

**WORKING GROUP ON METEOROLOGY ACTIVITIES
ANNUAL REPORT 2022**

(Submitted by WGM Chair)

ACTION REQUIRED:

The Committee is invited to:

- a) Take note of the Members activities and major progress and issues in meteorology component in 2022 as reported by Members at the 17th IWS.
- b) Review the activities of WGM conducted in 2022.
- c) Approve the recommendations and planned activities of WGM for 2023 and beyond.

APPENDICES:

- A. DRAFT TEXT FOR INCLUSION AT SESSION REPORT
- B. Report on activities of Working Group on Meteorology (WGM) in 2022
- C. Summary Report of WGM Parallel Meeting at the 17th IWS

APPENDIX A

DRAFT TEXT FOR INCLUSION IN THE SESSION REPORT

8.1 Meteorological Component

1. The Committee took note of the Member's activities and major progress and issues in Meteorological Component in 2022 as reported by Members at the 17th 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 X**.
3. The Committee took note of the outcomes of the WGM Parallel Session at the 17th IWS on 29-30 November 2022. With the assistances of TCP/WMO and TCS and the strong support from all Members, WGM has successfully completed the tasks in 2022 with significant outcomes as follows:
 - a. WGM has fulfilled all the action plans (4 POPs, 9 AOPs and 2 PPs) in 2022, which were endorsed at the 54th TC Session.
 - b. Since the outbreak of COVID-19 in early 2020, the impacts of the COVID-19 pandemic have been deep and wide. Some activities in WGM such as research fellowships, technical transfer and meetings have been either cancelled or postponed due to global travel restrictions and border closure as well as strict social distancing measures in many countries/places.
 - c. After the 54th TC Session in 2022, WGM has been carrying out the following activities that involve the cooperation among Members as well as other TC WGs and international organizations:
 - i. Coordinated with the Malaysian Meteorological Department (MET Malaysia) to organize the fifth WGM Annual Meeting in a hybrid mode (video and face-to-face) on 13 October 2022.
 - ii. Coordinated with China Meteorological Administration (CMA) for the training Course "Seventh International Distance Training Course on Tropical Cyclone Monitoring and Forecasting" from 24 October to 4 November 2022.
 - iii. Coordinated with TRCG to host the 2022 research fellowship by the Hong Kong Observatory (HKO) on a topic entitled "Study on the characteristics and model forecast performance of rapid intensification (RI) of near-landfall tropical cyclones" via a remote approach.

Conclusions of WGM

Based on the information provided by Members and the respective coordinators of the operating plans, and 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 2022.
- b. Members made significant progress during 2022 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 2022.
- d. Based on the discussion on the operating plans for 2022 during the 17th IWS, it was concluded to adopt the operating plans as follows:
 - i. The POP items 1-4 will be continued in 2023.
 - ii. The AOP items 1-9 will be continued in 2023.
 - iii. The PP item 1 will be closed.
 - iv. The PP item 2 will be moved to AOP10 in 2023.
 - v. A new PP item 1 “Assessment Report on Regional Influence of Anomalous Tropical Cyclone Activity in the Western North Pacific (WNP)” organized by CMA will be introduced in 2023.
 - vi. A new PP item 2 “Tropical Cyclone Monitoring using Drifting Buoys” organized by KMA will be conducted in 2023.
- e. The total budget proposed by WGM, which will be concurred at the AWG meeting, for undertaking the operating plans (AOPs, POPs and PPs) in 2023 is US\$38,000.
- f. The proposed WGM 2023 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in [Annex II](#).

Recommendations of WGM

- a. To request KMA to further develop the techniques of typhoon summer prediction and provide the information to TC Members.
- b. To request CMA to encourage TC Members to use the Collaborative Discussion (CoDi) platform especially for tropical cyclones in the basin of SCS.
- c. To request CMA to enlarge the usage of CoDi platform for the International Training Course on Tropical Cyclone and examination of TC track and intensity.
- d. To request STI to publish the TCRR Journal on a quarterly basis in 2023, and to improve the editorial procedure and Journal’s influence.
- e. To request STI to issue the summary report on verification of TC forecast products in 2022 typhoon season in the western North Pacific, and to investigate the track predictability for other basins.

- f. To request STI to strengthen international cooperation and promote the exchange of TC data and verification techniques.
- g. To request JMA to provide the current operational TC genesis guidance products using ensemble forecast.
- h. To request JMA to seek further approaches to increase the benefit of ensemble forecast utilization, including improvement of the current operational products.
- i. To request CMA to improve the forecast ability and reduce the long-term forecast error of the CMA-TRAMS model, and to optimize the visualization for typhoon forecast product.
- j. To request JMA to further refine quality control techniques applied to the participants' radar networks to improve their quality of radar composites, and to implement and refine Malaysian Meteorological Department (MET Malaysia) and Thailand Meteorological Department (TMD)'s QPE calibration using rain-gauge.
- k. To request JMA to support applicants to join the experimental regional radar data exchange in the future, and to share the progress with the RA II/V WIGOS radar project in Southeast Asia.
- l. To request JMA to hold follow-up technical meeting(s) upon receipt of progress reports on the project Development of Regional Radar Network (AOP3) from participants.
- m. To request MET Malaysia and HKO to conduct training attachment for two participants from two TC Members on Radar Integrated Nowcasting System (RaINS) in 2023.
- n. To request JMA to add storm surge time series prediction upon request from Members, and to publish verification results of storm surge predictions.
- o. To request JMA to encourage Members to provide complete hourly sea level data of at least one year to provide accurate astronomical tides at the stations.
- p. To request JMA to encourage Members to provide sea level observations during storm surge events for verification of storm surge predictions.
- q. To request CMA to conduct more scientific experiments with focus on boundary layer structure and air-sea interaction, and to share experiment datasets under support of the Asia-Pacific Typhoon Collaborative Research Center (AP-TCRC).
- r. To request CMA to conduct research based on experiment datasets to improve forecast skills including identification technique for intensity and gale radius, and data assimilation and physical scheme.
- s. To request JMA to improve Rapidly Developing Cumulus Area (RDCA) algorithm through the joint development by JMA and Met Malaysia.
- t. To request JMA to provide supports for development of RDCA by Meteorological Service Singapore (MSS), TMD and Viet Nam Meteorological and Hydrological Administration (VNMHA).
- u. To request JMA to hold follow-up meeting(s) upon receipt of progress reports on the project **Enhancing Utilization of Himawari 8/9 Products** (AOP7) from participants.
- v. To request CMA to hold a specific seminar on **Parallel Analysis of Satellite Data in Operational Tropical Cyclone Monitoring** (AOP8) in 2023.
- w. To request CMA to share the work of AOP8 and discuss with experts during ITWC-10 on December 5-9, 2022.
- x. To request CMA to analyze TCs in the SCS using parallel satellite data.

