

ESCAP/WMOTyphoon Committee
Fiftieth Session
28 February – 3 March 2018
Hanoi,
Viet Nam

FOR PARTICIPANTS ONLY
WRD/TC.50/9.1
15 January 2018

ENGLISH ONLY

**WORKING GROUP ON METEOROLOGY ACTIVITIES
ANNUAL REPORT 2017**

(Submitted by WGM Chair)

ACTION PROPOSED:

The Committee is invited to:

- (a) Take note of the Members activities and major progress and issues in meteorology component in 2017 as reported by Members at the 12th IWS.
- (b) Review the activities of WGM conducted in 2017.
- (c) Approve the recommendations and planned activities of WGM for 2018 and beyond.

APPENDICES :

- I. Summary Report of WGM Parallel Meeting at the 12th IWS

APPENDIX A

DRAFT TEXT FOR INCLUSION IN THE TC50 SESSION FINAL REPORT

(Submitted by WGM Chair)

9.1 Meteorological Component

1. 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.
2. 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 I**.
3. The Committee took note of the outcomes of the WGM Parallel Session at the 12th IWS on 30 October-3 November 2017 (**Appendix I**). 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 49th Session.
 - b. After the 49th 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.
- Subject to the availability of the participant, the HKO will host the Typhoon Committee Research Fellowship in January-February 2018 on a topic entitled “Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products”.
- The fellowship for the Visiting Editor for Tropical Cyclone Research and Review offered by STI will be 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 will be invited to as visiting editors.

Conclusions of WGM

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 were invited to the TCRR editorial office as visiting editors 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, and the finalized draft would be submitted to the 50th TC Session for approval.
- 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 1-2 and 4-7 will be continued in 2018
 - iv. The AOP3 and 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 12th IWS, for undertaking the actions plans (5 POPs, 6 AOPs and 2 PPs) in 2018 is US\$27,000. In addition, a budget of US\$11,000 will be allocated for the support of WGM attendance at the next Integrated Workshop, leading to a total budget of US\$38,000 for WGM in 2018. 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

- 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 daily verification of guidance with the support from ECMWF.

- j. To request JMA to further refine quality control techniques and QPE calibration applied to MMD and TMD radar networks.
- k. 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.
- l. To request JMA to hold follow-up technical meetings upon receipt of progress reports from TMD and MMD.
- m. 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.
- n. To request JMA to provide astronomical tide estimated by an ocean model to stations where astronomical tide is not available.
- o. To request JMA to add storm surge time series prediction upon request from Members.
- p. To request JMA to encourage Members to provide complete hourly tidal data as well as tidal observations during storm surge events.
- q. 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.
- r. To request CMA to encourage TC Members to share available surface observations
- s. To request CMA to encourage TC Members to nominate contact(s) to get the account and password for using the CoDi Platform.
- t. 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.
- u. To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.

WORKING GROUP ON METEOROLOGY ACTIVITIES

ANNUAL REPORT 2017

1. Introduction

1.1 According to the terms of reference, Working Group on Meteorology (WGM) is to promote cooperation among the Members of Typhoon Committee (TC) in the implementation of activities under the Meteorological Component of the Committee's Strategic Plan with the aim to support the socio-economic development process and enhance cooperation among the Members in all the three components. Training and Research are incorporated as part of these three components. Towards this end, the WGM is expected to advise and assist the Committee in:

- (a) Identifying priority issues and areas of cooperation in the Meteorological Component;
- (b) Promoting and facilitating the exchange of experiences and knowledge on latest developments and techniques related to the above issues and areas;
- (c) Coordinating and implementing priority activities and programmes of the Committee aiming at strengthening capacity of the Members in meteorology;
- (d) Mobilizing resources to carry out priority activities of the Committee related to the meteorological Component;
- (e) Reporting overall progress in the implementation of the meteorology component of the Strategic Plan;
- (f) Recommending to the Committee priority areas, programmes and activities for cooperation in meteorological research by related experts of the Members.

2. Membership

2.1 After the 49th TC Session, the composition and focal point members list of WGM are:

Chair	Dr. Lei Xiaotu (China)
Vice Chair	Dr. Vicente Malano (Philippines) Ms. Che Gayah Ismail (Malaysia)
Members	Ms. Peou Phalla (Cambodia) Mr. Ryu Ki Ryol (DPR Korea) Mr. C.M. Cheng (Hong Kong, China) Mr. Chiashi Muroi (Japan) Mr. Vanhdy Douangmala (Lao PDR) Mr. Lao Ieng Wai (Macao, China) Mr. Renito B. Paciente (Philippines)

	Dr. Nam-young Kang (Rep. of Korea) Ms. Patricia Ee (Singapore) Dr. Songkran Aksom (Thailand) Mr. Raymond Tanabe (USA) Mr. Vo Van Hoa (Viet Nam)
TCS Meteorologist	Clarence Fong

2.2 Experts from other working groups of TC, WMO/TCP, WMO/WWRP, TCS, RSMC-Tokyo, JTWC, etc. have also provided assistances to accomplish the tasks of WGM over 2017, endorsed at the 49th session of TC. These include RSMC Tokyo attachment training and technical meeting for radar composite project in JMA, research fellowships offered by CMA, HKO and KMA, visiting editors to TCRR editorial office and second OC meeting for EXOTICCA in STI/CMA.

