ESCAP/WMO Typhoon Committee The Fifty-seventh Session 17-20 February 2025 Seda Manila Bay Parañaque City, Metro Manila, Philippines FOR PARTICIPANTS ONLY WRD/TC.57/8.1 17 January 2025 ENGLISH ONLY

WORKING GROUP ON METEOROLOGY ACTIVITIES

ANNUAL REPORT 2024

(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 2024 as reported by Members at the 19th IWS.
- b) Review the activities of WGM conducted in 2024.
- c) Approve the recommendations and planned activities of WGM for 2025 and beyond.

APPENDICES:

- A. DRAFT TEXT FOR INCLUSION AT SESSION REPORT
- B. Report on activities of Working Group on Meteorology (WGM) in 2024
- C. Summary Report of WGM Parallel Meeting at the 19th 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 2024 as reported by Members at the 19th 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 ??**.
- 3. The Committee took note of the outcomes of the WGM Parallel Session at the 19th IWS on 19-22 November 2024. With the assistance of TCP/WMO and TCS and the strong support from all Members, WGM has successfully completed the tasks in 2024 with significant outcomes as follows:
 - a. WGM has fulfilled all the action plans (4 POPs, 12 AOPs and 1 PP) in 2024, which were endorsed at the 56th TC Session.
 - b. After the 56th TC Session in 2024, WGM has been carrying out the following activities that involve cooperations among Members as well as other TC WGs and international organizations:
 - i. Coordinated with RSMC Tokyo Typhoon Center for the online Attachment Training Course from 15 to 26 January 2024.
 - ii. Coordinated with Japan Meteorological Agency (JMA), Japan to organize the 7th WGM Annual Meeting in hybrid mode from 30 to 31 October 2024.
 - iii. Coordinated with Thailand Meteorological Department (TMD) for the Roving Seminar 2024 in hybrid mode from 17 to 19 December 2024.
 - iv. Coordinated with TRCG to offer one research fellowship hosted by the Hong Kong Observatory (HKO).

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 2024.

- b. Members made significant progress during 2024 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 sincere cooperation of all Members and the effective efforts of the WGM focal points, WGM has successfully completed the tasks in 2024 as listed in Annex I of Appendix C.
- d. Based on the discussion on the operating plans for 2024 during the 19th IWS, it was concluded to adopt the operating plans as follows:
 - i. POP item 2 will be closed. POP items 1, 3 and 4 will continue in 2025 as POP1-3.
 - ii. AOP items 1-12 will continue in 2025.
 - iii. PP item 1 will continue and will be moved to AOP item 13 in 2025.
 - iv. A new PP1 titled "Utilization of FengYun Satellite for High Frequency Observation of Tropical Cyclone" will start in 2025.
- e. The total budget proposed by WGM, which will be concurred at the AWG meeting, for undertaking the operating plans (AOPs, POPs and PPs) including the 8th WGM annual meeting in 2025 is US\$47,000.
- f. The proposed WGM 2025 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in Annex II of Appendix C.

Recommendations of WGM

- a. To request KMA to:
 - (i) improve typhoon summer prediction techniques; and share knowledge and encourage TC Member's cooperation.
 - (ii) introduce and share GK2A products related to typhoon forecast.
 - (iii) provide real-time drifting buoys data for monitoring tropical cyclones; and enhance the use of ocean data in analyzing impact on tropical cyclone activities.
- b. To request STI to:
 - (i) enhance the role of the TCRR editorial board; increase international influence; and align research and publication with the development of the Asia Pacific-Typhoon Collaborative Research Center (AP-TCRC).
 - (ii) continue scientific experiments for EXOTICCA; share experiment data under the support of AP-TCRC; and improve forecast skills based on experiment data.

