



# 50<sup>th</sup> ESCAP/WMO TYPHOON COMMITTEE Session Report

Ha Noi • Viet Nam  
29 February - 03 March 2018



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**Fiftieth Session of Typhoon Committee**

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**REPORT OF THE FIFTIETH SESSION  
OF TYPHOON COMMITTEE**

**Ha Noi, Viet Nam  
28 February – 03 March 2018**

**PART I – DECISIONS OF THE COMMITTEE**

1. The Committee decided to:
  - a. Approve the recommendations submitted by Credential Committee as provided in the **Appendix IV**.
  - b. Approve the Typhoon Committee Operational Manual (TOM) with the amendments provided in the **Appendix XV**.
  - c. Approve the recommendations submitted by Working Group on Meteorology (WGM) as expressed in **paragraph 63**.
  - d. Approve the recommendations submitted by Working Group on Hydrology (WGH) as expressed in **paragraph 79**.
  - e. Approve the recommendations submitted by Working Group on Disaster Risk Reduction (WGDRR) as expressed in **paragraph 90**.
  - f. Approve the recommendations submitted by Training and Research Coordination Group (TRCG) as expressed in **paragraph 97**.
  - g. Approve the recommendations submitted by Typhoon Committee Secretariat (TCS) and also the general principles associated with public communication issues for TCS and TCS staff as presented in **paragraph 101**.
  - h. Approve a change to the Terms of Reference for the Working Groups for Meteorology, Hydrology, and Disaster Risk Reduction, and the Training and Research Coordination Group to include the option of using a Co-Chairpersons system. The Terms of Reference for these WGs will be amended as follows:
    - The WGM/WGH/WGDRR/TRCG shall be comprised as follows:
    - The Chairperson and Vice-Chairperson(s);
    - or, Co-Chairpersons;
    - Focal point of Meteorological/Hydrological/DRR/Training Component from each Member;
  - i. Request AWG to further discuss with the WGs in clarifying the remaining issues of the Co-Chairpersons system.
  - j. Request AWG to identify procedures to document how to accept new Members in coordination with TCS, ESCAP, and WMO.
  - k. Approve the Tropical Cyclone Forecast Competency in the TC region.

- l. Approve MULAN, TRASES, HINNAMNOR, NYATOH as replacement names for HAIMA, SARIKA, NOCK-TEN and MERANTI, respectively, in the list of the names of tropical cyclones.
- m. Approve retirement of the names of tropical cyclones TEMBIN, HATO, and KAI-TAK, respectively and request TCS to issue letters to relevant Members (Japan and Hong Kong, China) to provide replacement names in accordance with the Committee's procedure.
- n. Approve the 2018/2019 Budget as presented below (see **Appendix XXVII** for detail):

<b>By Group</b>	<b>2018/2019</b>
	<b>Proposed</b>
<b>TCS</b>	<b>33,000.00</b>
<b>ALL WGs (IWS ONLY)</b>	<b>40,000.00</b>
<b>TRCG</b>	<b>23,500.00</b>
<b>WGM</b>	<b>27,000.00</b>
<b>WGH</b>	<b>15,000.00</b>
<b>WGDRR</b>	<b>24,000.00</b>
<b>TOTAL</b>	<b>162,500.00</b>
<b>Plus</b>	
Special Request Budget for WGs	28,500.00
<b>Total</b>	<b>28,500.00</b>
<b>Total Proposed Budget plus Special Request Budget in 2018/2019</b>	<b>191,000.00</b>

- o. Accept the kind offer of Thailand to host the 13<sup>th</sup> IWS. The proposed dates are 05-09 November 2018 in Chiang Mai, Thailand.
- p. Accept the kind offer of USA to host the 14<sup>th</sup> IWS in 2019. The final date and place will be confirmed in due course by USA and later communicated to TCS.
- q. Accept the kind offer of China to host the 51<sup>st</sup> Session. The final date and place will be confirmed in due course by China and later communicated to TCS.

## PART II – PROCEEDINGS OF THE COMMITTEE

### I. ORGANIZATION OF THE SESSION

2. The Fiftieth Session of the ESCAP/WMO Typhoon Committee (TC) was held at the Ha Noi Daewoo Hotel, Ha Noi, Viet Nam, from 28 February to 03 March 2018.

The Session was attended by **153** participants from 13 of 14 Members of the Typhoon Committee, namely: Cambodia; China; Hong Kong, China; Japan; Lao People’s Democratic Republic (Lao PDR); Macao, China; Malaysia; Philippines; Republic of Korea; Singapore; Thailand; United States of America (USA); and the Socialist Republic of Viet Nam. Representatives of United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), World Meteorological Organization (WMO) and Typhoon Committee Secretariat (TCS) also attended the Session.

The Session was attended by observers from Change from Indonesia to Indonesian Agency for Meteorology Climatology and Geophysics (BMKG) of Indonesia, Joint Typhoon Warning Center (JTWC), Japan International Cooperation Agency (JICA), Weathernews Inc., International Centre for Water Hazard and Risk Management (ICHARM), Mekong River Commission (MRC), International Telecommunications Union (ITU), Intergovernmental Oceanographic Commission (IOC)/UNESCO and Tohoku University of Japan.

For celebrating the 50<sup>th</sup> years of Typhoon Committee, the “Old Friends” listed on the **Appendix I** were invited to attend the Opening Day of the Session. The list of all participants is given in **Appendix II**. —

On a side event a Display Area for Members was set-up with exhibits by the Members showing their historical material and major achievements on the past 50 years.

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

3. The opening ceremony of the Session began at 09:05 am on Wednesday, 28 February 2018. The Local Organizing Committee of Viet Nam conducted the opening ceremony.
4. The following speeches were delivered at the opening ceremony and are provided in **Appendix III**:
  - a) **Mr. Le Cong THANH**, Director General of National Hydro-Meteorological Service (NHMS) Viet Nam provided welcoming remarks.
  - b) **Dr. Petteri TAALAS**, Secretary-General, World Meteorological Organization.
  - c) **Mr. Kaveh ZAHEDI**, Deputy Executive Secretary, United Nations Economic and Social Commission for Asia and the Pacific.
  - d) **Dr. Toshihiko HASHIDA**, Chair of Typhoon Committee.
  - e) **Mr. YU Jixin**, Secretary of the Typhoon Committee.

f) **Dr. TRAN Hong Ha**, Minister of Ministry of Natural Resources and Environment (MONRE), declared the opening of the Session.

5. Dr. Roman L. KINTANAR Award for typhoon related disaster mitigation was presented to:
- (i) **The National Centre for Hydro-Meteorological Forecasting of National Hydro-Meteorological Service (NHMS) – Viet Nam**, in recognition of their outstanding contribution towards the typhoon-related risk reduction and damage mitigation and achievements on their professional tasks, scientific research and international/regional cooperation in 2017; and
  - (ii) **National Disaster Management Research Institute (NDMI) – Republic of Korea**, in recognition of their commitment and outstanding contribution towards typhoon-related disaster mitigation and WGDRR's activities, particularly in research on Disaster Management sharing on typhoon-related policies and technologies within the Typhoon Committee's Region and international/regional cooperation in 2017.

## **II. REPORT ON CREDENTIAL COMMITTEE (agenda item 2)**

6. Dr. LEI Xiaotu, Chair of WGM, Mr. Yoshio TOKUNAGA, Chair of WGH and Dr. Jaehyun SHIM, Chair of WGDRR, as appointed members of the Credential Committee, reviewed the Credential Letters submitted by TC Members. Dr. LEI Xiaotu, who was appointed as Chair of the Credential Committee at the 49<sup>th</sup> Session, presented the Summary Report of the Credential Committee which can be consulted at **Appendix IV**.

## **III. ELECTION OF OFFICERS (agenda item 3) —**

7. Dr. Le Cong THANH, Director General of NHMS, was elected Chairperson and Mr. YU Yong, Deputy Administrator of China Meteorological Administration (CMA) was elected Vice-Chairperson of the Committee.
8. Mr. Tom EVANS, Deputy Director, Pacific Region of NOAA, National Weather Service (NWS), was elected Chairperson of the Drafting Committee.
9. The appointment of the Chair of the Credential Committee will be on rotation basis within the 3 Chairs of the WGs. Therefore, the WGH Chair, Mr. Yoshio TOKUNAGA, has been appointed to serve as Chair of the Credential Committee for the 51<sup>st</sup> Session.

## **IV. HIGH LEVEL SESSION (agenda item 4)**

10. The High-Level Session was completed by 13 Heads of Delegation speeches and presentations related to Member Achievements in the past 50 years. **Appendix V**
11. The Committee noted with appreciation the Old Friends who were invited to share their history/experience on the past key events and development of the Typhoon Committee. In particular, the many changes in TC down through the years were recognized and it was important that a progressive mindset be maintained by the leadership such as AWG for improvement and development to continue in the future. ESCAP and WMO Secretariats were also encouraged to help raise TC profile and link up TC's regional effort with relevant international initiatives.