- y. To request JMA to support a new AOP of WGH through providing 1-month and 3-month ensemble NWP model data, necessary for the project and available, to ICHARM.
- z. To request JMA to continue sharing knowledge and experience on awareness raising through lectures for online workshops and meetings of IFI project.
- aa. To request JMA to promote awareness with hydrological authorities to both local governments and public, including the appropriate use of products.
- bb. To request KMA to introduce GK2A high level products related to typhoon forecast and share the technique using GK2A data.
- cc. To request KMA to hold follow-up technical meeting(s) upon the receipt of progress reports to identify a way forward.
- dd. To endorse the proposed action plans in 2023 (including 4 POPs, 10 AOPs and 2 PPs) as listed in **Annex II of Appendix C – Summary Report for the WGM Parallel Meeting at the 17th IWS**, which summarizes the above recommendations with additional action items.
- ee. To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.
- ff. To re-appoint Dr. Tang Jie as Chair of WGM, Dr. Vicente B. Malano and Mr. Muhammed Helmi Abdullah as Vice-Chairs of WGM.
- gg. To re-appoint Mr. Hosomi Takuya as the rapporteur of TOM.
- hh. To encourage project coordinators of all working groups to submit the outcome (research paper) to the TCRR journal.

Appendix B
Report on activities of Working Group on Meteorology (WGM)
in 2022

2022 ANNUAL REPORT OF WGM

(Submitted by Chair of WGM)

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 54th TC Session, the composition and focal point members list of WGM are:

Chair	Dr. TANG Jie (China)
Vice Chair	Dr. Vicente B. MALANO (Philippines) Mr. Muhammed Helmi ABDULLAH (Malaysia)
Members	Ms. Phalla PEOU (Cambodia) Ms. XIANG Chunyi (China) Mr. RYU Ki Ryol (DPR Korea) Mr. K. K. HON (Hong Kong, China) Mr. HOSOMI Takuya (Japan) Mr. Bounteum SISOUPHANTHAVONG (Lao PDR) Mr. LOK Chan Wa (Macao, China) Mr. Jun GALANG (Philippines) Ms. WON Seonghee (Rep. of Korea) Mr. Lesley CHOO (Singapore) Dr. Wattana KANBUA (Thailand) Mr. Christopher BRENCHLEY (USA) Dr. Hoang Phuc LAM (Viet Nam)
Secretary of Mete.	Mr. Clarence FONG

2.2 Experts from other working groups of TC, TCP/WMO, WWRP/WMO, TCS, RSMC-Tokyo, etc. have also provided assistances to accomplish the tasks of WGM over 2022, endorsed at the 54th session of TC. However, the outbreak of COVID-19 in early 2020 caused deep and wide impacts over the world and some activities in WGM such as research fellowships, technical transfer and meetings have been either cancelled or postponed due to global travel restrictions and border closure as well as strict social distancing measures in many countries/places.

3. The progress of WGM's plans in 2022

With the assistances of TCP/WMO and TCS and the strong support from all Members, WGM has successfully completed the action plans (4 POPs, 9 AOPs and 2 PPs) in 2022, which were endorsed at the 54th Session. The WGM activities and the progress of all action items in 2022 are reported in the **Appendix C – Summary Report of the WGM Parallel Meeting at the 17th IWS**. The complete table of the 2022 action plans and its implementation status are listed in **Annex I** of the Summary Report.

After the 54th TC Session in 2022, WGM has been carrying out the following activities that involve the cooperation among Members as well as other TC WGs and international organizations:

- i. Coordinated with the Malaysian Meteorological Department (MET Malaysia) to

organize the fifth WGM Annual Meeting in a hybrid mode (video and face-to-face) on 13 October 2022.

- ii. Coordinated with China Meteorological Administration (CMA) for the training Course “Seventh International Distance Training Course on Tropical Cyclone Monitoring and Forecasting” from 24 October to 4 November 2022.
- iii. Coordinated with TRCG to host the 2022 research fellowship by the Hong Kong Observatory (HKO) on a topic entitled “Study on the characteristics and model forecast performance of rapid intensification (RI) of near-landfall tropical cyclones” via a remote approach.

4. Conclusions

Based on the information provided by Members and the respective coordinators of the operating plans, and 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 2022.
- b. Members made significant progress during 2022 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 2022.
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- f. The proposed WGM 2023 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in [Annex II](#).

5. **Recommendations**

- a. To request KMA to further develop the techniques of typhoon summer prediction and provide the information to TC Members.
- b. To request CMA to encourage TC Members to use the Collaborative Discussion (CoDi) platform especially for tropical cyclones in the basin of SCS.
- c. To request CMA to enlarge the usage of CoDi platform for the International Training Course on Tropical Cyclone and examination of TC track and intensity.
- d. To request STI to publish the TCRR Journal on a quarterly basis in 2023, and to improve the editorial procedure and Journal's influence.
- e. To request STI to issue the summary report on verification of TC forecast products in 2022 typhoon season in the western North Pacific, and to investigate the track predictability for other basins.
- f. To request STI to strengthen international cooperation and promote the exchange of TC data and verification techniques.
- g. To request JMA to provide the current operational TC genesis guidance products using ensemble forecast.
- h. To request JMA to seek further approaches to increase the benefit of ensemble forecast utilization, including improvement of the current operational products.
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- q. To request CMA to conduct more scientific experiments with focus on boundary layer structure and air-sea interaction, and to share experiment datasets under support of AP-TCRC.
- r. To request CMA to conduct research based on experiment datasets to improve forecast skills including identification technique for intensity and gale radius, and data assimilation and physical scheme.
- s. To request JMA to improve Rapidly Developing Cumulus Area (RDCA)

algorithm through the joint development by JMA and Met Malaysia.