3. The progress of WGM's plans in 2017

With the assistances of WMO/TCP and TCS and the strong support from all Members, WGM has successfully completed the action plans (5 POPs, 8 AOPs and 2 PPs) in 2017, which were endorsed at the 49th Session. The WGM activities and the progress of all action items in 2017 are reported in the Appendix I – Summary Report of the WGM Parallel Meeting at the 12th IWS. The complete table of the 2017 action plans and its implementation status are listed in Annex I of the Summary Report.

After the 49th 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 includes:

- Coordinated with STI/CMA to organize the second OC meeting for EXOTICCA in Shanghai from 7-8 September 2017.
- Coordinated with CMA for the International Training Course on Typhoon Monitoring and Forecast from 18 to 27 September 2017.
- 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.
- Coordinated with WMO Regional Training Centre Nanjing for the WMO International Training Course on Tropical Cyclone from 13 to 24 November 2017.
- 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.
- Coordinated with JMA for holding a technical meeting for radar composite project from 12 to 15 December 2017.
- 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/CMA).
- The fellowship on “Benefit evaluation of Typhoon disaster prevention and preparedness” was offered by STI/CMA 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.
- Subject to the availability of the participant, the HKO will host the Typhoon Committee Research Fellowship in January-February 2018 on a topic entitled “Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products”.
- The fellowship for the Visiting Editor for Tropical Cyclone Research and Review (TCRR) offered by STI/CMA will be 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 will be invited to as visiting editors.

4. Conclusions

- a. KMA continued to provide seasonal outlook information for number of typhoon genesis and track pattern to TC Members.
- b. A dynamical-statistical model II was being developed by KMA and probabilistic interpretation became available.
- c. The web-based typhoon forum was linked by STI/CMA and TCS to TC website to provide real-time information, forecast verification and historical cases.
- d. Two experts from Thailand and Viet Nam were invited by STI/CMA to the TCRR editorial office as visiting editors in early 2018.
- e. TCRR was included in two databases: China National Knowledge Infrastructure (CNKI) and Emerging Sources Citation Index (ESCI) to increase influence and exposure.
- f. 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.
- g. 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.
- h. 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).

- i. 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.
- j. The TRAMS (Tropical Region Atmospheric Model System) was upgraded by CMA in 2017 with resolution from 18km to 9km with improvement on model physics and dynamics.
- k. Observation Experiment in the South China Sea was performed by CMA using data from Maoming Bohe Marine Meteorological Science Experiment Base.
- l. 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.
- m. 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.
- n. 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.
- o. 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.
- p. Literature review and discussion for TCAR3 continued in 2017 and a survey on “tropical cyclone impacts in Typhoon Committee region” was conducted.
- q. The compilation of some chapters in TCAR3 has commenced with satisfactory progress.
- r. 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.
- s. 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.
- t. The second Organization Committee (OC) meeting for EXOTICCA was held by STI/CMA 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.
- u. Benefits on joining the EXOTICCA project was explained by TCS to TC Members and Members were invited to join the project based on the Terms and Conditions.
- v. A research fellowship of demonstration research was offered by CMA and two experts from Thailand and Viet Nam visited STI/CMA in September 2017.
- w. The draft for tropical cyclone forecast competency was completed by JMA and circulated to WGM Members for comments, and the finalized draft would be submitted to the 50th TC Session for approval.
- x. 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.
- y. 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.
- z. 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 1-2 and 4-7 will be continued in 2018
 - iv. The AOP3 and 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.
- aa. The total budget proposed by WGM, which will be concurred at the AWG meeting during the 12th IWS, for undertaking the actions plans (5 POPs, 6 AOPs and 2 PPs) in 2018 is US\$27,000. In addition, a budget of US\$11,000 will be allocated for the support of WGM attendance at the next Integrated Workshop, leading to a total budget of US\$38,000 for WGM in 2018. 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”.

5. 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 daily verification of guidance with the support from ECMWF.
- j. To request JMA to further refine quality control techniques and QPE calibration applied to MMD and TMD radar networks.
- k. 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.

- l. To request JMA to hold follow-up technical meetings upon receipt of progress reports from TMD and MMD.
- m. 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.
- n. To request JMA to provide astronomical tide estimated by an ocean model to stations where astronomical tide is not available.
- o. To request JMA to add storm surge time series prediction upon request from Members.
- p. To request JMA to encourage Members to provide complete hourly tidal data as well as tidal observations during storm surge events.
- q. 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.
- r. To request JMA to submit the final draft of tropical cyclone forecast competency to the 50th TC Session for approval and include the approved tropical cyclone forecast competency in the Typhoon Committee Operational Manual (TOM).
- 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 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.
- v. To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.

ESCAP/WMO Typhoon Committee
12th Integrated Workshop
30 October – 03 November 2017
Jeju, Republic of Korea

FOR PARTICIPANTS ONLY
22 October 2017
ENGLISH ONLY

**WORKING GROUP ON METEOROLOGY ACTIVITIES
PROGRESS REPORT 2017**

(For TC 12th IWS)

(Drafted and Submitted by WGM Chair)

ACTION PROPOSED:

The Committee is invited to:

- (a) Take note of the Members activities and major progress and issues in meteorology component in 2017 as reported
- (b) Review the implementations of all WGM' activities conducted in 2017
- (c) Approve the recommendations and planned activities of WGM for 2018 and beyond.