12. The Committee appreciated the dedication and hard work of the people involved and the spirit of international cooperation for the 50 years of achievements. The Committee firmly reconfirmed that Committee continues to operate consensus based of decision making process which is an effort of Members seek to reach a mutual acceptable solution.

## **V. ADOPTION OF THE AGENDA (agenda item 5)**

13. The Committee adopted the agenda as shown in **Appendix VI**.

## **VI. TECHNICAL PRESENTATIONS (agenda item 6)**

### **6.1 Summary of the 2017 typhoon season**

14. The Committee noted with appreciation the review of the 2017 typhoon season provided by the RSMC Tokyo as provided in **Appendix VII**, whose summary is presented in paragraph 14 – 23.
15. In the western North Pacific and the South China Sea, 27 named tropical cyclones (TCs) formed in 2017, which was near the average number, and 11 out of them reached typhoon (TY) intensity.
16. Eight named TCs formed in July, which equalled the largest number of formation in July in 1971 since 1951 when the statistical record on TC in RSMC Tokyo – Typhoon Center started. Among the eight named TCs, four formed in South China Sea, two in the east of the Philippines and two in the East of Minamitorishima Island. During the month, the sea surface temperature was high in these areas and convections were active, partly because of the phase of the Madden-Julian Oscillation (MJO), to which the large number of TC formation could be attributed.
17. The mean genesis point of named TCs formed in summer (June to August) was 19.7°N and 134.5°E, with almost no deviation from the 30-year summer average (18.4°N and 135.9°E, averaged for 1981 – 2010 period), and that of named TCs formed in autumn (September to November) was 14.6°N and 126.0°E, showing a large westward deviation from the 30-year autumn average (15.9°N and 137.8°E), which contributes to the westward deviation of the annual average. The autumn deviation can be attributed to the higher sea surface temperature in the east of the Philippines throughout the autumn season because of the La Nina event which started in the beginning of autumn, and the active convection caused by the warm sea. In contrast, convection was not active in the middle of the Pacific Ocean, which contributed to the smaller number of TC formation in this area. As the result, more number of TCs formed around the Philippines and contributed to the westward deviation of the mean genesis point of named TCs formed in 2017.
18. The mean duration of TCs sustaining TS intensity or higher was 4.3 days, shorter than the 30-year average (5.3 days).
19. Two named TCs formed from April to June. Merbok (1702) formed over the South China Sea and hit China.



20. Eight named TCs formed in July. Nanmadol (1703) formed south of Okinawa Island and caused severe damage mainly to the western Japan. Talas (1704) formed over the South China Sea and caused serious damage to Lao PDR, Thailand and Viet Nam. Noru (1705) formed northeast of Minamitorishima Island and took a slow unique track over the sea southeast to south of Japan. Its duration of TS intensity or higher was 19 days, which is the second longest on record. Noru made landfall in the western Japan and damaged the country in August. Roke (1707) formed around the Luzon Strait and hit China. Sonca (1708) formed over the South China Sea and damaged Lao PDR, Thailand and Viet Nam. Nesat (1709) formed east of the Philippines and Haitang (1710) formed over the South China Sea. These two TCs hit China one after another within 24 hours and caused severe damage to the country.
21. Six named TCs formed in August. Hato (1713) formed east of the Philippines and caused severe damage to the southern China including Hong Kong, China and Macao, China, and Lao PDR and Viet Nam. Pakhar (1714) also formed east of the Philippines and damaged China including Hong Kong, China. Sanvu (1715) formed around the Northern Mariana Islands and damaged the Ogasawara Islands, Japan. Mawar (1716) formed over the South China Sea and hit China.
22. Three named TCs formed in September. Talim (1718) formed around the Northern Mariana Islands and caused severe damage to Japan. Doksuri (1719) formed over the South China Sea and caused severe damage to Lao PDR, Thailand and Viet Nam.
23. Three named TCs formed in October. Khanun (1720) formed northeast of Luzon Island and hit the Philippines and China. Lan (1721) formed around the Yap Islands and damaged Japan. Saola (1722) formed west of the Mariana Islands and also damaged Japan.
24. Five named TCs formed in November and December. Damrey (1723) formed over the South China Sea and caused severe damage to Viet Nam. Kai-tak (1726) formed around the sea east of the Philippines and caused severe damage to the Philippines. Tembin (1727) formed east of Mindanao Island and caused severe damage to the island.

## **6.2 Verification of tropical cyclone operational forecast in 2017 typhoon season**

25. The Committee took note with appreciation of the report on Verification of tropical cyclone operational forecast in 2017 typhoon season provided by the Shanghai Typhoon Institute (STI) in **Appendix VIII** and presented by Dr. LEI Xiaotu, Chairperson of WGM. Viet Nam had provided comments and further information to update verification.

## **6.3 Cross cutting Projects**

### **6.3.1 SSOP-II Report**

26. The Committee took note of the progress made in SSOP-II project presented in the report (**Appendix IX**).
27. The Committee took note of the planning for the next step for the SSOP-II Project, namely the in-country workshops for the TC and PTC Member countries.
28. The Committee thanked the WMO Regional Training Centre, Nanjing University of Information Science and Technology, Nanjing China for hosting the Training Workshop.

29. The Committee thanked the SSOP-II Instructors, Project Manager and TCS Representatives for their continuing effort and commitment in support of SSOP-II activities.
30. The Committee noted with appreciation the all Member's contributions and support for the SSOP-II Project which have strengthen relationships among member organizations of the Typhoon Committee and the Panel on Tropical Cyclones. The Committee further urged Members to take measures and actions for continuing support the SSOP-II Project.
31. The Committee was requested to promote SSOP-II as TC knowledge product and encourage its applications in the country level.

#### **6.3.2 ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness: Strategic Note 2017-2020**

32. The Committee expressed its appreciation to the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness for its continued support **(Appendix X)**.
33. The Committee took note of new strategic note of ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness for the implementation of the SSOP-II project and future proposals to be submitted.

## **VII. REPORT ON TC'S KEY ACTIVITIES AND OVERVIEW SUMMARY OF MEMBERS' REPORTS (agenda item 7)**

### **7.1 Report on TC's Key Activities and Main Events in the Region**

34. The Committee took note of the report of the Typhoon Committee Chairperson on the TC's Key Activities and Main Events in the Region, 2017. **(Appendix XI)**
35. The Committee expressed appreciation to the contributions of Dr. Toshihiko HASHIDA and Dr. TRAN Hong Thai as the Chairperson and Vice Chairperson of the Committee, respectively.

### **7.2 Overview Summary of Members' Reports**

36. The Committee took note of the Summary of Members' Reports 2017 **(Appendix XII)** that highlighted the key tropical cyclone impacts on Members in 2017 and the major activities undertaken by Members under the various KRAs and components during the year.
37. The Committee expressed its sincere appreciation to AWG Chair for preparing the Summary of Members' Reports and the observations made with respect to the trends in KRA activities under the different components.

### **Recommendations of AWG**

- a) Consider the key tropical cyclone impacts on Members in 2017 and review the initiatives to be pursued under the various KRAs and components for mitigating such impacts.

- b) Adopt Section 2.1 of the Summary of Members' Reports 2017 as an "Executive Summary" to be distributed to Members' governments for information and reference.
- c) To develop a new standard format/template for the preparation of Members Reports based on the new strategic plan.
- d) TCS and AWG will explore the possibility of setting up online a web-based Member Report submission form

## **VIII. REVIEW OF THE ACTIVITIES OF RSMC TOKYO AND AMENDMENTS OF TOM (agenda item 8)**

### **8.1 Review of the activities of the Regional Specialized Meteorological Center (RSMC) Tokyo 2017 (Appendix XIII)**

- 38. The Committee noted with appreciation the review of RSMC advisories, products and operational activities and changes made in 2017. It noted the forecast verification results for 27 typhoons formed in 2017: the forecast track errors for the year of 82 km (79 km in 2016), 151 km (142 km), 248 km (243 km), 335 km (316 km) and 420 km (442 km) for 24-, 48-, 72-, 96- and 120-hour forecasts, respectively, the annual mean RMSEs for central pressure forecasts of 10.6 hPa (14.6 hPa), 14.6 hPa (21.5 hPa) and 16.4 hPa (23.4 hPa) for 24-, 48- and 72-hour forecasts, respectively, and those for maximum wind speed forecasts for 24-, 48- and 72-hour forecasts of 5.1 m/s (6.5 m/s), 6.7 m/s (8.9 m/s) and 7.7 m/s (10.0 m/s), respectively.
- 39. The Committee noted planned changes of RSMC advisories, products and operational activities, particularly the advance notice of an upgrade to a tropical storm for TC Members via email and NTP website, intensity forecast for 96 and 120 hours and the extended RSMC Guidance for Forecast.
- 40. The Committee expressed its appreciation to the operation of RSMC Tokyo's Numerical Typhoon Prediction (NTP) website and noted changes made in 2017.
- 41. The Committee expressed its appreciation to the continuous contribution of RSMC Tokyo to the regional Storm Surge Watch Scheme (SSWS), especially the provision of various products including storm surge forecast distribution maps, time-series charts at selected stations and multi-scenario storm surge predictions as well as week-range wave forecasts. The Committee noted RSMC Tokyo's efforts to publish verification results of storm surge products in Annual Report on the Activities of the RSMC Tokyo and encouraged Members to make their tide observation available in University of Hawaii Sea Level Center (UHSLC) data base to contribute to the verification activity.
- 42. The Committee with appreciation noted the further development of RSMC Tokyo's Tropical Cyclone Activity Prediction maps using ensembles of ECMWF and UKMO, which would be expanded to those of NCEP and JMA and a multi-center grand ensemble (MCGE).
- 43. The Committee was pleased to note the progress of the regional radar network development project, whose experimental exchange of radar composite data among RSMC Tokyo, the Thai Meteorological Department (TMD) and the Malaysian Meteorological Department (MMD) started in 2016. The Committee expressed its appreciation to RSMC Tokyo for having made available the three Members' radar composite imagery on the NTP website since October 2017. It also noted with appreciation that a technical meeting for the