- t. To request JMA to provide supports for development of RDCA by Meteorological Service Singapore (MSS), TMD and Viet Nam Meteorological and Hydrological Administration (VNMHA).
- u. To request JMA to hold follow-up meeting(s) upon receipt of progress reports on the project **Enhancing Utilization of Himawari 8/9 Products** (AOP7) from participants.
- v. To request CMA to hold a specific seminar on **Parallel Analysis of Satellite Data in Operational Tropical Cyclone Monitoring** (AOP8) in 2023.
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- x. To request CMA to analyze TCs in the SCS using parallel satellite data.
- y. To request JMA to support a new AOP of WGH through providing 1-month and 3-month ensemble NWP model data, necessary for the project and available, to ICHARM.
- z. To request JMA to continue sharing knowledge and experience on awareness raising through lectures for online workshops and meetings of IFI project.
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- ee. To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.
- ff. To re-appoint Dr. Tang Jie as Chair of WGM, Dr. Vicente B. Malano and Mr. Muhammed Helmi Abdullah as Vice-Chairs of WGM.
- gg. To re-appoint Mr. Hosomi Takuya as the rapporteur of TOM.
- hh. To encourage project coordinators of all working groups to submit the outcome (research paper) to the TCRR journal.

Appendix C

Summary Report of WGM Parallel Meeting at the 17th IWS

ESCAP/WMO Typhoon Committee
17th Integrated Workshop
29-30 November 2022
Video Conference

FOR PARTICIPANTS ONLY
11 November 2022
ENGLISH ONLY

WORKING GROUP ON METEOROLOGY ACTIVITIES PROGRESS REPORT 2022

(For TC 17th IWS)

(Drafted and Submitted by WGM Chair)

ACTIONS PROPOSED:

The Committee is invited to:

- (a) Take note of the Members activities and major progress and issues in meteorology component in 2022 as reported.
- (b) Review the implementations of all WGM activities conducted in 2022.
- (c) Approve the recommendations and planned activities of WGM for 2023 and beyond.

ANNEXES:

- I. Implementation status of WGM plans in 2022
- II. Proposal plans of WGM activities in 2023
- III. Summary of the 5th WGM Annual Meeting

Progress report on the WGM in 2022
(For TC 17th IWS, Video Conference, 29-30 November 2022)

1. Background

- After the 54th TC Session, the composition and focal point members list of WGM are:

Chair	Dr. TANG Jie (China)
Vice Chair	Dr. Vicente B. MALANO (Philippines) Mr. Muhammed Helmi ABDULLAH (Malaysia)
Members	Ms. Phalla PEOU (Cambodia) Ms. XIANG Chunyi (China) Mr. RYU Ki Ryol (DPR Korea) Mr. K. K. HON (Hong Kong, China) Mr. HOSOMI Takuya (Japan) Mr. Bounteum SISOUPHANTHAVONG (Lao PDR) Mr. LOK Chan Wa (Macao, China) Mr. Jun GALANG (Philippines) Ms. WON Seonghee (Rep. of Korea) Mr. Lesley CHOO (Singapore) Dr. Wattana KANBUA (Thailand) Mr. Christopher BRENCHLEY (USA) Dr. Hoang Phuc LAM (Viet Nam)
Secretary of Mete.	Mr. Clarence FONG

- At the 7th IWS 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 the proposal was adopted by WGM. POPs refer to WGM activities that will be carried out repeatedly in following years while PPs refer to projects which preliminary studies are needed to be undertaken by WGM.
- The action plans in 2022 (including 4 POPs, 9 AOPs and 2 PPs) have been endorsed by 54th TC Session.

2. Progress of WGM operating plans (POPs, AOPs and PPs) in 2022

- The progress and the results of all the priority plans (include 4 POPs, 9 AOPs and 2 PPs) since the 54th TC Session as well as the proposed plans for 2023 submitted by the respective coordinators, which were reported as shown in

bullet 2.1 to 2.15.

- The implementation status of WGM operating plans in 2022 including the action plans and completion status; and the proposed operating plans in 2023 including success indicators and budget request are listed in [Annex I and Annex II](#) respectively.

2.1 POP1: Improve the Algorithm of Typhoon Summer Prediction (Previous name: Development of Typhoon Seasonal Prediction System)

- KMA continues to provide the products of typhoon seasonal prediction for TC Members and distribute the results to Members by email.
- The forecast is based on one statistical model (multiple linear regression model), one dynamical model (Global seasonal forecasting system – GloSea6 model) and two hybrid models (CFS and GloSea6 models).
- A second statistical model is on test run which includes 22 climate indices and 14 sea ice indices, with the western North Pacific divided into two domains (west of 140°E and east of 140°E).

2.2 POP2: Collaborative Discussion (CoDi) Forum on TC Analysis and Forecast

- Tropical Cyclone Collaborative Discussion (CoDi) Platform provides real-time exchange of information. User can communicate through online discussions and audio/video conferences. A user manual has been developed.
- The system supports various devices, and instant reminder messages will be sent to user's email address if user does not check the information.
- Enhanced image of FY-4B for NORU (2022) was shared in the Forum in 2022. More probability products such as probability of genesis and tropical storm force winds will be shared in the future.
- Open registration for international trainees at the international training course on tropical cyclone will be provided. Re-examination of TC track and intensity will also be available.

2.3 POP3: Tropical Cyclone Research and Review

- Since its launch in February 2012, 43 issues of *Tropical Cyclone Research and Review* (TCRR) were published, covering the topics of tropical cyclone (TC) intensity and structure, TC climatology, review of TC in history, operational TC forecast verification, TC induced storm surge, flood or wave, and risk management etc.

- Authors come from 20 different countries and regions, two-thirds of them are international authors. Quality of the journal is ensured by strict peer-review, with two-thirds of the reviewers are overseas experts.
- The journal is hosted in different locations, including TCRR official homepage, ScienceDirect and KeAi. Readers spread over 126 Countries, and over 137,000 full-text downloads via ScienceDirect. 40 articles published in 2020-2021 has been cited 130 times.
- Currently, TCRR has been included in four databases: ScienceDirect, Directory of Open Access Journals (DOAJ), China National Knowledge Infrastructure (CNKI) and Emerging Sources Citation Index (ESCI).

2.4 POP4: Verification of Tropical Cyclone Operational Forecast

- Official subjective deterministic forecast guidance and objective deterministic/ensemble forecast guidance (global and regional model) of 18 tropical cyclones (2201-2218) in 2022 was studied and verified. Will continue to issue the summary report on verification of TC forecast products in 2022 typhoon season in western North Pacific.
- Tropical cyclone track predictability in the next 15 years was also discussed. A further 2-day improvement in TC track forecast lead times may be projected for the coming 15 years up to 2035.
- It is planned to issue the verification results (data and figures) for other basins and continue to strengthen international cooperation and promote the exchange of TC data and verification techniques.