ANNEXS:

- I. Implementation status of WGM plans in 2017
- II. Proposal plans of WGM activities in 2018

Progress report on the WGM in 2017

(For TC 12th IWS, Jeju, Republic of Korea 30 October – 03 November 2017)

1. Background

- After the 49thTC Session, the composition and focal point members list of WGM are:

Chair	Mr. Lei Xiaotu (China)
Vice Chair	Dr. Vicente B. Malano (Philippines) Ms. Che Gayah Ismail (Malaysia)
Members	Ms. Peou Phalla (Cambodia) Mr. Ryu Ki Ryol (DPR Korea) Mr. C.M. Cheng (Hong Kong, China) Mr. Chiashi Muroi (Japan) Mr. Vanhdy Douangmala (Lao PDR) Mr. Lao Leng Wai (Macao, China) Mr. Renito B. Paciente (Philippines) Dr. Namyong Kang (Rep. of Korea) Ms. Patricia Ee (Singapore) Dr. Songkran Agsorn (Thailand) Mr. Raymond Tanabe (USA) Mr. Vo Van Hoa (Viet Nam)
Secretary of Mete.	Clarence Fong

- At the 7thIWS held in Nanjing, China, WGM Chair proposed to restructure the table of Annual Operating Plans (AOPs), namely the inclusion of 2 additional tables, which are the Perennial Operating Plans (POPs) and Preliminary Projects (PPs), and was adopted by WGM. POPs are referring to the WGM activities that will be carried out repeatedly in the following years while the PPs referring to the projects of which preliminary studies needed to be undertaken by WGM.
- The action plans in 2017 (including 5 POPs, 8 AOPs and 2 PPs) have been endorsed by 49th TC Session.

2. Progress of WGM action plans (POPs, AOPs and PPs) in 2017

- The progress and the results of all the priority plans (include 5 POPs, 8 AOPs and 2 PPs) since the 49th TC Session as well as the action plans in 2017

submitted by the respective coordinators, which were reported as shown in bullet 2.1 to 2.15 (including new AOPs and PPs).

- The Implementation status of WGM Action plans in 2017 including the actions and the completion status; and the action plans in 2018 are listed in Annex I and Annex II respectively.

2.1 POP1: Development of typhoon seasonal prediction system

- In 2017, the KMA provided TC members with seasonal outlooks for western North Pacific typhoons on the website. The seasonal outlooks for summer and fall have been issued in late May and late August, respectively.
- In the fall (Sep-Nov) seasonal outlook, 9-12 typhoons were forecasted to occur. Storm frequency would be above normal in the East China Sea and the North Pacific, and below normal in the South China Sea and the Pacific east of the Philippines.
- The KMA is planning to keep providing TC members with the seasonal outlooks on typhoon activities through the website. The improvement of the typhoon seasonal prediction systems is expected in near future, and the website will be revised accordingly.

2.2 POP2: Web-based typhoon forum

- The web-based typhoon forum continued to run in 2017, to provide tropical cyclone realtime information and forecast, historical cases and forecast verification.
- The forum is linked under Typhoon Committee Website and accessible to the public.
- It was decided to combine with PP2 and renamed as Web-based typhoon forum and CoDi platform in 2018.

2.3 POP3: Tropical Cyclone Research and Review

- Since its launch in February 2012, 18 issues of Tropical Cyclone Research and Review (TCRR) were published with a total of 102 articles, covering the topics of tropical cyclone intensity and structure, climatology, review of tropical cyclone in history, operational forecast verification, storm surge, flood or wave, and risk management etc. Authors come from 13 different countries and regions, two-thirds of them are international authors.

- We insist on strict peer-review process to ensure the quality of our journal, and two-thirds of the reviewers are also overseas experts. All of the published papers are available freely from the website. Readers spread over 100 countries; the most are from the US, accounting for 52%. The full-text download capacity is increasing steadily, and exceeded 24000 times from January to September in 2017.
- Two visiting editors are planned to be invited to the Editorial Office located in Shanghai Typhoon Institute in the second half year. So far, we had received three nominations from Thailand, Viet Nam and Lao PDR, respectively.
- In September 2017, two of the editorial staff attended the 34th annual meeting of China Meteorological Society and leased an exhibition booth to propagandize TCRR.
- TCRR has been included in two databases. One is the database of China National Knowledge Infrastructure (CNKI), the other is the Emerging Sources Citation Index (ESCI). As a new index in the Web of Science™ Core Collection, Emerging Sources Citation Index (ESCI) expands the citation universe and reflects the growing global body of science and scholarly activity. ESCI complements the highly selective indexes by providing earlier visibility for sources under evaluation as part of SCIE, SSCI, and AHCI's rigorous journal selection process. Inclusion in ESCI provides greater discoverability which leads to measurable citations and more transparency in the selection process.
- In September 2017, we began to cooperate with one of the most famous international publishers, Elsevier BV on behalf of KeAi Communications Co., Ltd. to enhance the journal's citation frequency. TCRR will become open access in the ScienceDirect database.