experts of the three Members was held at the JMA headquarters in December 2017 to discuss technical issues to improve data quality of nationwide radar composite maps developed by TMD and MMD and to discuss challenges for the development and improvement of Quantitative Precipitation Estimation (QPE) techniques as well as the utilization of Doppler velocity data. The Committee requested to extend this project to other Members.

44. The Committee noted with appreciation that RSMC Tokyo published the RSMC Tokyo Technical Review No.19 and the Annual Report on the Activities of the RSMC Tokyo Typhoon Center 2016 in March and December 2017 respectively.
45. The Committee was informed that RSMC Tokyo started tropical cyclone satellite re-analysis in 2012 for the period from 1981 to confirm and improve the quality of the Current Intensity (CI) number in the satellite TC analysis. Re-analysis for the period from 1987 to 1995 has been completed. In addition, TC satellite analysis datasets for the period from 2004 to 2013 were investigated and the re-analysis was partially completed. RSMC Tokyo plans to complete re-analysis 1987 to 2013 by the end of 2018.
46. The Committee noted with appreciation the operation of Himawari-8/9 geostationary meteorological satellites and further welcomed the intention of RSMC Tokyo to continue providing technical supports for Members to utilize Himawari products. The Committee noted JMA's new international service for Target Area observation requests.
47. The Committee was pleased to note that RSMC Tokyo conducted the 17th Attachment Training from 11 to 21 December 2017, inviting three forecasters from Hong Kong, China; Thailand; and Viet Nam. In accordance with the decision of the third joint session of the Panel on Tropical Cyclones (PTC) and the Typhoon Committee, RSMC Tokyo, ESCAP, WMO, and PTC secretariats invited three forecasters from PTC Members: Bangladesh, Maldives and Myanmar. For additional information of Annual Training 2018-2021, see the TRCG Report (**Appendix XIX**).
48. The Committee noted with appreciation Japan's intention to invite forecasters from PTC Member countries who did not participate in 2017 training, to RSMC Tokyo's attachment training in 2018, to enhance collaboration in training activities between the Committee and PTC.
49. The Committee noted the results of the annual observation exchange monitoring during the period of two typhoons in 2017: Hato (1713) and Doksuri (1719), which highlighted the special observation conducted by Hong Kong, China and the Philippines during the periods. It expressed its appreciation to the two Members, who provided special observation data to the Committee Members, and further encouraged all the Members to conduct additional observation, as requested by the Typhoon Committee Operational Manual - Meteorological Components (TOM).

## **8.2 Tropical Cyclone Forecast Competency in the Typhoon Committee Region**

50. The Committee was informed that the Tropical Cyclone Forecast Competency Task Team met in Guam 14 - 16 March 2017, and produced the final draft of the competency, which included requirements for dedicated and specialized TC forecasters at TC forecast agencies

(Category 1) and those for general forecasters providing forecast services related to TCs based on information provided by the parent RSMC or other agencies (Category 2).

51. The Committee noted with appreciation the work of the task team for the development of the final draft tropical cyclone forecast competency in the ESCAP/WMO Typhoon Committee region under the initiative of RSMCs Tokyo and Honolulu.
52. The Committee approved the Tropical Cyclone Forecast Competency as shown in **Appendix XIV**. The Committee encourages the Competency to be used as a guiding document for Member's training activities as appropriate. The approved Competency will be included into TOM and may be updated as needed.

### **8.3 Typhoon Committee Operational Manual (TOM)**

53. The Session noted that the Typhoon Committee Operational Manual (TOM) rapporteur requests WMO to publish and upload the 2018 edition of TOM on the Tropical Cyclone Programme (TCP) Website as submitted by the Rapporteur, with the amendments given in **Appendix XV**.
54. The Committee expressed its appreciation to the rapporteur for update of TOM.

## **IX. REPORTS OF TC WORKING GROUPS AND TRCG (agenda item 9)**

55. Parallel sessions of the Working Groups on Meteorology, Hydrology and Disaster Risk Reduction were convened during the 12th IWS to review progress of work during the past year, identify priorities for cooperation and make recommendations to the Committee.
56. The outcomes of the parallel sessions of the three Working Groups were reported to the plenary session as given in the following sections.

### **9.1. Meteorological Component**

57. The Committee took note of the Member's activities and major progress and issues in Meteorological Component in 2017 as reported by Members at the 12th IWS.
58. The Committee reviewed the activities of Members in implementing the TC Strategic Plan and its annual operating plan in relation to Meteorological Component during past year, details of which are presented in **Appendix XVI**.
59. The Committee took note of the outcomes of the WGM Parallel Session at the 12<sup>th</sup> IWS on 30 October-3 November 2017. With the assistances of WMO/TCP and TCS and the strong support from all Members, WGM has successfully completed the tasks in 2017 with significant outcomes as follows:
  - a) WGM has fulfilled all the action plans (5 POPs, 8 AOPs and 2 PPs) in 2017, which were endorsed at the 49<sup>th</sup> Session.

- b) After the 49<sup>th</sup> TC Session in 2017, WGM has been carrying out many activities that involve the cooperation among Members as well as other TC WGs and international organizations, which include:
- i. Coordinated with STI to organize the second OC meeting for EXOTICCA in Shanghai from 7-8 September 2017.
  - ii. Coordinated with CMA for the International Training Course on Typhoon Monitoring and Forecast from 18 to 27 September 2017.
  - iii. Coordinated with WMO Regional Training Centre Nanjing for the SSOP-II Workshop on Mechanism of Establishing and Preparing SSOP for Coastal Multi-hazards EWS from 24 to 26 October 2017.
  - iv. Coordinated with WMO Regional Training Centre Nanjing for the WMO International Training Course on Tropical Cyclone from 13 to 24 November 2017.
  - v. Coordinated with JMA for the RSMC Tokyo Attachment Training from 11 to 21 December 2017 with three forecasters from Thailand, Viet Nam and Hong Kong, China and three forecasters from Bangladesh, Maldives and Myanmar as part of the project of SSOP-II.
  - vi. Coordinated with JMA for holding a technical meeting for radar composite project from 12 to 15 December 2017.
  - vii. Coordinated with TRCG to host the 2017 research fellowships which include the following:
    - The National Typhoon Center (NTC) of KMA provided a training and research program on typhoon track and intensity forecast, numerical weather prediction and typhoon re-analysis methods from 16 to 29 April 2017 to four participants from Philippines, Thailand and Viet Nam.
    - Two forecasters from Thailand and Viet Nam participated in the fellowship on “Observational Study on Intensity and Structure of Offshore Typhoon for EXOTICCA” which was conducted from 1 to 30 September 2017 in Shanghai Typhoon Institute (STI).
    - The fellowship on “Benefit evaluation of Typhoon disaster prevention and preparedness” was offered to a forecaster from Malaysia (4-17 September 2017). The objective of the fellowship is introducing the techniques for evaluating benefits of tropical cyclone disaster prevention and preparation to the Members.
    - The fellowship for the Visiting Editor for Tropical Cyclone Research and Review offered by STI was conducted in February 2018. Two experts, Mr. Somkuan Tonjan from TMD and Dr. Doan Quang Tri from the National Hydro-Meteorological Service of Viet Nam served as visiting editors for TCRR.

60. The Committee took note that AOP3 will be continue in 2018 according to the request of Viet Nam.

61. The Committee took note that WGM Meeting will be held in Shanghai, China in June 2018.

## **CONCLUSIONS of WGM**

62. On the basis of the information provided by Members and the respective coordinator of the actions plan and based on the discussion during the 12th IWS, the following conclusions were reached:

- a) WGM action plans in 2017 were successfully completed.