2.5 AOP1: Enhanced Use of Ensemble Forecast

- Performance of the guidance using EDA and global ensemble has been verified using the data from May 2018 to April 2021.
- JMA updated its global ensemble model in 2022 with improved prediction model and higher resolution. The new ensemble products are utilized in the TC activity prediction map and track forecast probability circle.
- JMA plans to update its global ensemble prediction model in 2023.

2.6 AOP2: Improve the Performances and Impacts of South China Sea Typhoon Model

- TC genesis forecast in 2021 was verified and CMA-TRAMS generally is able to predict cyclone genesis more than 3 days ahead, except for Chanthu (2114).
- Average lead time is 108 hours, which is a significant advantage compared with other global models. And the location error is about 281.6 km.
- It is planned to upgrade the surface layer scheme and PBL scheme to improve forecast ability of rainfall and wind; and develop a typhoon initialization scheme to reduce the long-term forecast error.

2.7 AOP3: Development of Regional Radar Network

- The Guidelines for the Participation in Experimental Regional Radar Composite Data Exchanges in Southeast Asia were developed in 2019 by BKMKG, MET Malaysia, TMD and JMA. VNMHA newly participated in May 2022. JMA has sent official letters with the Guidelines to the participants and they sent back letters with their acceptance.
- An online technical meeting was held from 11 to 12 November 2021 to improve radar techniques and expand the regional radar network in Southeast Asia, with attendees from BKMKG, MET Malaysia, PAGASA, MSS, TMD and VNMHA.
- The Guide to Quantitative Precipitation Estimation (QPE) Program was finalized by TMD, MET Malaysia and JMA in July 2022. The guide is available to interested members.

2.8 AOP4: Radar Nowcasting based on RaINS/SWIRL

- Attachment training on RaINS was successfully held from 8 to 19 August 2022 at MET Malaysia with two participants from TMD and VNMHA, respectively.
- The next attachment training on RaINS is proposed to be held in August 2023.

2.9 AOP5: Storm Surge Watch Scheme

- Verification of storm surge prediction (multi-scenario prediction) in 2021 was completed for stations where sea level observations were available in University of Hawaii Sea Level Center (UHSLC) database. The results were published in the Annual

Report of RSMC Tokyo 2021.

- JMA upgraded the storm surge watch scheme model and renewed its products in August 2022.

2.10 AOP6: Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICCA-II)

- A set of typhoon field scheme based on surface-ocean-aero-satellite unified platform has been set up. Expect to have 1-3 experiment cases each year. Observation study based on experiment data will be carried out.
- A special issue of Frontiers of Earth Science about Typhoon Lekima (2019) was issued in 2022 with 13 papers.
- In 2022, LIDAR array experiments were carried out by STI for Muifa (2212) and Hinnamnor (2211); and rocket with dropsondes was deployed for Noru (2216).

2.11 AOP7: Enhancing Utilization of Himawari 8/9 Products

- JMA developed a technique to identify Rapidly Developing Cumulus Areas (RDCA) using Himawari 8/9 products. Online lecture was provided to MSS, TMD and VNMHA in February 2020.
- JMA held an online technical meeting on the RDCA products on 18 February 2022 to enhance NMHS utilization of observation data from the Himawari-8/9 geostationary meteorological satellites through the development of the RDCA detection techniques. Participants included MET Malaysia, MSS, TMD and VNMHA.
- Source code for RDCA detection was provided to MSS, TMD and VNMHA in 2022 after the meeting.

2.12 AOP8: Parallel Analysis of Satellite Data in Operational Tropical Cyclone Monitoring

- Parallel analysis of TC cases with subjective Dvorak Analysis for both Himawari-8 and FY-4 were carried out. The central cold cloud patterns are basically similar and the final AI-Dvorak analysis shows little difference. However the warmest eye temperature and minimum cold cloud radii show an order between satellites.
- Due to COVID-19 pandemic, the specific seminar on this project has been postponed and is expected to be held in 2023. The project will be shared and

discussed during IWTC-10 on December 5-9, 2022.

2.13 AOP9: Enhancement of Disaster Risk Reduction against Heavy Rain in Collaboration of AOP7 of WGH

- JMA has been providing 1-month ensemble NWP model data and has arranged for providing 3-month ensemble NWP model data to ICHARM.
- By introducing the joint press conferences with MLIT (Ministry of Land, Infrastructure, Transport and Tourism) calling for caution against flood disasters, JMA advised similar cooperation of meteorological and hydrological organizations in other Member countries.
- WGH members visited Japan this year for the annual on-site review in October 2022. JMA hosted a technical excursion for WGH experts at the JMA Headquarters, introducing the general and flood forecast operations and related disaster risk reduction activities.

2.14 PP1: Workshop on Typhoon Forecasting Techniques and WGM Project Progress Review

- The workshop was successfully held in Malaysia for 2.5 days on 11-13 October 2022 in hybrid format. There were 5 speakers (3 physical from USA and KMA, and 2 online from KMA and STI), and 24 participants (19 physical and 5 online).
- The 5th WGM Annual Meeting was hosted by MET Malaysia in the afternoon of 13 October 2022.

2.15 PP2: GK2A Utilization for Tropical Cyclone

- GEO-KOMPSAT-2A(GK2A) was launched on December 4, 2018 and in operation since 00UTC July 25, 2019. Data in netCDF format are distributed via land line service and satellite broadcasting service. Request-based GK2A Rapid Scan Observation is also available for Asian Pacific Region (RA II and V).
- The products were also introduced in (1) Workshop on Satellites for Tropical Cyclones (IWSATC-3) on December 9, 2021; (2) Typhoon Forecasting Techniques Workshop (PP1) on October 12, 2022; and (3) Meteorological Satellite Data Utilization over Asia Region on October 17-18, 2022.
- The project will be moved to AOP in 2023.