2.4 POP4: Transfer of the Technology of the Typhoon Operation System (TOS)

- The NTC/KMA carried out the Typhoon Operation System (TOS) technology transfer to the Thai Meteorological Department (TMD) and the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) from October 11 to 15, 2017.
- Transfer of the Technology of the Typhoon Operation System (TOS) will be

continued at Member's request. Interested Members could send the request to the KMA for planning the work.

2.5 POP5: Verification of tropical cyclone operational forecast

- Forecasts of tropical cyclone tracks and intensity from deterministic guidance and ensemble systems in 2016 were evaluated and the results were reported to the 49th Session of Typhoon Committee ([http://www.typhooncommittee.org/49th/Docs49/item%205/5.2%20TC%20verification%20report 2016\(20170215\).pdf](http://www.typhooncommittee.org/49th/Docs49/item%205/5.2%20TC%20verification%20report%202016(20170215).pdf)). Part of the work has been submitted to the journal of *Tropical Cyclone Research and Review* (TCRR).
- Providing real time verification on track and intensity forecasts through WMO-TLFDP website.
- STI/CMA continued to fund and host a one-month visit of Mr. Ri Hak Il and Mr. PAK Sang Il from State Hydro-Meteorological Administration of DPRK in November 2016. They implemented the tropical cyclone precipitation products in quasi real time based on NCEP-GFS model data and rain gauge data output in Typhoon Forecast Evaluation and Assessment System (TFEAS) by utilizing Model Evaluation Tools (MET).
- Associate researcher Chen Guomin from STI/CMA participated in the 7th International Verification Methods Workshop (IVMW) in Berlin from May 8-11, 2017. Mr. Chen gave a detail introduction regarding to current capability of operational numerical models in predicting tropical cyclone in western North Pacific at IVMW.

2.6 AOP1: Enhanced use of ensemble forecast

- In 2017, preliminary verification was conducted for the ensemble tropical cyclone activity predictions using the results of ensemble forecasts of ECMWF and UK Met Office. Verification methods need to be further refined.
- Tropical cyclone activity predictions using JMA's ensemble forecasts were added to those of using ECMWF and UK Met Office, and that of NCEP will be added by the end of 2017, along with that of Multi Center Grand Ensemble (MCGE).

2.7 AOP2: Improve the performances and impacts of South China Sea

typhoon model

- The Tropical Region Atmospheric Model System (TRAMS) has been upgraded in 2017.
- The resolution of new version TRAMS has been upgraded to 9km, the accuracy of discretization scheme and pressure gradient have improved. Which shows a overall superior performances than the old one, especially on the alleviation of weaker forecasting for strong typhoon.
- The precipitation conversion rate parameters have been improved based on the simulation results of cloud resolving model, and was used in the new version TRAMS for investigation of sensitivity of typhoon forecast to precipitation conversion rate. In the original SAS scheme, precipitation conversion rate is assumed to be a constant, which does not change with height. While the rate in the modified scheme is decreasing with height. Thus the transform ratio from hydrometeor into precipitation should be less than the original scheme. The statistical results during last typhoon season forecast show that the new scheme not only can improve the typhoon precipitation prediction, but also the typhoon track and intensity.
- The SST used in old version TRAMS is from the initial field, and it is fixed during the model integration. Thus this simplified method is not reasonable for air-sea interaction process, which could affect the calculation of surface fluxes and the typhoon forecast effects. The surface temperature prediction scheme based on the energy balance of the sea surface (Brunke et al (2008)), has been developed and test during 2017, the experimental results show that the new scheme and retrieved SST by satellite could improve the prediction of typhoon track and intensity, especially for the longer forecasting.
- The observational data from Maoming Bohe (of Guangdong province) marine meteorological science experiment base are used to study the given respectively shallow, medium depth and deep air sea drag coefficient in South China Sea region. Through the analysis of the time sequence of air sea flux variation of typhoon process, it is found that the heat transport is transported from the right front quadrant of the atmosphere to the ocean, while the heat transport is transported from the ocean to right posterior quadrant atmospheric. According to the observation of SST and temperature, the flux difference is mainly caused due to the temperature differences between the different quadrants at same height.

2.8 AOP3: Implementing roles of RFSC-Ha Noi in South East Asia

- In 2017, the web site (<http://www.swfdp-sea.com.vn>) continued to share

global and regional NWP products, satellite images and satellite-related products, and 1-5 day guidance for heavy rainfall and strong wind.

- Under support from ECMWF, a daily verification of the guidance will be carried out to enhance the skill of the forecasters in SWFPD-SeA RFSC Ha Noi team in 2018.
- A training desk with experts from HKO will be held in Ha Noi in 2017-2018 to improve the guidance between RFSC and SWFDP participating NHMSs.

2.9 AOP4: Development of regional radar network

- Radar composite map for Japan, Malaysia and Thailand is available at the RSMC Tokyo NTP web site since 25 October 2017.
- A technical between JMA, MMD and TMD will be held from 12 to 15 December 2017 to share progress, identify issues and provide technical advice as well as the way forward.
- The RA II & V WIGOS regional radar project was approved at RA II-16 in Abu Dhabi, UAE in February 2017 and a workshop will be held in Bangkok, Thailand in February 2018.