- b) Members made important progress in the implementation of the TC Strategic Plan during the year 2017.
- c) Members made significant progress during 2017 in tropical cyclone monitoring and communication systems, data assimilation and numerical weather prediction systems, tropical cyclone forecasting-aid systems, and scientific understanding of tropical cyclone activities.
- d) KMA continued to provide seasonal outlook information for frequency of typhoon genesis and track pattern to TC Members.
- e) A dynamical-statistical model II was being developed and probabilistic interpretation became available.
- f) The web-based typhoon forum was linked to TC website to provide real-time information, forecast verification and historical cases.
- g) Two experts from Thailand and Viet Nam served as visiting editors for TCRR in early 2018.
- h) TCRR was included in two databases: China National Knowledge Infrastructure (CNKI) and Emerging Sources Citation Index (ESCI) to increase influence and exposure.
- i) KMA carried out the Typhoon Operation System (TOS) technology transfer to TMD and PAGASA in October 2017. More technology transfer will be carried out upon Member's requests.
- j) STI/CMA continued to evaluate the performance of tropical cyclone forecast in western North Pacific in 2017 and provided real-time verification in WMO-TLFD website.
- k) New tropical cyclone activity prediction maps (JMA, NCEP) were developed by JMA and would be included in the NTP website soon with that of Multi-Center Grand Ensemble (MCGE).
- l) JMA established a new early Dvorak Analysis (EDA) scheme and tropical cyclone genesis guidance was under development with combination of EDA results and global ensemble predictions.
- m) The TRAMS (Tropical Region Atmospheric Model System) was upgraded in 2017 with resolution from 18km to 9km with improvement on model physics and dynamics.
- n) Observation Experiment in the South China Sea was performed using data from Maoming Bohe Marine Meteorological Science Experiment Base.
- o) The web site (<http://www.swfdp-sea.com.vn>) continued to share global and regional NWP products as a key function of RFSC-Ha Noi.
- p) Experimental radar data exchange among JMA, TMD and MMD continued in 2017, and the radar composite map was available at the RSMC Tokyo NTP website since 25 October 2017.
- q) A technical meeting between JMA, TMD and MMD was held in JMA from 12 to 15 December 2017 to identify issues and provide technical advice.
- r) The experience in radar data exchange would be shared with RA II & V WIGOS regional project and a WIGOS/ASEAN workshop would be held in February 2018.
- s) Literature review and discussion for TCAR3 continued in 2017 and a survey on "tropical cyclone impacts in Typhoon Committee region" was conducted.
- t) The compilation of some chapters in TCAR3 has commenced with satisfactory progress.
- u) Storm surge time-series charts for Cambodia and Singapore were added in 2017 which made the total number of stations to 77 in 10 Members.

- v) Verification results of storm surge products were published annually in Annual Report on Activities of RSMC Tokyo and Members are encouraged to provide tidal observations during storm surge events for verification.
- w) The second Organization Committee (OC) meeting for EXOTICCA was held in Shanghai on 8 September 2017, with 18 participants from China, Hong Kong, Thailand, Viet Nam, Malaysia and USA. 6 papers for the demonstration research for EXOTICCA were published since the last meeting.
- x) Benefits on joining the EXOTICCA project was explained to TC Members and Members were invited to join the project based on the Terms and Conditions.
- y) A research fellowship of demonstration research was offered by CMA and two experts from Thailand and Viet Nam visited STI in September 2017.
- z) The draft for tropical cyclone forecast competency was completed by JMA and circulated to WGM Members for comments.
- aa) New available data, including radar and AWS real-time analysis, should be combined with ideal model and Dvorak analysis when estimating tropical cyclone intensity, especially for landing tropical cyclones when sufficient data are present.
- bb) The Collaborative Discussion Forum (CoDi) was implemented in CMA NMC's website in 2017 for testing. Users can post on desktop computers, laptops, tablets and smartphones.
- cc) Based on the discussion on the action plans for 2018 during the 12th IWS, it was concluded to adopt the action plans as follows:
  - i. The POP items 1, 3-5 will be continued in 2018.
  - ii. The POP2 will be continued but combined with the current PP2, and "Web-based typhoon forum and CoDi platform" will be the new title.
  - iii. The AOP items 1-7 will be continued in 2018
  - iv. The AOP8 were completed in 2017 and will be closed.
  - v. The PP1 will be continued in 2018.
  - vi. A new PP2 item of "Enhancing Utilization of Hiramari 8/9 Products" will commence in 2018.
- dd) The total budget proposed by WGM, which will be concurred at the AWG meeting during the 12<sup>th</sup> IWS, for undertaking the actions plans (5 POPs, 7 AOPs and 2 PPs) in 2018 is US\$27,000. The financial support of US\$5,000 for OC Meeting for EXOTICCA (AOP6), US\$5,000 for Expert Team Meeting for TCRR (POP3), and US\$7,500 for Expert Meeting for Assessment Report on the Impact of Climate Change on Tropical Cyclone in TC Region (AOP4) will be allocated through "Special funding request".

## **RECOMMENDATIONS of WGM**

63. The WGM made the following recommendations:
- a) To request KMA to continue develop the dynamical-statistical model II and provide seasonal typhoon outlook information for TC Members.
  - b) To request STI/CMA and TCS to call for more contributions from TC Members and working groups to the TCRR Journal, including technical summaries and operation innovation, and research results associated with strategic plans and AOPs.
  - c) To request KMA to upgrade TOS up to TD forecast, provide technical support and patch for new version, and package the analysis, training and statistics into modules and transfer the modules step by step.
  - d) To request STI/CMA to continue the evaluation of performance of tropical cyclone forecast in western North Pacific in 2018, provided real-time verification in WMO-TLFD website, present the post seasonal verification report in next TC Session.



- e) To request JMA to provide verification results of ensemble tropical cyclone activity predictions from four NWP centers and multi-center grand ensemble (MCGE).
- f) To request JMA to develop tropical cyclone genesis guidance using early Dvorak Analysis (EDA) and global ensemble.
- g) To request CMA to continue improving the TRAMS (Tropical Region Atmospheric Model System) and provide forecast products to TC Members.
- h) To request NHMS of Viet Nam to host a training desk with experts from HKO to improve the guidance between RFSC and SWFDP participating NHMSs.
- i) To request NHMS of Viet Nam to perform point forecast verification of guidance with the support from ECMWF and post the results to NHMS and SWFDP web pages.
- j) To request NHMS of Viet Nam to host the Regional Training Workshop in Severe Weather Forecasting and Delivering of Warning Services for Southeast Asia.
- k) To request JMA to further refine quality control techniques and QPE calibration applied to MMD and TMD radar networks.
- l) To request JMA to continue the experimental regional radar composite data exchange and share the progress with RA II/V WIGOS radar project in Southeast Asia for expansion of the experiment.
- m) To request JMA to hold follow-up technical meetings upon receipt of progress reports from TMD and MMD.
- n) To request SMG to coordinate and hold the expert meeting in 2018, and complete the first draft of the assessment report (TCAR3) for Members' comments in 2018/2019.
- o) To request JMA to provide astronomical tide estimated by an ocean model to stations where astronomical tide is not available.
- p) To request JMA to add storm surge time series prediction upon request from Members.
- q) To request JMA to encourage Members to provide complete hourly tidal data as well as tidal observations during storm surge events.
- r) To request STI/CMA to continue field campaign, improve major instruments, conduct demonstration research and hold a joint workshop of WMO-TLFDP and EXOTICCA in 2018.
- s) To request CMA to encourage TC Members to share available surface observations.
- t) To request CMA to encourage TC Members to nominate contact(s) to get the account and password for using the CoDi Platform.
- u) To request all WGM focal point and coordinator of the projects to attend the WGM Meeting.
- v) To request WGM to update the Annual Report after the input the detail action of AOP3 from Viet Nam.
- w) To endorse the action plans in 2018 (including 5 POPs, 6 AOPs and 2 PPs) as listed in Annex II of Appendix I – Summary Report for the WGM Parallel Meeting at the 12th IWS, which summarizes the above recommendations with additional action items.
- x) To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.
- y) To appoint Mr. Chiashi MURIOI as the rapporteur of TOM.

## **8.2. Hydrological Component**

- 64. The Committee reviewed the activities of the Members related to the implementation of the TC Strategic Plan and its annual operating plan (AOP) for the hydrological component during the past year. Details can be found in the **Appendix XVII**.
- 65. The Session noted that, the water-related disaster events, including river flood, urban flood, flash flood and debris flow, and drought caused serious damage in some Members of the

Committee in the past year, such as China, Laos, Japan, Malaysia, Philippines, Viet Nam, etc. The hydrological departments in the Members provided valuable service of flood forecasting and warning to the decision-making departments of the Governments. The Members achieved remarkable progresses on capacity building of hydrological monitoring, data collection and flood forecasting and warning in 2017.