3. Conclusions and the proposed operating plans for 2023

Based on the information provided by Members and the respective coordinators of the operating plans, and 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 2022.
- b. Members made significant progress during 2022 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 2022.
- d. Based on the discussion on the operating plans for 2022 during the 17th IWS, it was concluded to adopt the operating plans as follows:
 - i. The POP items 1-4 will be continued in 2023.
 - ii. The AOP items 1-9 will be continued in 2023.
 - iii. The PP item 1 will be closed.
 - iv. The PP item 2 will be moved to AOP10 in 2023.
 - v. A new PP item 1 “Assessment Report on Regional Influence of Anomalous Tropical Cyclone Activity in the Western North Pacific (WNP)” organized by CMA will be introduced in 2023.
 - vi. A new PP item 2 “Tropical Cyclone Monitoring using Drifting Buoys” organized by KMA will be conducted in 2023.
- e. The total budget proposed by WGM, which will be concurred at the AWG meeting, for undertaking the operating plans (AOPs, POPs and PPs) in 2023 is US\$38,000.
- f. The proposed WGM 2023 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in [Annex II](#).

Annex I: Status of Perennial Operating Plans (POPs), Annual Operating Plans (AOPs) and Preliminary Projects (PPs) of WGM in 2022

Status of Perennial Operating Plans (POPs) of WGM in 2022

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
KRA1 KRA2 KRA6	1	Improve the algorithm of typhoon summer prediction (Previous name: Development of typhoon seasonal prediction system)	(a) To improve typhoon summer prediction techniques (b) To share knowledge and encourage member's cooperation	(a) Provide the information of typhoon summer prediction via e-mail for member countries on late May (b) Submission of the progress report	/	KMA	/	Dr. Se Hwan Yang (KMA)	Continued (2021-)	Completed
KRA 6 SG 6b SG 6c	2	Collaborative Discussion (CoDi) Forum on TC Analysis and Forecast	(a) To encourage Members' typhoon forecasters to use this platform for instant or real time online discussions or information exchange (b) To run routinely.	Submission of the progress report	/	CMA, HKO, TCS	Members	Mr. Qian Chuanhai (CMA) Mr. Wong Wai-Kin (HKO) Ms. Lu Xiaoqing (CMA)	Continued (2018-)	Completed
KRA 1 - 6	3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2022. (b) Improvement of the editorial procedure and the journal's influence	Submission of the progress report	US\$9,000	CMA	Members	Dr. Wang Dongliang (CMA) Ms. Zhou Xiao (CMA)	Continued (2013-)	Completed
KRA1 KRA2 KRA6 SG 6b SG 6c	4	Verification of tropical cyclone operational forecast	(a) To carry out post-season verification on the operational forecast of 2021 typhoon and report to Committee session. (b) To further improve the verification methodologies of evaluation system for typhoon forecast. (c) To offer fellowship for training on (b).	(a) Submission of the post-season verification report for TC Session (b) Progress report on the improvement of evaluation system for tropical cyclone forecast	-	CMA, HKO	Members	Mr. Chen Guomin (CMA), Mr. Wong Wai-Kin (HKO)	Continued (2015-)	Completed

Status of Annual Operating Plans (AOPs) of WGM in 2022

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	1	Enhanced use of ensemble forecast	(a) To further develop tropical cyclone genesis guidance using early Dvorak Analysis (EDA) and global ensemble.	(a) Provide verification results. (b) Submit progress report	/	JMA	/	Mr. HOSOMI Takuya (JMA)	Continued (2011-)	In progress
KRA1 KRA2 KRA6	2	Improve the performances and impacts of South China Sea typhoon model	To Improve the performances and impacts of TRAMS. (a) Dynamical core: improve time-varying reference scheme, and the calculation accuracy of model's lower levels SL advection scheme. (b) Physical processes: improve convection parameterization scheme and develop a micro-physic scheme with AI learning capabilities. (c) Model products: Improve typhoon intensity forecast products and typhoon maximum wind speed products.	Submission of the assessment of performance report of model	/	CMA	Viet Nam, PAGASA, MET Malaysia	Dr. Chen Zitong (CMA)	Continued (2012-)	Completed

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
KRA1 KRA2	3	Development of regional radar network	<p>(a) To further refine quality control techniques applied to the participants' radar networks, including dual pol. radars, to improve their quality of radar composites.</p> <p>(b) To implement and refine MET Malaysia and TMD's QPE calibration using rain-gauge with technical assistance of JMA.</p> <p>(c) To support applicants to join the experimental radar data exchange in the near future, and to share the progress with the RA II/V WIGOS radar project in Southeast Asia.</p> <p>(d) To compose a user's guide among JMA, MET Malaysia and TMD.</p> <p>(e) Submission of progress reports by participants. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.</p>	Submission of the progress report by involved Members	US\$8,000	TMD, MET Malaysia, JMA	Lao PDR, Viet Nam, Philippines	Mr. Asmadi Abdul Wahab (MET Malaysia) Ms. Patchara Petvirojchai (TMD) Mr. MINEMATS U Hiroaki (JMA)	Continued (2011-)	In progress (a)-(c), (e) Completed (d)
KRA1 KRA2 KRA3	4	Radar nowcasting based on RaINS/SWIRL	<p>Training for two participants from two ESCAP/WMO TC Member Countries. Topics of training are:</p> <p>(a) Composite radar reflectivity from multiple radars</p>	Presentation and Submission of the progress report	US\$5,000	MET Malaysia, HKO	Mr Nguyen Quang Vinh, Meteorological and Hydrological Viet Nam Administration (VNMHA) and Ms Pantaree Nongnut, Thailand Meteorologi-	Mr. Hamray Muhammad Yazit (MET Malaysia), Mr. Nursalleh K Chang (MET Malaysia), Mr. Yip Weng Sang (MET	Continued (2019-)	Attachment Training on RaINS was successfully held on 8-19 Aug 2022 at MET Malaysia

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
			<p>(b) Retrieve radar reflectivity from satellite data using AI.</p> <p>(c) Blending radar data with satellite derived radar reflectivity.</p> <p>(d) Nowcasting of Radar-Satellite Blend</p> <p>(e) Preparation of progress report</p>				cal Department (TMD)	Malaysia) Mr. Wong Wai Kin (HKO)		
KRA 1 KRA 2 KRA 4 /SG4(a)	5	Storm surge watch scheme	<p>(a) To add storm surge time series prediction points if requested by Members.</p> <p>(b) To publish verification results of storm surge predictions.</p> <p>(c) To request Members to provide complete hourly sea level data of at least one year to provide accurate astronomical tides at the stations.</p> <p>(d) To request Members to provide sea level observations during storm surge events for verification of storm surge predictions.</p> <p>(e) To upgrade the storm surge watch scheme model and renew SSWS products on the NTP website</p>	Submission of the progress report	/	JMA	/	Mr. HOSOMI Takuya (JMA)	Continued (2012-)	I In progress (a)~(d) Completed (e)