2.10 AOP5: Assessment report on the impact of climate change on tropical cyclone in TC region

- Literature review and discussion continued. Search for some non-English papers (in Chinese, Japanese or Korean) published in national journals continued.
- A survey on the “Tropical cyclone impacts in Typhoon Committee region” has been conducted with seven returns received.
- The compilation of some of the chapters has commenced with a satisfactory progress.
- The expert meeting will be postponed towards the end of 2018 due to relevant funding arrangements.

2.11 AOP6: Storm surge watch scheme

- In 2017, storm surge time-series charts for 4 stations in Cambodia and 6 in Singapore were added, which made the total number of stations 77 in 10 Members. Stations will be further added upon request.

- Verification results of storm surge products are published annually in Annual Report on Activities of the RSMC Tokyo, starting with the volume of 2015. In addition to the statistical verification results, verification for typical storm surge cases will be published starting with 2016 volume. Members are encouraged to provide tidal observations during storm surge events for verification.

2.12 AOP7: Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICCA)

- The Terms and Conditions of EXOTICCA for participating members was approved by 49th Session. According to the 49th Session, Mr. Clarence Fong, the meteorological secretary of TCS, sent the email and invited TC members to join based on the T&C, expressing the benefits on joining the project.
- The field campaign and the demonstration research were conducted by CMA, HKO and participating members in 2017.
- Trial of the new drop-sonde measurements system using a new mini-rocket will be piloted by STI/CMA as well as the low-level unmanned aerial vehicle (UAV) in South China coastal area in 2017 autumn. A special coordination meeting for field campaign scheme in South China Sea this autumn was held in 11 August in Haikou. The experts from UAV and min-rocketsonde system developing group, STI and Hainan province meteorological service attend the meeting.
- HKO conducted reconnaissance flights and the jet aircraft over the South China Sea in summer for the tropical cyclones (Haitang, Mawar, etc.), and continue in autumn 2017.
- The fellowship of demonstration research offered by CMA. Two experts, Mr. Jaral Yiemwech from Thailand, and Ms. Bui Thi Khanh Hoa from Viet Nam, visited STI in September, 2017 and focus on observational study of intensity and structure change in coastal area typhoon based on the field campaign data, the scheme for the research fellowship.
- The 2nd Organizing Committee (OC) Meeting was held in 7-8 September 2017 in Shanghai. The OC co-chair (Mr. Edwin Lai), members of OC and about 20 experts participated. The participants come from China, Hong Kong China, Thailand, Viet Nam, Malaysia, and United States of American, participated. Technical presentations about the latest technologies and experiments have been delivered by STI, HKO and NRL.

2.13 AOP8: Development of tropical cyclone forecasting competency

- RSMC Honolulu and Tokyo established the task team consisting of ten WGM Members (China, Hong Kong, China, Japan, Lao P.D.R., Malaysia, Republic of Korea, Thailand, the Philippines, U.S.A., and Viet Nam).
- In March 2017, a questionnaire was sent to the task team members in order to identify the current status and training needs, as a preparatory work for the task team meeting. It was responses by the task team members and was utilized for discussion during the meeting.
- At the invitation of the NWS, RSMCs Honolulu and Tokyo jointly organized a task team meeting in Guam, U.S.A. from 14 to 16 March 2017, aiming 1) to review and finalize the draft tropical cyclone forecast competency in the typhoon Committee region, and 2) to discuss how to utilize the competency for capacity development activity in the region.
- The task team successfully developed the final draft, and also agreed that the competency should be utilized as a guiding document for developments of training materials, as well as evaluation of effectiveness of training courses.

2.14 PP1: Available data used in operational tropical cyclone analysis

- In 2017, more available sources including satellite data and radar data have been used by CMA in comparison with surface observation data. A few recommendations of using those data in operational analysis have been concluded. As a new attempt of using those available data in operational tropical cyclone analysis, wind structure estimation method has been developed and tested in several cases.
- It is necessary to investigate available data sources in the South China Sea and assess the quality of those data in operational analysis of tropical cyclones.
- It is found that the tropical cyclone's radial profile of rotational winds, in which the inner-core (normally within the MWR) extreme value, is related to the intensity change of the tropical cyclone.
- Compared to satellite-based winds and radar-based winds, surface observations show more reliability to capture the real-time intensity of tropical cyclone.
- Intensity estimation method based on surface observations can be used in operational work for landing tropical cyclone in the case of sufficient samples.
- Compared to satellite retrieval surface winds, surface observations of gusts can also represent the structure change of tropical cyclone before and after

landfall.

2.15 PP2: Collaborative Discussion (CoDi) platform on tropical cyclone analysis and forecast

- An Online Discussion Forum has been implemented in March 2017 and made available on NMC of CMA website (<http://eng.nmc.cn/typhoon>) for first phase of testing. Using recent web technology including HTML5 and Java Web services, the Forum can be accessible on both desktop computers and mobile devices. The Online Discussion Forum is password-protected that the registered users can use the web-chat interface to exchange information, comments, images and documents (e.g. PDF file) to facilitate quick discussions and input of illustrations.
- The Online Discussion Forum is ready for other TC Members to join for trial with a view to promoting it as collaborative platform among TC Members for sharing and providing views on tropical cyclone monitoring, analysis and forecasting, as well as related marine meteorology operations.
- Developments are underway to implement additional functionality in next phases of release for trial in coming years. For instance, a daily summary of discussions disseminated to registered users' e-mails; availability of video / audio chats so that forecasters and supporting staff / experts in various TC Members can discuss more effectively.