66. The Session noted with pleasure that, the 6th WGH working meeting was successfully held from 25 to 28 September 2017 in Seoul, the Republic of Korea (ROK) with theme of “Adaptive Capacity Building for Extreme Flood Preparedness”. About 20 participants from 8 Members namely China, Japan, Laos, Philippines, the Republic of Korea, Thailand, USA and Viet Nam, and the hydrologist of TCS took part in the meeting. The Session expressed its appreciation to the Ministry of Land, Infrastructure and Transport (MOLIT) of ROK, through Han River Flood Control Office (HRFCO) with cooperation of Korea Institute of Civil Engineering and Building Technology (KICT), for generously hosting the meeting.
67. The Session noted with appreciation that, Japan expressed its willingness to host WGH 7th Working Meeting in September 2018. The meeting is temporarily proposed 4 days, including one-day workshop for the project led by Japan, namely Flash Flood Risk Information for Local Resilience, and one-day seminar to be funded by China on Decision Supporting to SOP for Coastal Multi-hazards Early Warning and Reduction.
68. The Committee was informed on the implementation status in 2017 and future activities of on-going projects (AOPs):
  - a) Flash Flood Risk Information for Local Resilience
  - b) Extreme Flood Forecasting System
  - c) Guidelines for Extreme Flood Risk Management in TC Region
  - d) Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members
  - e) Application of Hydrological Data Quality Control System in TC Members
  - f) Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique
  - g) Impact Assessment of Climate Change on Water Resource Variability in TC Members
69. The Session was informed that, the Ministry of Land, Infrastructure and Transport (MLIT) and the International Centre for Water Hazard and Risk Management (ICCHARM) of Japan has put the project of Flash Flood Risk Information for Local Resilience substantially forward in 2017, including analyzing the Members’ disaster prevention policies by using questionnaire and exchanging information in WGH meetings. The Session also noted with pleasure that Japan will promote the collaboration between this AOP and the “National Platform on Water and Disaster” project of the International Flood Initiatives in 2018 and beyond.
70. The Session was informed that, two projects led by Republic of Korea, namely a) Extreme Flood Forecasting System (EFFS), and b) Guidelines for Extreme Flood Risk Management in TC Region, have been closed successfully in 2017. The technical reports have been published in 2017 as two publications of the Committee (TC/TD-No. 0015 and TC/TD-No. 0016) and distributed at 12th Integrated Workshop which was held in Jeju, Republic of Korea from 30 October to 03 November 2017. The operation system for EFFS has been tested in pilot Members, namely Lao PDR, Philippines, ROK and Thailand. The Session also noted with appreciation that, the HRFCO and KICT committed to continue improving the functions of EFFS, and continue providing the technical support to Members.

71. The Session was informed that, the project on Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members, which was led by China, made remarkable progresses and achievement in 2017, including: a) software updating and system configuration for Dongguan City of China, Hat Yai City of Thailand; b) field survey missions in Malaysia from 24 to 31 August 2017 and in Viet Nam from 13 to 19 November 2017; c) experts from Department of Irrigation and Drainage (DID) of Malaysia and Royal Irrigation Department (RID) of Thailand working in SYS University from 19 to 21 April 2017 and from 20 to 22 October 2017, respectively; d) OSUFFIM workshop was held in SYS University from 27 to 30 December 2017, with participants from China, Myanmar, Malaysia, Philippines, Thailand and Viet Nam as well as TCS; and e) experts of SYS University working in Hat Yai, Thailand for geographic data collection from 29 January to 3 February 2018. The session also noted with appreciation that, SYS University generously provided funding and expertise support for implementation of OSUFFIM.
72. The Session noted that, the project of OSUFFIM was proposed to be closed at 50th Annual Session of TC, in order to extend the achievement to more TC Members, WGH will conduct phase-II for OSUFFIM in a period of 3 more years from 2018 to 2020 with objectives of a) updating OSUFFIM software and application in new selected pilot cities in 2-3 interested Members; and b) studying the trend of urban flood pattern in TC Members under a changing climate and urbanization. The Session also noted with appreciation that, Prof. CHEN Yangbo of SYS University, as chief scientist of OSUFFIM, is willing to contribute his knowledge and share his expertise on urban flood forecasting and inundation mapping to the Members.
73. The Session was informed that, WGH will officially launch three new initiatives in 2018 based on the detail discussion and communication at 6th WGH working meeting and 12th TC Integrated Workshop, including:
- a) Application of Hydrological Data Quality Control System in TC Members. The purpose of the project is to support and provide the guideline and system to improve the quality control of hydrological data in TC regions. The project is proposed to be driven by HRFCO of Republic of the Korea in cooperation with KICT in a period of 5 years from 2018 to 2022, with objectives of: (1) enhancement of TC Member's capacity for managing & monitoring of hydrological data (Rainfall, Water Level, Discharge); (2) reducing the uncertainty of input data for flood forecasting; (3) suggesting the procedure of producing hydrological data; and (4) establishment of the hydrological data quality control system linkage to EFFS.
  - b) Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique. The purpose of the project is to upgrade the developed EFFS, especially flood forecasting technology using radar data and probabilistic flood forecasting technology. The project is proposed to be driven by HRFCO of the Republic of Korea in cooperation with KICT in a period of 5 years from 2018 to 2022, with objectives of: (1) enhancing TC Member's capacity for flood forecasting using radar rainfall data & stochastic techniques; (2) upgrading the LEVEL3 module of EFFS; (3) evaluating the uncertainty of flood forecasting, and suggesting the procedure of stochastic flood forecasting.
  - c) Impact Assessment of Climate Change on Water Resource Variability in TC Members. The purpose of this project is to collect, collate, analyst, evaluate and develop the water resources modelling information for better decision management system so as to improve the capacity building among TC Members on better understanding water

modelling and water resources management. The project is proposed and will be driven by Hydrological Forecast Center (HFC) of MWR, China in cooperation of Nanjing Hydraulic Research Institute (NHRI) with the objective of extending the application of the Water Balance Model (WBM) developed by the Research Center for Climate Change (RCCC) of the Ministry of Water Resources (MWR), China to assess the impact of climate change to water resource variability in TC Members so as to provide the sustainable water resources information to the Member Governments on water resources management and social-economic planning in the country.

74. The Session noted that, WGH established the project-bank for coming years under TC Strategic Plan and the strategic framework of ESCAP and WMO on water-related disaster reduction, which mainly focuses on enhancing the knowledge and capacity building on the management of water-related disaster risks for a resilient future in Typhoon Committee region, including:
- Innovative flood forecasting for ungauged river basin;
  - Flash flood (landslide, mud-flow) prediction and warning using QPE/QPF;
  - Extension the application of urban flood forecasting and inundation mapping;
  - Rainfall-runoff inundation mapping for river basins;
  - Radar and satellite data utilization in flood forecasting and warning;
  - Long-term forecasting for water resource management and drought monitoring and warning under climate change;
  - Data-sharing in transboundary rivers;
  - Dam operation for flood risk management under climate change;
75. The Session noted that, TC WGH webpage has been operated for sharing information among WGH members, and has been linked with TC Webpage (<http://www.typhooncommittee.org/wgh-web-page/>). The webpage will be updated and operated by HRFCO continuously in cooperation with KICT and TCS.
76. The Session was informed that, following the decision of TC 49th Session, WGH at its 6th working meeting coordinated and selected Mr. Yoshio TOKUNAGA from ICHARM of Japan and Dr. CHO Hyo Seob from HRFCO of the Republic of Korea continue working as Chairperson and vice chairperson of WGH, respectively, to TC 51st Session. Dr. HOU Aizhong from HFC of China continues serving as Vice-chairpersons of WGH to 51st Annual Session.
77. The Session noted that, based on deep discussion at TC 12th IWS, WGH requested AWG to discuss and consider the possibility of Chair/Co-Chair system for WGH and to advise WGH Chairmanship for the final decision. The Session also noted that, AWG has discussed this matter and had an initial comprehensive consideration at its meeting at TC 12th IWS held in Jeju, Republic of Korea. The Session also noted with a pleasure that WGH expressed to be obligated to follow the advice from AWG as final solution (refer to item 20 for details discussed during TC50 Session).

## **CONCLUSIONS of WGH**

78. On the basis of the outcomes 6th WGH working meeting and the discussion of the WGH Parallel Session at 12th IWS, the following conclusions were reached:
- a) The working meeting of WGH is very important to review hydrological activities, deep technical discussion and implementation status of WGH AOPs, and also is very

necessary to prepare IWS and annual session. The funding support and contribution from the Republic of Korea played the vital role in organizing the annual working meeting in past years. WGH encourages more and wider resources to support the activities to keep its sustainability.