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
KRA1 KRA2 KRA6	6	Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICCA-II)	<p>(a) To implement the field campaign collaboration among participating Members by using aircraft, Unmanned Surface Vessel (UAS), airship, rocket, high-resolution radar etc.</p> <p>(b) To collect and share the field observation and research data</p> <p>(c) Demonstration research on tropical cyclone intensity change in conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme).</p>	Submission of the progress report	/	CMA, HKO	Participant Members (KMA, TMD)	Dr. TANG Jie (STI) Mr. WONG Wai-Kin (HKO) Dr. LEI Xiaotu (CMA)	Continued (2014-)	
KRA 4 KRA 6 SG6(a)	7	Enhancing Utilization of Himawari 8/9 Products	<p>(a) To improve RDCA algorithm through the joint development with technical assistance by JMA to MET Malaysia.</p> <p>(b) To provide supports for development of RDCA by MSS, TMD and VNMHA.</p> <p>(c) Submission of progress reports by the participants. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.</p>	Submission of the progress report.	US\$9,000	JMA	MET Malaysia, MSS, TMD, VNMHA	Mr. MINEMATSU Hiroaki (JMA) Mr. Asmadi Abdul Wahab (MET Malaysia) Mr. Wong Songhan (MSS) Ms. Patchara Petvirojchai (TMD) Mr. Nguyen Vinh Thu (VNMHA)	Continued (2018-)	In progress

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
	8	Parallel analysis of satellite data in operational tropical cyclone monitoring (Available data used in operational tropical cyclone analysis)	<ul style="list-style-type: none"> (a) To hold a specific seminar on this project. (b) To analysis TCs with AI-Dvorak based on parallel satellite data (c) To submit a summary. 	Submission of the progress report	US\$7,000	CMA	Members interested in this project	Ms. XIANG Chunyi (CMA)	Continued	
Cross-cutting project	9	Enhancement of disaster risk reduction against heavy rain in collaboration of AOP7 of WGH	<p>To support AOP7 of WGH through</p> <ul style="list-style-type: none"> (a) Providing 1-month and 3-month ensemble NWP model data, necessary for the project and available, to ICHARM. (b) Sharing the knowledge such as characteristics and features related to NWP. (c) Continuing sharing knowledge and experience on awareness raising through lectures for online workshops and meetings of IFI project (d) Promoting awareness with hydrological authorities to both local governments and public, including the appropriate use of products 	Submission of the progress report	/	JMA	Philippines	Mr. HOSOMI Takuya (JMA)	Continued (2019-)	In progress

Status of Preliminary Projects (PPs) of WGM in 2022

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks	Status of Completion
KRA1 KRA2 KRA3	1	Workshop on typhoon forecasting techniques and WGM project progress review	(a) Training for the younger operational forecaster on the typhoon forecasting new techniques (b) Review the progress of WGM projects	Submission of the progress report	US\$12,000	MET Malaysia (in cooperation with WGM and TRCG)	5 Speakers – 3 Physical (2 USA & 1 KMA) ; 2 Online (1 KMA & 1 STI) 24 Participants – 19 Physical ; 5 Online	MET Malaysia (in cooperation with WGM and TRCG) Ms. Nor Khafiza Manan (MET Malaysia) Mr. Wong Wai-kin (HKO)	Completed	Completed. The workshop was successfully held in hybrid format on 11 – 13 Oct 2022 at Petaling Jaya, Malaysia
KRA1 KRA4	2	GK2A Utilization for Tropical Cyclone	(a) Introduce GK2A upper level products related typhoon forecast and share the technique using GK2A data (b) Submit progress reports. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.	Submission of the progress report	-	KMA	-	Mr. Jun Park (KMA)	Completed and propose moving to AOP for sharing the ideas	Completed

Annex II: Proposal for Perennial Operating Plans (POPs), Annual Operating Plans (AOPs) and Preliminary Projects (PPs) of WGM in 2023

Proposal for Perennial Operating Plans (POPs) of WGM in 2023

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
KRA1 KRA2 KRA6	1	Improve the algorithm of typhoon summer prediction (Previous name: Development of typhoon seasonal prediction system)	(a) To improve typhoon summer prediction techniques (b) To share knowledge and encourage member's cooperation	(a) Provide the information of typhoon summer prediction via e-mail for member countries on late May (b) Submission of the progress report	/	KMA	/	Dr. Se Hwan Yang (KMA)	Continued (2021-)
KRA 6 SG 6b SG 6c	2	Collaborative Discussion (CoDi) Forum on TC Analysis and Forecast	(a) To encourage Members' typhoon forecasters to use this platform for instant or real time online discussions or information exchange (b) To run routinely.	Submission of the progress report	/	CMA, HKO, TCS	Members	Mr. Qian Chuanhai (CMA) Mr. Wong Wai-Kin (HKO) Ms. Lu Xiaoqing (CMA)	Continued (2018-)
KRA 1 - 6	3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2022. (b) Improvement of the editorial procedure and the journal's influence	Submission of the progress report	US\$9,000	CMA	Members	Dr. Wang Dongliang, (CMA) Mr. Fang Zheqing (CMA)	Continued (2013-)
KRA1 KRA2 KRA6 SG 6b SG 6c	4	Verification of tropical cyclone operational forecast	(a) To carry out post-season verification on the operational forecast of 2022 typhoon and report to Committee session. (b) To further improve the verification methodologies of evaluation system for typhoon forecast. (c) To offer fellowship for training on (b).	(a) Submission of the post-season verification report for TC Session (b) Progress report on the improvement of evaluation system for tropical cyclone forecast	-	CMA, HKO	Members	Mr. Chen Guomin (CMA), Mr. Wong Wai-Kin (HKO)	Continued (2015-)

Proposal of Annual Operating Plans (AOPs) of WGM in 2023

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
KRA 2	1	Enhanced use of ensemble forecast	(a) To continue providing the current operational products using ensemble forecast. (b) To seek further approaches to increase the benefit of ensemble forecast utilization, including improvement of the current operational products.	Submission of the progress report	/	JMA	/	Mr. HOSOMI Takuya (JMA)	Continued (2011-)
KRA1 KRA2 KRA6	2	Improve the performances and impacts of South China Sea typhoon model	To Improve the performances and impacts of TRAMS. (a) Dynamical core: improve time-varying reference scheme, and the calculation accuracy of model's lower levels SL advection scheme. (b) Physical processes: improve convection parameterization scheme and develop a micro-physic scheme with AI learning capabilities. (c) Model products: Improve typhoon intensity forecast products and typhoon maximum wind speed products.	Submission of the assessment of performance report of model	/	CMA	Viet Nam, PAGASA, MET Malaysia	Dr. Chen Zitong (CMA)	Continued (2012-)