- (iii) share the AI-based TC forecast information; and continue strengthening international cooperation and promote the exchange of TC data and verification techniques.
- c. To request CMA to
 - (i) continue to organize satellite workshop in 2025 for further collaboration among TC Members; and develop and implement new satellite data and technology for operational tropical cyclone monitoring.
 - (ii) enhance research cooperation among experts participating in the 4th assessment report; and request the AP-TCRC to offer international cooperation opportunities.
 - (iii) continue improving the physical process, data assimilation and ensemble forecasting of the CMA-TRAMS model with the use of AI techniques.
- d. To request JMA to:
 - (i) continue providing operational tropical cyclone products using ensemble forecast; research probabilistic forecast products; and update the Global Ensemble Prediction System for improving probabilistic forecasts.
 - (ii) further refine quality control techniques in the radar network; implement and refine QPE calibration with MMD and TMD; support applicants to join the experimental radar data exchange as contribution to RBON (Regional Basic Observing Network) of WMO; and hold follow-up technical meetings/workshop upon submission of progress reports by participants.
 - (iii) publish verification results of storm surge predictions and improve storm surge watch scheme mode; add storm surge time series points if requested by TC Members;
 - (iv) assist MMD, MSS, TMD and VNMHA to improve Himawari 8/9 RDCA algorithm product verification; and provide support for operating RDCA by PAGASA; hold follow-up technical meetings/workshop upon submission of progress reports by participants.
- e. To request Met Malaysia to organize the next Attachment Training on RaINS in 2025 with modules 1) radar QPF/nowcasting; 2) NWP blended with radar QPF; 3) nowcast verification and 4) satellite-derived reflectivity.
- f. To request HKO to establish an expert team for AI applications under WGM and decide the scope and implementation plan regarding the reseach-to-operation initiative on tropical cyclone forecasting and verification; and organize a workshop if resources are available.
- g. To endorse the proposed action plans in 2025 (including 3 POPs, 13 AOPs and 1
 PP) as listed in Annex II of Appendix C Summary Report for the WGM Parallel

Meeting at the 19th IWS, which summarizes the above recommendations with additional action items.

- h. To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.
- i. To re-appoint Dr. ISHIHARA Koji as the rapporteur of TOM.
- j. To re-appoint Dr. Tang Jie as Chairperson, xxx and xxx as Vice-chairpersons of WGM.
- k. To encourage project coordinators of all working groups to submit the outcome (research paper) to the TCRR journal.
- l. To encourage more members to join the collaborative research of AP-TCRC and apply the funding of STCRF of AP-TCRC.

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

in 2024

2024 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 56th TC Session, the composition and focal point members list of WGM are:

Chair	Dr. TANG Jie (China)
Vice Chair	(Vacant)
	Ms. Phalla PEOU (Cambodia)
	Ms. XIANG Chunyi (China)
	Mr. RYU Ki Ryol (DPR Korea)
	Mr. K. K. HON (Hong Kong, China)
	Dr. ISHIHARA Koji (Japan)
	Mr. Bounteum SISOUPHANTHAVONG (Lao PDR)
Members	Mr. LOK Chan Wa (Macao, China)
	Mr. Jun GALANG (Phillippines)
	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 2024, endorsed at the 56th session of TC. WGM activities have returned to normal in 2024 after COVID-19 with new action plans and activities.

3. The progress of WGM's plans in 2024

With the assistances of TCP/WMO and TCS and the strong support from all Members, WGM has successfully completed the action plans (4 POPs, 12 AOPs and 1 PP) in 2024, which were endorsed at the 56th Session. The WGM activities and the progress of all action items in 2024 are reported in the **Appendix C – Summary Report of the WGM Parallel Meeting at the 19th IWS**. The complete table of the 2024 action plans and its implementation status are listed in **Annex I** of Appendix C. After the 56th TC Session in 2024, 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 RSMC Tokyo Typhoon Center for the online Attachment Training Course from 15 to 26 January 2024.
- ii. Coordinated with Japan Meteorological Agency (JMA), Japan to organize the 7th WGM Annual Meeting in hybrid mode from 30 to 31 October 2024.
- iii. Coordinated with Thailand Meteorological Department (TMD) for the Roving Seminar 2024 in hybrid mode from 17 to 19 December 2024.
- iv. Coordinated with TRCG to offer one research fellowship hosted by the Hong Kong Observatory (HKO).

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 2024.
- b. Members made significant progress during 2024 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 sincere cooperation of all Members and the effective efforts of the WGM focal points, WGM has successfully completed the tasks in 2024 as listed in Annex I of Appendix C.
- d. Based on the discussion on the operating plans for 2024 during the 19th IWS, it was concluded to adopt the operating plans as follows:
 - i. POP item 2 will be closed. POP items 1, 3 and 4 will continue in 2025 as POP1-3.
 - ii. AOP items 1-12 will continue in 2025.
 - iii. PP item 1 will continue and will be moved to AOP item 13 in 2025.
 - iv. A new PP1 titled "Utilization of FengYun Satellite for High Frequency Observation of Tropical Cyclone" will start in 2025.

- e. The total budget proposed by WGM, which will be concurred at the AWG meeting, for undertaking the operating plans (AOPs, POPs and PPs) including the 8th WGM annual meeting in 2025 is US\$47,000.
- f. The proposed WGM 2025 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in Annex II of Appendix C.