- b) To promote the capacity of forecasting, early warning and risk management for urban flood is an urgent need among TC Members, especially urban flood forecasting and inundation mapping. As subsequent activity of TC first Cross-cutting project of Urban Flood Risk Management (UFRM), the on-going project of WGH on Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) is a tangible measure on this aspect and it will play a very meaningful and important role for TC Members to promote the capacity on the technique of urban flood forecasting and warning.
- c) Acquisition of the high quality hydrological data is the most basic work in flood forecasting. However, most of TC Members do not have adequate quality control system of hydrological data. The suggestion of HRFCO for new AOP regarding data quality control system is very meaningful for TC members to promote their capacity of flood forecasting and warning with better hydrological data.
- d) In TC Members, water is considered as the core of sustainable development and a critical element for its socio-economic development. Water is the driver of the key sectors of its economy and will remain as a crucial element to sustain its healthy ecosystem which eventually affects the well-being of its population. Water is a finite resource and it is only renewable if well managed. Water can pose serious challenges to sustainable development but if managed efficiently and equitably, water would play a key enabling role in strengthening the resilience of social, economic and environmental systems in the light of rapid and unpredictable changes. Therefore, one of the key elements in managing water resources is to provide a comprehensive management instrument which could provide multiple functions including accounting for water resources, providing real time via on-line information and long term (projection) on water availability and variability, an assessment tool to evaluate operation options for efficient water allocation and a forecasting system to assist in the decision making process. It is necessary and important for WGH to conduct the cooperation on Impact Assessment of Climate Change on Water Resource Variability among TC Members for implementation of KRA 3 of Strategic Plan 2017-2021.
- e) Enhancement of the close collaboration with the AWG of WMO CHy, WMO RA II Working Group on Hydrological Services in several themes of common interest provides significant benefits to the Committee.

## **RECOMMENDATIONS of WGH**

- 79. On the basis of the outcomes of 6th WGH working meeting and the discussion at the Parallel Session of 12th IWS and subsequent discussion, the WGH made the following recommendations:
  - a) to request AWG to advise on the matter of Chairpersonship for WGH as the final solution. Before that, WGH will follow its current TERMS OF REFERENCE in a consultative and harmonized manner.
  - b) to request US\$10,000 from TCTF in total for supporting WGH members participating TC 13th IWS.

- c) to request US\$15,000 from TCTF in total for supporting overall WGH activities for 2018 calendar year.
- d) to request US\$3,000 special budget to support publishing OSUFFIM technical report in 2018;
- e) To request MLIT and ICHARM of Japan to host WGH 7th working meeting with funding support in September 2018.
- f) to approve the proposal to conduct phase II for OSUFFIM as a continual project in a period from 2018 to 2020;
- g) to approve the initiatives of two AOPs in the period from 2018 and 2022 proposed by HRFCO of the Republic of Korea with cooperation of KICT: (1) Application of Hydrological Data Quality Control System in TC Members; and (2) Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique.
- h) to approve the project in the period from 2018 and 2020 proposed by HFC of MWR and NHRI of China: Impact Assessment of Climate Change on Water Resource Variability in TC Members.
- i) to request HRFCO to continue maintaining and operating the WGH webpage for effective sharing information among WGH members with support from KICT and TCS;
- j) To re-appoint the focal point of WGH, Ms. Ji-Youn SUNG, HRFCO of the Republic of Korea as the liaison to WGH of WMO RA II for WGH of the Committee.
- k) To continue focusing on improving the ability to forecast hydrological phenomena and provide measures for the effectiveness of the improvements.

### **8.3. Disaster Risk Reduction Component**

- 80. The Committee took note of the activities; relevant major progress and issues related to Working Group on Disaster Risk Reduction (WGDRR) as presented in WGDRR report 2017
- 81. The Committee reviewed the activities of WGDRR in implementing the TC Strategic Plan and its Annual Operating Plans (AOPs) in relation to DRR component during the past year. Details of which are presented in **Appendix XVIII**.
- 82. The Committee was informed that 12th WGDRR Annual Workshop was successfully held in Ulsan, Republic of Korea from 30 May to 02 Jun 2017 with the theme of “Future Strategic Plan of WGDRR after Sendai Framework”, which was hosted and funded by National Disaster Management Research Institute (NDMI) and ESCAP, WMO and AWG Members were also invited to join the meeting.
- 83. The Committee expressed its appreciation to National Disaster Management Research Institute (NDMI) for their kind contribution and continued support on WGDRR activities.
- 84. The Committee expressed its appreciation to Dr. SHIM Jaehyun from Republic Korea for his remarkable contribution as the Chair of WGDRR in the past year.
- 85. The Committee expressed its appreciation to Ms. Genevieve MILLER from USA for her contribution and effort in the past year

86. The Committee expressed its sincerely appreciation to Ms. Cecilia, LEONG Fong Peng from Macau for her contribution and effort serving as the Vice Chair of WGDRR for past many years as the Committee was informed that Ms. Cecilia LEONG has officially resigned the role of Vice Chair as her job has changed.
87. The Committee was informed that Dr. Yuntae KIM from Republic of Korea to be appointed as the Vice Chair replacing of Ms. Cecilia, LEONG Fong Peng.
88. The Committee was informed that the projects (AOPs) for 2018 recommended by WGDRR as follows:
- a) AOP1: Expert Mission- the project aims to exchange information and experience sharing related to DRR such as policies and technologies among the Members in order to improve the capacities on DRR. It was planned to continually conduct the expert mission for interested Members.
  - b) AOP2: Setting up early warning and alert systems – The project is fund by NDMI. With installation of the EW and Alert Systems, they improve the capacities of resilience for typhoon related disaster for participating members. NDMI has planned to carry out the project in Laos and Viet Nam in 2018.
  - c) AOP3: iCowin project- HKO provides training workshop with the basic equipment for setting up the community weather station in the interested TC Members in order to raise public awareness on severe weather such as climate change.
  - d) AOP4: WGDRR Annual Meeting- NDMI will continue to organize and fund the WGDRR annual workshop in order to facilitate follow-up of the WGDRR activities and information sharing related to DRR, as well as the communication among members.
  - e) AOP5: Promote TC-PTC Cooperation: NDMI will invite PTC Member to join the 13th WGDRR annual workshop for information exchange and experience sharing related to disaster management and discussion about the cooperation between TC and PTC on DRR activities.
  - f) AOP6: Participation in the PRiMO Conference- the Conference will be held in Honolulu in August 2018. WGDRR will take part in the conference in order to exchange information related to DRR, as well as introduce TC to the participants.
  - g) AOP7: Benefit evaluation of typhoon disaster prevention and preparedness project- this project is led by Shanghai Typhoon Institute (STI), China that functions to establish a set evaluation index and provide an evaluation report that assists in decision-making basis for the optimization of typhoon disaster behaviour. China will provide a fellowship program to the Members for this project in 2018. Miss ZHOU Xiao and CHEN Peiyan from STI, China will be the coordinator of the project.
  - h) AOP8: Supporting SSOP II Project- The SSOP Project Phase II that is aimed at implementing the Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System. The execution of this project (phrase II) will be mainly focused on the training on how to establish an appropriate standard operating procedure (SOP) based on the published SSOP Manual and on promoting the TC and PTC Members' capacity building on Multi-Hazards Risk early warning based on existing technical achievement for National Meteorological and Hydrological Services (NMHSs) in the 10 beneficiary countries. WGDRR will fully support this project's implementation.

- i) AOP9: Sharing information related to disaster risk management- In order to improve the capacities of Members' Disaster Management, WGDRR will continue to exchange information and experience related to DRR through the forum on TC website established by TCS and DRR annual meeting.
- j) AOP10: TC Report about Big Data and Social Media use for DRR- It was suggested to collect the report from Members about big data and social media use for DRR then elaborate the publication for sharing with Members in order to improve the capacities of disaster management. The project will be led by STI, China and coordinated by Miss. ZHOU Xiao and CHEN Peiyan from STI, China.
- k) AOP11: Making education videos related to DRR- WGDRR planned to continually produce education videos related to disaster management and share it with the Members for the DRR educational material.

## **CONCLUSIONS of WGDRR**

89. On the basis of the information provided by the Members, the reports presented by project coordinator/leader and findings of the parallel session on WGDRR, the following conclusions were reached:
- a) By the Member's efforts, it has made important progress in the implementation of the TC SP during 2017
  - b) The 12th WGDRR annual workshop was successfully conducted in Ulsan, Republic of Korea from 30 May to 02 Jun 2017 with the theme of "Future Strategic Plan of WGDRR after Sendai Framework". During the Workshop, Working Group on DRR followed up on projects and shared information related to DRR among Members. AWG Members were also invited to attend the workshop and AWG Meeting was held during the Workshop. NDMI showed that they will continue to organize the 13th WGDRR annual workshop and plan to invite AWG Members to join the workshop in 2018
  - c) WGDRR will continue to conduct the projects that can improve capacities of disaster management for TC Members through exchange of information such as Expert Mission and information sharing or participation in important conference.
  - d) WGDRR will continue planning the projects related to public education on DRR in coming future that can facilitate raising public awareness on typhoon related disasters such as setting up of community weather station and producing educational video etc.
  - e) It was suggested to enhance the cooperation among the Members and another regional body such as PTC on DRR activities.
  - f) Aside from the AOP items 1-6, the following are the new projects suggested by WGDRR, based on the discussion at the 12th IWS:
    - i. WGDRR Annual Meeting- NDMI will continue organize and fund the WGDRR annual workshop to enhance the DRR Members' communication such as follow-up of the progress of the project, Member's activities and information sharing.
    - ii. Participation in the PRiMO Conference - the Conference will be held in Honolulu, Hawaii in August 2018. WGDRR will take part in the conference in order to exchange information related to DRR, as well as introduce TC to the participants.
    - iii. Promote TC and PTC Cooperation- NDMI will invite PTC Member to join the 13th WGDRR annual workshop for exchange of information related to disaster management and seeking the cooperation between TC and PTC



- iv. TC Report about Big Data and Social Media use for DRR- To improve the big data and social media use in DRR. It was suggested to collect the information on how to effectively use big data and social media on DRR among TC Members. After the successful collection, a publication will be made to share with the Members. The project will be led by STI, China.
- g) For implementation of the proposed projects in 2018, WGDRR proposed the requests of totally US\$ 32,000 allocated TCTF as the following items:
  - i. To allocate US\$ 6,000 budget of TCTF in 2018 for supporting the Expert Mission.
  - ii. To allocate US\$ 5,000 budget of TCTF in 2018 for supporting the training workshop for the iCowin project that will be held in HKO.
  - iii. To allocate US\$ 8,000 budget of TCTF in 2018 for supporting the participation in PRiMO Conference in Honolulu.
  - iv. To allocate US\$ 6,000 budget of TCTF in 2018 for supporting the research fellowship, which will be held in STI, China, related to benefit evaluation of Typhoon disaster prevention and preparedness.
  - v. To allocate US\$ 4,000 budget of TCTF in 2018 for making a publication after collecting the report about big data and social media use for DRR.
  - vi. To allocate US\$ 3,000 budget of TCTF in 2018 for supporting to make educational video related to DRR.