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
KRA2 KRA5	3	Development of regional radar network	<p>(a) To further refine quality control techniques applied to the participants' radar networks, including dual pol. radars, to improve their quality of radar composites.</p> <p>(b) To implement and refine MET Malaysia and TMD's QPE calibration using rain-gauge with technical assistance of JMA.</p> <p>(c) To support applicants to join the experimental radar data exchange in the near future, and to share the progress with the RA II/V WIGOS radar project in Southeast Asia.</p> <p>(d) Submission of progress reports by participants. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.</p>	Submission of the progress report by involved Members	US\$8,000	TMD, MET Malaysia, JMA	Lao PDR, Viet Nam, Philippines	Mr. Asmadi Abdul Wahab (MET Malaysia) Mr. Tanya THONGNUNU I (TMD) Mr. HAGIYA Satoshi (JMA)	Continued (2011-)
KRA1 KRA2 KRA3	4	Radar nowcasting based on RaINS/SWIRL	<p>Training for two participants from two ESCAP/WMO TC Member Countries. Topics of training are:</p> <p>(a) Composite radar reflectivity from multiple radars</p> <p>(b) Retrieve radar reflectivity from satellite data using AI.</p> <p>(c) Blending radar data with satellite derived radar reflectivity.</p> <p>(d) Nowcasting of Radar-Satellite Blend</p> <p>(e) Preparation of progress report</p>	Presentation and Submission of the progress report	US\$5,000	MET Malaysia, HKO	TBC	Mr. Hamray Muhammad Yazit (MET Malaysia), Mr. Nursalleh K Chang (MET Malaysia), Mr. Yip Weng Sang (MET Malaysia) Mr. Wong Wai Kin (HKO)	Continued (2019-)

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
KRA 2 KRA 3 KRA 5 KRA 7	5	Storm surge watch scheme	<ul style="list-style-type: none"> (a) To add storm surge time series prediction points if requested by Members. (b) To publish verification results of storm surge predictions. (c) To request Members to provide complete hourly sea level data of at least one year to provide accurate astronomical tides at the stations. (d) To request Members to provide sea level observations during storm surge events for verification of storm surge predictions. 	Submission of the progress report	/	JMA	/	Mr. HOSOMI Takuya (JMA)	Continued (2012-)
KRA1 KRA2 KRA6	6	Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICCA-II)	<ul style="list-style-type: none"> (a) To implement the field campaign collaboration among participating Members by using aircraft, Unmanned Surface Vessel (UAS), airship, rocket, high-resolution radar etc. (b) To collect and share the field observation and research data (c) Demonstration research on tropical cyclone intensity change in conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme). 	Submission of the progress report	/	CMA, HKO	Participant Members (KMA, TMD)	Dr. TANG Jie (STI) Mr. WONG Wai-Kin (HKO) Dr. LEI Xiaotu (CMA)	Continued (2014-)
KRA 2 KRA 5	7	Enhancing Utilization of Himawari 8/9 Products	<ul style="list-style-type: none"> (a) To improve RDCA algorithm through the joint development with technical assistance by JMA to MET Malaysia. (b) To provide supports for development of RDCA by MSS, TMD and VNMHA. (c) Submission of progress reports by the participants. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward. 	Submission of the progress report.	US\$9,000	JMA	MET Malaysia, MSS, TMD, VNMHA	Mr. HAGIYA Satoshi (JMA) Mr. Asmadi Abdul Wahab (MET Malaysia) Mr. Lim Yi Xiang (MSS) Mr. Tanya THONGNUNU I (TMD) Mr. Nguyen Vinh Thu (VNMHA)	Continued (2018-)

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
	8	Parallel analysis of satellite data in operational tropical cyclone monitoring (Available data used in operational tropical cyclone analysis)	<ul style="list-style-type: none"> (a) To hold a specific seminar on this project. (b) To analysis TCs with AI-Dvorak based on parallel satellite data (c) To submit a summary. 	Submission of the progress report	US\$7,000	CMA	Members interested in this project	Ms. XIANG Chunyi (CMA)	Continued
KRA 1 KRA 2 KRA 3 KRA 4 KRA 5	9	Enhancement of disaster risk reduction against heavy rain in collaboration of a new AOP of WGH	<p>To support AOP7 of WGH through</p> <ul style="list-style-type: none"> (a) Providing 1-month and 3-month ensemble NWP model data, necessary for the project and available, to ICHARM. (b) Continuing sharing knowledge and experience on awareness raising through lectures for online workshops and meetings of IFI project. (c) Promoting awareness with hydrological authorities to both local governments and public, including the appropriate use of products. 	Submission of the progress report	/	JMA	Philippines	Mr. HOSOMI Takuya (JMA)	Continued (2019-)
KRA1 KRA4	10	GK2A Utilization for Tropical Cyclone	<ul style="list-style-type: none"> (a) Introduce GK2A upper level products related typhoon forecast and share the technique using GK2A data (b) Submit progress reports. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward. 	Submission of the progress report	-	KMA	-	Mr. Jun Park (KMA)	Continued (2021-)

Proposal for Preliminary Projects (PPs) of WGM in 2023

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator	Remarks
	1	Assessment Report on Regional Influence of Anomalous Tropical Cyclone Activity in the Western North Pacific (WNP)	<ul style="list-style-type: none"> (a) Review research on decadal-interdecadal change and variability of tropical cyclone activities. (b) Assess a possible way to observe decadal-interdecadal changes and variability in the recent 5-10 years. (c) Enhance scientific understanding of the regional influences related to anomalous tropical cyclone (TC) activity in WNP. (d) Enhance public/stakeholders' knowledge on the status of scientific understanding and its limitation on regional influences and their long-term variability due to anomalous TCs. (e) Promote research collaboration with the Members to assess and understand decadal-interdecadal variability of TC activities and their influences in the Member's regions. (f) Submit progress reports annually to timely inform 	Submission of the progress report	-	CMA	Scientists and forecasters from Members	Dr. Xin Huang(CMA)	New and will support by AP-TCRC and STCRF

			the progress of research on anomalous climate states of WNP TC activities and influences.						
2	Tropical Cyclone Monitoring using Drifting Buoys	<ul style="list-style-type: none"> (a) Enhance the monitoring of tropical cyclone development and intensification in the western North Pacific (WNP) using drifting buoys (b) Fill in the missing ocean observation over the main region of TC generation and contribute to the decision-making process for tropical cyclone forecasting in real-time (c) Produce the observed ocean data (Pressure, SST) and share with TC members the data in real-time (d) Promote the international cooperation with TC members to drop buoys on the wider area and produce more sufficient ocean data (e) Enhance the utilization of observed ocean data to analyze the influence of oceanic environment in TC activities and improve the prediction skill of TC intensification 	Submission of the progress report	-	KMA	Members interested in this project	Ms. Seonghee Won (KMA)	New	

