training Seminar. The 2010 China

Study Tour was carried out in May 2010 in conjunction with the opening of the MeteoWorld Pavilion in Shanghai Expo 2010.

157. The Committee further noted the recent emergency assistance provided under the Emergency Assistance Fund scheme to WMO Members affected by natural disasters, including Lao PDR for the restoration of damaged meteorological instruments and equipment at synoptic stations following TY Ketsana was ongoing with the support of China. Affected TC Members who need emergency assistance were advised to utilize this scheme, and all Members were requested to consider possible support to the affected Members. With reference to the key findings and recommendations of the WMO fact-finding and needs-assessment mission to Pakistan **carried out in collaboration with ESCAP** following the 2010 floods, the TC Members were invited to give consideration of possible support, as appropriate, in particular for short-term requirements of the Pakistan Meteorological Department (PMD). In this connection, the delegate from Hong Kong, China informed the Committee that in response to a request from PMD, forecast products were recently launched for 20 Pakistani cities under the WMO RA II Pilot Project on the Provision of City-Specific NWP Products. Training material on data post-processing was provided to facilitate PMD's development of forecast guidance. Training course for participating members including Pakistan would be provided at an opportune time.

(b) Typhoon Committee Trust Fund (TCTF)

158. The Committee was informed that the TCS concluded the Memorandum of Understanding (MoU) between WMO and TCS referring to TCTF arrangement and WMO provided legal review, as requested by decision of the Committee in paragraph 1.g of the 42nd Report. (Appendix XXIII, Annex I)
159. The Committee reviewed the statement of account of TCTF for the period of 1 January to 31 December 2009 and the provisional statement for 1 January to 31 December 2010 submitted by the representative of the WMO Secretariat as shown in Appendix XXIII.
160. The Committee was informed that some Members contributions were not included in the provisional statement for 2010, owing to the complex accounting procedures.

X. DATE AND PLACE OF THE FORTY-FOURTH SESSION (agenda item 10)

161. The Committee noted that TCS will send Circular Letter to Members to invite proposals on the possible dates and host for the Forty Fourth Session in 2012. The dates and the host will be coordinated through the TCS and announced by March 2011.

XI. SCIENTIFIC LECTURES (agenda item 11)

162. The scientific lectures were presented as shown in Appendix XXIV. The Committee expressed its appreciation to all the lecturers and requested the TCS to disseminate all the lecture papers/PowerPoint presentation and to include them in the Typhoon Committee Annual Review for 2010.

XII. ADOPTION OF THE REPORT (agenda item 12)

163. The Committee adopted the report of the session at 10:10 am 22 January 2011.

XIII. CLOSURE OF THE SESSION

164. The delegates from the Members of the Typhoon Committee, representatives of ESCAP, WMO and TCS and observers expressed their thanks and appreciation to the Korea Meteorological Administration of Republic of Korea for the successful hosting of the Forty Third session of the Typhoon Committee. They also expressed gratitude to Dr. Byung-Seong CHUN, Administrator of KMA and his staff for the warm hospitality and excellent arrangements made and also for organizing a tour through the beautiful sites of Jeju Island, Republic of Korea.
165. The Session was closed by the Chairman at 10:33 am, 22 January 2011.