## **RECOMMENDATIONS of WGDRR**

90. On the basics of the conclusion of discussion and deliberations, the WGDRR made the following recommendations:
- a) To appoint Dr. Yuntae KIM from Republic of Korea as the WGDRR's Vice Chair to replace Cecilia, LEONG Fong Peng from Macau, China.
  - b) To request NDMI to conduct the Expert Mission that is aimed at improving the capacities of disaster management through knowledge exchange and experience sharing among TC Members.
  - c) To request HKO to continue conducting training workshops for iCowin project for interested Members in 2018 and encourage the Members to join the project.
  - d) To encourage the benefited TC Members to participate in the activities of the SSOP Project II.
  - e) To request NDMI and NOAA, USA organize the participation of TC WGDRR in PRiMO Conference.
  - f) To request STI, China continually conduct the research fellowship for the Project of benefited evaluation of typhoon disaster prevention and preparedness to the interested TC Members.
  - g) To request STI, China coordinate the collection of big data and social media use for DRR from the Members.
  - h) To request NDMI continually make a video related to public education on DRR.
  - i) To request NDMI, Republic of Korea to hold the 13th WGDRR Annual Workshop in 2018.

- j) To request NDMI continually to support and carry out the establishment of the early warning and alert system in Lao PDR and Viet Nam and encourage the Members to join the project in the future.
- k) To encourage Members to actively share information related to DRR via the forum of TC website.
- l) To request the Committee to approve the proposed projects and related budget in 2018.

#### **8.4. Training and Research Coordination Group (TRCG)**

- 91. The Committee took note of the progress made in training and research activities as presented in the TRCG Report 2017 and the progress and completion of the organization of the Technical Conference (TECO) in conjunction with the 50th Session of the Typhoon Committee (TC50) in 2018 (**Appendix XIX**). The Committee expressed its appreciation to NHMS of Viet Nam for hosting the TECO in Hanoi and the contribution of speakers in the event.
- 92. The Committee took note of the planning and recommendations made in the 3rd TRCG Meeting held on 31 October and 1 November 2017, particularly with respect to the revised priority research and training areas, the proposed themes of roving seminars in 2018-2020 and the formulation of a new 4-year work plan of TRCG for 2018-2021. The Committee thanked TRCG Members for their continuing effort and commitment in support of TRCG activities.
- 93. The Committee thanked China, Hong Kong, China and Republic of Korea for hosting research fellowship programs in 2017.
- 94. The Committee took note of the successful completion of the RSMC Tokyo training attachment of six forecasters from TC and PTC Members and expressed its appreciation to JMA and WMO TCP for continuously supporting this capacity-building initiative.
- 95. The Committee thanked China for offering the International Training Course on Typhoon Monitoring and Forecasting for three forecasters from TC.
- 96. The Committee appreciated TRCG's inputs in support of training and research activities in connection with TC's cross-cutting projects.

#### **RECOMMENDATIONS of TRCG:**

- 97. Based on the discussion in the 3rd TRCG Meeting on 30 October – 1 November 2017 and as presented in the TRCG Report 2017, the TRCG made the following recommendations:
  - a) To re-appoint Dr. TC LEE (Hong Kong, China) as a Chairperson of TRCG.
  - b) To appoint Dr. Nam-young KANG (Republic of Korea) as the new Vice Chairperson of TRCG, replacing Mr Roger EDSON (USA) for the remainder of the term.
  - c) To request Members to confirm their respective focal points as members of TRCG and update the list of resource persons as appropriate.

- d) To endorse the revised priority training and research areas as proposed in TRCG Report 2017.
- e) To endorse the new TRCG Work Plan for 2018-2021.
- f) To endorse the TRCG AOP 2018 including the hosting of the roving seminar under the support of TCTF and other budget requests which are included in the budget proposal to be submitted by AWG.

## **X. REPORTS OF THE TCS AND AWG (agenda item 10)**

### **10.1 Activities of TCS**

- 98. The Committee took note of the report of the Typhoon Committee Secretariat. **(Appendix XX)**.
- 99. The Committee noted with appreciation the TCS's activities 2017 in order to enhance coordination and support to Members, improve the cooperative mechanism between TC and PTC, implement SSOP II project, increase the visibility of Typhoon Committee via the social media, improve the TC website for sharing the forecast products and information, coordinate Working Groups activities, and keep TCS operation smoothly when Typhoon Hato hit Macao, China and the office was seriously damaged.
- 100. The Committee expressed appreciation to Members for their donation for the Typhoon Committee Trust Fund and in-kind contributions, and encourage Members to continue support activities of the Committee.
- 101. In connection with some public communication issues of TCS recently encountered, the Committee agreed that the following should be observed by TCS as general principles:
  - a) Except for information, recommendations and resolutions officially presented and adopted at the annual sessions or reporting of activities in TC related events, TCS commenting on issues or releasing information relating to a particular TC Member to the media (including social media) should consult the Member concerned beforehand.
  - b) TCS staff commenting on issues or releasing information related to TC or any TC Member to the media (including social media and even after consulting the Member concerned) should only do so on behalf of TC/TCS in his/her capacity as TCS staff, and not in association with his/her affiliation to other organizations as such mixing up of capacity could potentially be seen as a conflict of interest.

### **9.2 Activities of AWG**

- 102. The Committee was informed of the activities of the AWG as presented in the AWG Report 2017 **(Appendix XXI)**.
- 103. The Committee was briefed on the major issues discussed at the AWG meetings in Ulsan, Republic of Korea on 31 May 2017 and in Jeju, Republic of Korea on 3 November 2017.

104. The Committee was informed of the preparation of the budget for 2018, including items in support of activities for the celebration of 50th Anniversary of Typhoon Committee as well as other non-recurring items for special funding consideration.
105. The Committee was informed of the successful completion of the Typhoon Committee Strategic 2017 – 2021. The Committee is invited to recognize and thank Mr. Ken KLEESCHULTE (USA) for leading the update efforts.
106. The Committee was informed Tom EVANS (USA) was selected as the project manager for the SSOP-II project.
107. The Committee was informed the SSOP-II project was successfully launched with the Training Workshop on Synergized Standard Operating Procedures for Coastal Multi-hazards Early Warning System on 24-26 October 2017 in Nanjing, China and the 2017 RSMC Tokyo attachment training.

#### **RECOMMENDATIONS of AWG**

108. AWG recommended the Committee to:
  - a) Recognize and thank Mr. Ken KLEESCHULTE (USA) for leading the update of the Typhoon Committee Strategic Plan 2017-2021.
  - b) Recognize and thank Mr. Edwin LAI for his outstanding leadership as the Chairperson of the AWG from 2014-2017.
  - c) Take note of the progress and recommendations made in the planning and implementation of TC activities, including the preparation of the budget for 2018.
  - d) Review and provide comments on the 2018 work plan for the SSOP-II project (Agenda item 6.3).

#### **XI. STRATEGIC PLAN 2017-2021 UPDATES (agenda item 11)**

109. The Committee took note that there's no new inputs on the update of Strategic Plan 2017-2021.

#### **XII. PUBLICATIONS (agenda item 12)**

110. The Committee took note of the publications of the Typhoon Committee in 2017 .
111. The Committee noted with appreciation that all Member's contributions to the publications of Typhoon Committee have promoted visibility and transparency of TC. The Committee further urged Members to take measures and actions for continuing support the TC publication.
112. The Committee noted with appreciation STI, TCS, WGs and all Members contributions to the publication of Typhoon Committee TCRR Special Issues for the 50<sup>th</sup> Session.