Report of the 5th Annual Meeting of Working Group on Meteorology (WGM)

I. Organization of the Meeting

1. The 5th Annual Meeting of Working Group on Meteorology (WGM) was hosted by the Malaysian Meteorological Department (MET Malaysia) in the afternoon of October 13, 2022 in conjunction with the WGM's PP1 "Workshop on Typhoon Forecasting Techniques". The Meeting was held in hybrid mode.
2. 12 of 14 Members and Typhoon Committee Secretariat (TCS) with more than 44 participants attended the Meeting. The agenda and participant list can be found in Annex I and II, respectively.
3. The Meeting was moderated by Dr. Tang Jie, Chair of WGM. The main purpose of the Meeting was to review the progress of the annual priority plans of WGM in 2022, and to discuss the implementation plans in 2023.

II. Progress of WGM Annual Priority Plans in 2022 and Implementation Plans for 2023

4. In 2022, WGM has 15 annual priority plans (including 4 POPs, 9 AOPs and 2 PPs). Representatives from the participating Members reviewed the progress of the plans in the meeting. Due to COVID-19 pandemic, some of the plans were postponed.
5. The Members also discussed the implementation plans for 2023. All POPs and AOPs would be continued in 2023, while PP1 "Workshop on Typhoon Forecasting Techniques" by MET Malaysia was completed and would be closed, and PP2 "GK2A Utilization for Tropical Cyclone" would be moved to AOP in 2023.
6. The Members also discussed the feasibility of a newly proposed preliminary project "Annual Western North Pacific Tropical Cyclone Activity Bulletin" in the Meeting. Considering the overlap with the Members' existing activities and concerns about the workload to consolidate the Members' opinions on each topic of the bulletin, the WG will continue to discuss the matter among Members.
7. Details of the progress and plans for the annual priority plans are included in the WGM progress report to be submitted at IWS17.

III. Progress of the Establishment of AP-TCRC

8. The first administration group meeting of AP-TCRC was held on August 8, 2022 and the president of the AP-TCRC signed the agreement in the meeting.
9. The document "Pilot Project of the Technical Cooperation and Research Activities between TC and AP-TCRC" was finalized, and details of the pilot projects were discussed and reported to AWG in September.

10. It was proposed that Prof. Johnny Chan would be the Scientific Director to the administration group of AP-TCRC; and at least 2 ISSC member nominations from Typhoon Committee were encouraged. The first ISSC meeting would be held on December 1, 2022.

IV. Introduction to SSOP-III

11. Mr. Tom Evans, Co-Vice-Chair of AWG introduced new concepts for Phase 3 of SSOP. The project should use a people-centered, bottom-up approach and focus on the hazard awareness and education. Members were encouraged to discuss further and submit a proposal at the IWS17.

V. Date and Venue of the 6th WGM Annual Meeting

12. China proposed to host the 6th WGM Annual Meeting in 2023 if no other Member was interested. The Meeting could be held at the AP-TCRC in Shanghai subject to COVID-19 situations.

VI. Other Business

13. Hong Kong, China discussed the challenges in handling and upgrading weak or monsoon-low type tropical systems in 2022. Communication between centers and sharing of key observations/justifications could be very valuable, and the “warn-on-forecast” approach (i.e. pre-genesis) could be a possible future direction.
14. RSMC Tokyo announced the coming RSMC Tokyo Attachment Training to be held 11-13 January 2023 online with no screening process.
15. Being no other business, the Meeting was closed at 6:00 pm on 13 October 2022.



**ESCAP/WMO Typhoon Committee
The 5th Annual Meeting of TC Working Group on Meteorology**

13 October 2022 14:30~18:10 (GMT+8)

Hosted by

Malaysian Meteorological Department, Malaysia

TENTATIVE AGENDA

Time	Activities	Presenters
14:30-14:45 (15 min)	<ul style="list-style-type: none">• Welcome address: MET Malaysia• Opening address: WGM Chair• Remarks: WGM Vice-Chairs• Introduction by Members• Group Photo	<ul style="list-style-type: none">• MET Malaysia• WGM Chair• WGM Vice-Chairs• Members
14:45-16:45 (120 min)	<ul style="list-style-type: none">• Presentation on POP/AOP/PPs (8 minutes each)	<ul style="list-style-type: none">• Project coordinators
16:45-17:15 (30 min)	<ul style="list-style-type: none">• Discuss and draft priority plans for 2023 (including new plans) and the 17th IWS	<ul style="list-style-type: none">• Project coordinators and Members
17:15-17:30 (15 min)	<ul style="list-style-type: none">• Progress of the establishment of APTCRC	<ul style="list-style-type: none">• STI
17:30-17:40 (10 min)	<ul style="list-style-type: none">• Introduction to SSOP-III	<ul style="list-style-type: none">• Tom Evans
17:40-18:10 (30 min)	<ul style="list-style-type: none">• Date and place for the 6th Annual Meeting• Any other business• Closing remarks	<ul style="list-style-type: none">• WGM Chair

Annex II Participant list of the 5th Annual Meeting of WGM

Member	Name	Email	
Cambodia	Ms PEOU Phalla	phallapeou1@gmail.com	
China	Prof CHEN Zitong	ztchen@gd121.cn	
	Dr WANG Dongliang	wangdl@typhoon.org.cn	
	Mr CHEN Guomin	chengm@typhoon.org.cn	
	Ms XIANG Chunyi	xiangcy@cma.gov.cn	
	Dr TANG, Jie	tangj@typhoon.org.cn	
Hong Kong China	Mr CHOY Chun-wing	cwchoy@hko.gov.hk	
	Mr HON Kai-kwong	kkhon@hko.gov.hk	
	Dr LEE Tsz-cheung	tclee@hko.gov.hk	
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