3. Conclusions and the proposed action plans for 2018

On the basis of the information provided by Members and the respective coordinators of the action plans and based on the discussions during the Parallel Meeting, the following conclusions were reached:

- a. Members have made important progress in the implementation of the TC Strategic Plan during the year 2017.
- b. Members made significant progress during 2017 in tropical cyclone monitoring and communication systems, data assimilation and numerical weather prediction systems, tropical cyclone forecast-aiding systems, and scientific understanding of tropical cyclone activities.
- c. With the help of Tropical Cyclone Programme (TCP) of WMO and Typhoon Committee Secretariat (TCS), and the absolute sincere cooperation of all Members and the effective efforts of the WGM focal points, WGM has successfully completed the tasks in 2017.
- d. Experts from other working groups of TC, WMO/TCP, TCS, RSMC-Tokyo, JTWC, etc. have also provided assistances to accomplish the tasks of WGM

- over 2017, namely the two WMO demonstration projects (TLFDP and TCEFP), TCRR editorial board meeting in Shanghai of China, visiting editor to TCRR editor office (Shanghai) and the fellowships.
- e. 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.
 - vii. The POP2 will be continued but combined with the current PP2, and “Web-based typhoon forum and CoDi platform” will be the new title.
 - viii. The AOP items 1-2 and 4-7 will be continued in 2018
 - ix. The AOP3 and AOP8 were completed in 2017 and will be closed.
 - x. The PP1 will be continued in 2018.
 - xi. A new PP2 item of “Enhancing Utilization of Hiramari 8/9 Products” will commence in 2018.
 - f. The total budget proposed by WGM, which will be concurred at the AWG meeting during the 12th IWS, for undertaking the actions plans (5 POPs, 7 AOPS and 2 PPs) in 2018 is US\$27,000. In addition, a budget of US\$11,000 will be allocated for the support of WGM attendance at the next Integrated Workshop, leading to a total budget of US\$38,000 for WGM in 2018. 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”.
 - g. The complete WGM 2018 action plans including the actions, the success indicators, coordinators and budget is listed in Annex II.

Annex I:

Status of Perennial Operating Plans (POPs) of WGM in 2017

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organi zer	Participan ts	Coordinator	Status of Completion
KRA1 KRA2 KRA6	1	Development of typhoon seasonal prediction system	(a) To provide the products of typhoon seasonal prediction for TC Members (b) To further develop the techniques of typhoon seasonal prediction	Submission of the progress report	/	KMA	/	Nam-Young Kang (KMA)	Yes
KRA 6 SG 6b SG 6c	2	Web-based typhoon forum	(a) To run routinely (b) Upgrade the forum and open for public (meteorologists) upon request (c) Link to TC website and operational website of Members	Submission of the progress report	/	TCS, CMA	Members	Clarence Fong (TCS) Lu Xiaoqing(CMA)	Yes
KRA 1 - 6	3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2016 and 2017 (b) Improvement of the editorial procedure and the journal's influence (includes inviting 2-3 visiting editors)	Submission of the progress report	US\$5,000	CMA	Members	Wang Dongliang, Zhou Xiao (CMA)	Yes
KRA 1 KRA 2 KRA 6 SG 6b SG 6c	4	Transfer of the Technology of the Typhoon Operation System (TOS)	(a) To train the typhoon forecasters on the use of the TOS upon Member's request (b) To provide follow-on technical assistance to Members on the implementation of TOS	Submission of the progress report	US\$5,000	KMA	Members	Nam-Young Kang (KMA)	Yes
KRA1 KRA2 KRA6 SG 6b SG 6c	5	Verification of tropical cyclone operational forecast	(a) To carry out post-season verification and reliability analyses on the operational forecast of tropical cyclones in Committee Session (b) To provide the real time verification information on track and intensity forecast through WMO-TLFDP website (c) To further improve the evaluation system for tropical cyclone forecast and	(a) Submission of the post-season verification report for TC Session (b)Progress report on the improvement of evaluation system	US\$3,000	CMA, HKO	Members	Yu Hui (CMA), Sai-Tick Chan (HKO)	Yes

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
			conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme) (d) To offer fellowship for training on (b)	for tropical cyclone forecast					

Status of Annual Operating Plans (AOPs) of WGM in 2017

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	1	Enhanced use of ensemble forecast	(a) To verify skills of ensemble tropical cyclone track and genesis guidance. (b) To provide tropical genesis guidance of other global ensembles if necessary NWP data are available.	Provide verification results.	/	JMA	/	Chiashi Muroi (JMA)	Yes
KRA1 KRA2 KRA6	2	Improve the performances and impacts of South China Sea typhoon model	(a) Increasing model products and enhancing the application of TRAMS (b) Further improving the forecasting ability of TRAMS, especially for the intensity and precipitation forecasting.	Submission of the assessment of performance report of model	/	CMA	Viet Nam, PAGASA, MMD	Chen Zitong (CMA)	Yes
KRA1 KRA2 KRA6	3	Implementing roles of RFSC-Ha Noi in SWFDP for South East Asia	(a) Providing tropical cyclone track and intensity and severe weather forecasting charts based on available global and regional NWP models (b) Collaborating with RMSC Tokyo to release the suitable guidance in case of tropical activity over the SouthEast Asia domain (c) Extending forecasting domain	Progress report	/	Viet Nam	Cambodia, Lao PDR, Thailand, Philippines, RSMC-Tokyo	Vo Van HOA (Duc TIEN NHMS of Viet Nam)	Yes