### **XIII. PROGRAMME FOR 2018 AND BEYOND (agenda item 13)**

#### **13.1. Retired and new tropical cyclone names**

113. The Committee noted China provided MULAN, FENGLING and TIANMA as replacement names for HAIMA.
114. The Committee noted Cambodia provided ROMPE, TRASES and KANTHEAY as replacement names for SARIKA.
115. The Committee noted Lao PDR provided HINNAMNOR, XEBANGFAI and DOKKHOUN as replacement names for NOCK-TEN.
116. The Committee noted Malaysia provided JATI, MERBAU and NYATOH as replacement names for MERANTI.
117. The Committee noted the request from Philippines and China to retire the names of tropical cyclone KAI-TAK, TEMBIN and HATO, respectively and request the relevant Members to provide replacement names.

### **XIV. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item 14)**

118. The Committee was presented about activities under, and those requiring coordination through, TCP. It appreciated the comprehensive presentation, and thanked WMO support to the Committee. **(Appendix XXII)**
119. The Committee was informed by the WMO Secretariat that the EC69 made a decision about development of WMO Global Multi-Hazard Alert System (GMAS), requesting all WMO technical programmes to contribute to GMAS development.
120. The Committee was informed that the Global Guide to Tropical Cyclone Forecasts has been reformatted with more readable and easily printable format. It can be downloaded at <https://www.wmo.int/cycloneguide/>.
121. The Committee was informed that the 9th International Workshop on Tropical Cyclones (IWTC-IX) will be held in Honolulu, Hawaii, USA, 3-7 December 2018. The Workshop is intended to aggregate researchers and forecasters in tropical cyclones to interact among them and exchange research results and operational requirements between research and operational communities. Members of the Committee are invited to utilize the opportunity to send their experts and forecasters to exchange and share knowledge and experience with others.
122. The Committee was informed that TCP activities during the inter-sessional period were mainly focused on following aspects:
  - a) Training and Capacity Development
  - b) Support to Operational Forecasting
  - c) Global and Regional Coordination of Forecasting Services
  - d) Support to DRR endeavours associated with tropical cyclones

123. The Committee noted TCP's plan to hold the Technical Coordinating Meeting (TCM-9), hopefully back-to-back with IWTC-9.
124. The Committee was informed that collaborative efforts were made by the TCP and WWRP for promoting application of research outcomes to operational forecasting within the framework of the Typhoon Committee to implement the Typhoon Landfall Forecast Demonstration Project (TLFDP) including EXOTICCA (Experiment on Typhoon Intensity Change in the Coastal A), and the Research and Development Project of Understanding and PreDiction of Rainfall Associated with LandFalling Tropical cyclones (UPDRAFT).

#### **14.2. Coordination with ESCAP activities on DRR**

125. The Committee took note of the ESCAP's analytical work on disaster risk reduction. **(Appendix XXIII)**
126. The Committee took note of the Asia-Pacific Disaster Resilience Network, the ESCAP's overall work programme on disaster risk reduction, and expressed its support for its implementation.

### **XV.SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (agenda item 15)**

#### **15.1. Technical Cooperation**

127. The Committee was informed that there's no technical cooperation presentation.

#### **15.2. In-kind Contributions**

128. The Committee expressed appreciation for the in-kind contributions from some Members, namely China, Hong Kong, China; Japan; Republic of Korea and Thailand. The Committee also invited other Members to report their in-kind contributions, quantifying the corresponding unit of Man-months that have consumed in actions related to TCTF projects. **(Appendix XXIV).**
129. The Committee also expressed the importance of having in-kind contributions with correspondence values.

#### **15.3. Typhoon Committee Trust Fund (TCTF)**

130. The Committee reviewed the statement of account of TCTF for the period of 1 January to 31 December 2016 and the provisional statement for 1 January 2017 to 31 March 2018 submitted by the representative of the WMO Secretariat as shown in **Appendix XXV.**
131. The Committee was informed by TCS, the summary of income and expenditure from 1 January to 31 December 2015 and 2016 and the provisional summary of income and expenditure for 2017/2018 related to the execution of the Work Plan 2017/2018. **(Appendix XXVI)**

#### **15.4. Approval of Typhoon Committee Trust Fund (TCTF) 2018/2019**

132. The Committee took note that the reallocation from special budget by WG's to be approved by Chair of Typhoon Committee and Secretary of Typhoon Committee.
133. The Committee discussed and approved the budget proposal for 2018/2019. **(Appendix XXVII)**
134. The Committee discussed and approved the change of TC financial period from 01 January-31 December to 01 April-31 March each year to facilitate the expenditure early in the calendar year required in support of the organization of the annual Session.
135. The transition will occur this financial period which runs from 01 January 2017 to 31 March 2018.

#### **15.5. Disaster information management services of ESCAP Asian and Pacific Centre for the Development of Disaster Information Management (APDIM)**

136. The Committee took note of ESCAP's new regional institution, the Asian and Pacific Centre for the Development of Disaster Information Management (APDIM) and its initial work programme. **(Appendix XXVIII)**
137. The Committee noted the potential collaboration with APDIM for disaster information management, especially for advancing impact-based forecasting.
138. The Committee also noted the priority of APDIM to support WGDRR, WGH and TC/PTC collaboration activities.

#### **XVI. DATE AND PLACE OF THE 13<sup>TH</sup> IWS (agenda 16)**

139. The Committee was informed that the Thailand will host the 13th IWS. The proposed dates are 05-09 November 2018 in Chiang Mai, Thailand.

#### **XVII. HOSTING OF THE 14<sup>TH</sup> IWS (agenda 17)**

140. The Committee was informed that Guam, USA are willing to host the 14th IWS in 2019. The final date and place will be confirmed in due course by USA and later communicated to TCS.

#### **XVIII. DATE AND PLACE OF THE 51<sup>ST</sup> TC SESSION (agenda 18)**

141. The Committee was informed that China will host the 51st Session. The final date and place will be confirmed in due course by China and later communicated to TCS

## **XIX. HOSTING OF THE 52<sup>nd</sup> TC SESSION (agenda 19)**

142. The Committee was informed that TCS had sent official letter to DPRK inquiring to host the 52<sup>nd</sup> TC Session, and so far no confirmation had been received. Based on the Mechanism for Hosting Sessions, Hong Kong, China informed the Committee that they will consider hosting the Session, if necessary.

## **XX. OTHER BUSINESS (agenda item 20)**

143. The Committee took note the presentation of the WGH Chair, Mr. Yoshio TOKUNAGA related to the Chair and Co-Chair Mechanism of the WGH. The proposed changes of the current Terms of Reference for Working Groups to include the use of Co-Chair system.
144. The Committee approved a change to the Terms of Reference for the Working Groups for Meteorology, Hydrology, and Disaster Risk Reduction, and the Training and Research Coordination Group to include the option of using a Co-Chairpersons system. The Terms of Reference for these WGs will be amended as follows:
- The WGM/WGH/WGDRR/TRCG shall be comprised as follows:
    - The Chairperson and Vice-Chairperson(s);
    - or, Co-Chairpersons;
    - Focal point of Meteorological/Hydrological/DRR/Training Component from each Member;
145. The Committee reaffirmed that there are no changes to the current Chairperson and Vice-Chairperson structure of each WG as approved at the 49<sup>th</sup> Session. If the WG would like to exercise the option of using the Co-Chairperson system, the WG should submit its proposal with detail operation structure and mechanisms for discussion and approval at the future Session. The Committee recognizes that current Chair and Vice-Chair system is working well for many of the WGs, and requested AWG to further discuss with the WGs in clarifying the remaining issues.
146. The Committee thanked Ms. Mia KHOTIMAH for providing a presentation to inform Members on the Badan Meteorologi, Klimatologi, dan Geofisika (BMKG) of Indonesia.
147. The Committee noted Indonesia has expressed interest in joining the Committee as a Member. The AWG will develop procedures to document this process in coordination with TCS, ESCAP, and WMO.
148. The Committee noted the presentation of Mr. Yuichi ONO, related to the World Bosai Forum and invited interested participants to join the event in Fall 2019.
149. The Committee was informed of the evaluation plan of ESCAP and WMO that reviews their engagement with the Committee and takes stock of 50 years of experiences and achievements of the Committee for better alignment with and contributions to the 2030 Agenda for Sustainable Development and the Sendai Framework and future direction of WMO strategies for Disaster Risk Reduction. The evaluation, in consultation with the TC Secretary, is to be conducted in 2018 and the outcome shall be reported at the 51<sup>st</sup> session of the Committee.



**XXI. ADOPTION OF THE REPORT (agenda item 21)**

150. The Committee adopted the report of the session at 12:43 pm, 03 March 2018.

**XXII. CLOSURE OF THE SESSION**

151. The delegates from the Members of the Typhoon Committee, representatives of WMO, ESCAP and TCS expressed their thanks and appreciation to the NHMS of Viet Nam for the successful hosting for organizing the Fiftieth Session of the Typhoon Committee. They also expressed gratitude to Mr. Le Cong THANH, Director General of NHMS and his staff for the warm hospitality and excellent arrangements made.

152. The Session was closed by the Chairperson at 01:15 pm, 03 March 2018.