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
			of regional NWP model in order to cover the east sea of Philippines and Myanmar if have enough computing resources (d) Providing verification of track and intensity forecast derived from available global and regional NWP models						
KRA1 KRA2	4	Development of regional radar network	(a) To update quality control techniques applied to MMD and TMD radar networks to improve their quality of radar composites. (b) To introduce the calibration process for QPE into operation of TMD radar network with technical assistance of JMA. (c) To continue experimental test of radar data sharing among JMA, TMD, and MMD, and to share the experiences of the test with the RA II WIGOS radar project in Southeast Asia. (d) Submission of progress reports by TMD and MMD. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.	Submission of the progress report by involved Members	US\$6,000	TMD	MMD, JMA (Lao PDR, Viet Nam, Philippines to be confirmed)	Ambun Dindang (MMD) Patchara Petvirojchai (TMD) Chiashi Muroi (JMA)	Yes

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
KRA 1 KRA 2 KRA 4	5	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) Conduct a survey on tropical cyclone impacts in Typhoon Committee region. (b) Organize an expert meeting.	Submission of the progress report		Macao (China)	CMA,HKO,USA,JMA,KMA	Lao Ieng Wai (SMG)	Partial
KRA 1 KRA 2 KRA 4 /SG4(a)	6	Storm surge watch scheme	(a) To provide astronomical tide estimated by a ocean model to all the stations where astronomical tide is currently not available. (b) To add storm surge time series prediction points if so requested by Members. (c) To verify storm surge predictions.	(a) &(b) submit progress reports. (c) Report verification results.	/	JMA	/	Chiashi Muroi (JMA)	Yes

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
KRA1 KRA2 KRA6	7	Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICCA)	(a) To implement the field campaign collaboration among participating Members by using buoy, mobile GPS radiosonde, aircraft and rocket drop-sondes. (b) Demonstration research on tropical cyclone intensity change conjunction with WMO-TLFD (to be included in the TC Fellowship Scheme).	(a) Carry out the field campaigns and gather the special observation data of 1-2 target typhoon (b) Submission of the progress report	US\$5,000 (special funding)	CMA, HKO	Participant Members (KMA, TMD)	LEI Xiaotu (CMA) WONG Wai-Kin (HKO)	Yes
KRA 1 KRA 2 KRA 4	8	Development of tropical cyclone forecasting competency	(a) To set up a Task Team to review and finalized the draft tropical cyclone forecast competency. (b) To hold a Task Team meeting if funds are available.	(a) & (b) submit a progress report		RSMC-Tokyo, RSMC-Honolulu	Members (interested in this project)	Chiashi Muroi (RSMC Tokyo) Raymond Tanabe (RSMC Honolulu)	Yes

Status of Preliminary Projects (PPs) of WGM in 2017

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
KRA 1 KRA 2 KRA 4 SG4(a)	1	Available data used in operational tropical cyclone analysis	(a) Use radar data to evaluate the quality of surface observations. (b) Develop wind structure estimation method based on available surface observations.	Submission of the progress report	/	CMA	Members (interested in this project)	Qian Chuanhai (CMA)	Yes
KRA 4 KRA 6 SG6(a)	2	Collaborative Discussion (CoDi) platform on tropical cyclone analysis and forecast	(a) To set up a mailing list and web-based discussion platform to facilitate real-time exchange of information and assessments on tropical cyclone analysis and forecast among the forecasters and/or tropical cyclone experts in Members. (b) To serve as a web-based knowledge portal containing resources on post-season analysis of tropical cyclone and the best practices in tropical cyclone analysis and forecast techniques, applications of satellites and enhanced observations for intensity estimation.	Submission of the progress report	/	CMA HKO	Members interested in this project	QIAN Chuanhai (CMA) WONG Wai-Kin (HKO)	Yes

Annex II:

Proposal for the Perennial Operating Plans (POPs) of WGM in 2018

No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
1	Development of typhoon seasonal prediction system	(a) To provide the products of typhoon seasonal prediction for TC Members (b) To further develop the techniques of typhoon seasonal prediction	Submission of the progress report	/	KMA	/	Nam-Young Kang (KMA)	Continued (2015-)
2	Web-based typhoon forum and CoDi platform	(a) To encourage TC Members and TCS to nominate contact to get the account and password. (b) To encourage interested Members to join for trial during typhoon season. (c) To run routinely.	Submission of the progress report	/	CMA, HKO, TCS	Members	Qian Chuanhai (CMA) Wong Wai-Kin (HKO) Lu Xiaoqing (CMA) Clarence Fong (TCS)	Combine with PP2 in 2017
3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2018, includes the special issue for TC50. (b) Improvement of the editorial procedure and the journal's influence (includes inviting 2-3 visiting editors, and hold 3 rd editorial board meeting)	Submission of the progress report	US\$5,000	CMA	Members	Wang Dongliang,(CMA) Zhou Xiao (CMA)	Continued (2013 -)
4	Transfer of the Technology of the Typhoon Operation System (TOS)	(a) To train the typhoon forecasters on the use of the TOS upon Member's request (b) To provide follow-on technical assistance to Members on the implementation of TOS	Submission of the progress report	US\$5,000	KMA	Members	Kim Dongjim (KMA)	Continued (2014 -)
5	Verification of tropical cyclone operational forecast	(a) To carry out post-season verification and reliability analyses on the operational forecast of tropical cyclones and report to Committee Session (b) To provide the real time verification information on track and intensity	(a) Submission of the post-season verification report for TC Session (b)Progress report on the	US\$3,000	CMA, HKO	Members	Yu Hui (CMA), Sai-Tick Chan (HKO)	Continued (2015 -)

No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
		forecast through WMO-TLFDP website (c) To further improve the evaluation system for tropical cyclone forecast, with special attention on genesis and ensemble forecast in conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme)	improvement of evaluation system for tropical cyclone forecast					

Proposal for the Annual Operating Plans (AOPs) of WGM in 2018

No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
1	Enhanced use of ensemble forecast	(a) To provide verification results of ensemble tropical cyclone activity predictions from four NWP centers and multi-center grand ensemble (MCGE). (b) To further develop tropical cyclone genesis guidance using early Dvorak Analysis (EDA) and global ensemble.	(a) Provide verification results. (b) Submit progress report	/	JMA	/	Chiashi Muroi (JMA)	Continued (2011 -)
2	Improve the performances and impacts of South China Sea typhoon model	(a) Increasing model products and enhancing the application of TRAMS (b) Further improving the forecasting ability of TRAMS, especially for the intensity and precipitation forecasting.	Submission of the assessment of performance report of model	/	CMA	Viet Nam, PAGASA, MMD	Chen Zitong (CMA)	Continued (2012 -)

No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
3	Development of regional radar network	(a) To further refine quality control techniques applied to MMD and TMD radar networks, including dual pol. radars, to improve their quality of radar composites (b) To implement and refine MMD and TMD's QPE calibration using rain-gauge with technical assistance of JMA. (c) To continue the experimental regional radar composite data exchange, and to share the progress with the RA II/V WIGOS radar project in Southeast Asia for its discussion on expansion of this experiment. (d) Submission of progress reports by TMD and MMD. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.	Submission of the progress report by involved Members	US\$6,000	TMD, MMD, JMA	Lao PDR, Vie Nam, Philippines	Lucia Euggong (MMD) Patchara Petvirojchai (TMD) Chiashi Muroi (JMA)	Continued (2011 -) Renamed from AOP4 in 2017
4	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) Complete the first draft of the assessment report for Members' comment. (b) Organize an expert meeting (likely in Macao, China).	Submission of the progress report	US\$7500	Macao (China)	CMA,HKO,USA , JMA, KMA	Lao Ieng Wai (SMG)	Continued (2014-) Renamed from AOP5 in 2017
5	Storm surge watch scheme	(a) To provide astronomical tide estimated by an ocean model to the stations where astronomical tide is not available.	Submission of the progress report	/	JMA	/	Chiashi Muroi (JMA)	Continued (2012-) Renamed from AOP6 in 2017

No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
		(b) To add storm surge time series prediction points if so requested by Members. (c) To publish verification results of storm surge predictions. (d) Request Members to provide complete hourly tidal data of at least one year to provide accurate astronomical tides at the stations. (e) Request Members to provide tidal observations during storm surge events for verification of storm surge predictions.						
6	Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICCA)	(a) To implement the field campaign collaboration among participating Members by using buoy, mobile GPS radiosonde, aircraft and rocket drop-sondes and so on. (b) Demonstration research on tropical cyclone intensity change and forecast in conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme). (c) To hold a joint workshop with WMO-TLFDP and HIWeather on the experiment of typhoon (likely in June in Shanghai).	(a) Carry out the field campaigns operationally. (b) Submission of the progress report	US\$5,000 (special funding)	CMA, HKO	Participant Members	LEI Xiaotu (CMA) WONG Wai-Kin (HKO)	Continued (2014-) Renamed from AOP7 in 2017

Proposal for the Preliminary Projects (PPs) of WGM in 2018

No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Status of Completion
1	Available data used in operational tropical cyclone analysis	(a) Use radar data to evaluate the quality of surface observations. (b) Develop wind structure estimation method based on available surface observations.	Submission of the progress report	/	CMA	Members (interested in this project)	Qian Chuanhai (CMA)	Continued (2015-)
2	Enhancing Utilization of Hiramari 8/9 Products	(a) Review and verification of the RDCA product through test operation in MMD. (b) Improvement of the product through a technical meeting at JMA. (c) Drafting a progress report by MMD with assistance of JMA.	Submission of the progress report.	US\$6,000	JMA	MMD, MSS, NHMS of Viet Nam	Ms Lucia Euggong (MMD) Mr Wong Songhan (MSS) Mr. Vo Van Hoa (NHMS of Viet Nam) Mr Koichiro Kakihara (JMA)	To be launched (2018 -)