5. Recommendations

- a. To request KMA to:
 - (i) improve typhoon summer prediction techniques; and share knowledge and encourage TC Member's cooperation.
 - (ii) introduce and share GK2A products related to typhoon forecast.
 - (iii) provide real-time drifting buoys data for monitoring tropical cyclones; and enhance the use of ocean data in analyzing impact on tropical cyclone activities.
- b. To request STI to:
 - (i) enhance the role of the TCRR editorial board; increase international influence; and align research and publication with the development of the Asia Pacific-Typhoon Collaborative Research Center (AP-TCRC).
 - (ii) continue scientific experiments for EXOTICCA; share experiment data under the support of AP-TCRC; and improve forecast skills based on experiment data.
 - (iii) share the AI-based TC forecast information; and continue strengthening international cooperation and promote the exchange of TC data and verification techniques.
- c. To request CMA to
 - (i) continue to organize satellite workshop in 2025 for further collaboration among TC Members; and develop and implement new satellite data and technology for operational tropical cyclone monitoring.
 - (ii) enhance research cooperation among experts participating in the 4th assessment report; and request the AP-TCRC to offer international cooperation opportunities.
 - (iii) continue improving the physical process, data assimilation and ensemble forecasting of the CMA-TRAMS model with the use of AI techniques.
- d. To request JMA to:

- (i) continue providing operational tropical cyclone products using ensemble forecast; research probabilistic forecast products; and update the Global Ensemble Prediction System for improving probabilistic forecasts.
- (ii) further refine quality control techniques in the radar network; implement and refine QPE calibration with MMD and TMD; support applicants to join the experimental radar data exchange as contribution to RBON (Regional Basic Observing Network) of WMO; and hold follow-up technical meetings/workshop upon submission of progress reports by participants.
- (iii) publish verification results of storm surge predictions and improve storm surge watch scheme mode; add storm surge time series points if requested by TC Members;
 - (iv) assist MMD, MSS, TMD and VNMHA to improve Himawari 8/9 RDCA algorithm product verification; and provide support for operating RDCA by PAGASA; hold follow-up technical meetings/workshop upon submission of progress reports by participants.
- e. To request Met Malaysia to organize the next Attachment Training on RaINS in 2025 with modules 1) radar QPF/nowcasting; 2) NWP blended with radar QPF; 3) nowcast verification and 4) satellite-derived reflectivity.
- f. To request HKO to establish an expert team for AI applications under WGM and decide the scope and implementation plan regarding the reseach-to-operation initiative on tropical cyclone forecasting and verification; and organize a workshop if resources are available.
- g. To endorse the proposed action plans in 2025 (including 3 POPs, 13 AOPs and 1 PP) as listed in Annex II of Appendix C Summary Report for the WGM Parallel Meeting at the 19th IWS, which summarizes the above recommendations with additional action items.
- h. To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.
- i. To re-appoint Dr. ISHIHARA Koji as the rapporteur of TOM.
- j. To re-appoint Dr. Tang Jie as Chairperson, xxx and xxx as Vice-chairpersons of WGM.
- k. To encourage project coordinators of all working groups to submit the outcome (research paper) to the TCRR journal.
- l. To encourage more members to join the collaborative research of AP-TCRC and apply the funding of STCRF of AP-TCRC.

Appendix C

Summary Report of WGM Parallel Meeting at the 19th IWS

ESCAP/WMO Typhoon Committee 19th Integrated Workshop/AP-TCRC Forum 19-22 November2024 Shanghai, China FOR PARTICIPANTS ONLY 18 November 2024 ENGLISH ONLY

WORKING GROUP ON METEOROLOGY ACTIVITIES

PROGRESS REPORT 2024

(For TC 19th 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 2024 as reported.
- (b) Review the implementations of all WGM activities conducted in 2024.
- (c) Approve the recommendations and planned activities of WGM for 2025 and beyond.

ANNEXES:

- I. Implementation status of WGM plans in 2024
- II. Proposal plans of WGM activities in 2025
- III. Summary of the 7th WGM Annual Meeting

Progress report on the WGM in 2024

(For TC 19th IWS, 19-22 November 2024)

1. Background

• After the 56th TC Session, the composition and focal point members list of WGM are:

Chair	Dr. TANG Jie (China)
Vice Chair	Vacant
	Ms. Phalla PEOU (Cambodia)
	Ms. XIANG Chunyi (China)
	Mr. RYU Ki Ryol (DPR Korea)
	Mr. K. K. HON (Hong Kong, China)
	Dr. ISHIHARA Koji (Japan)
	Mr. Bounteum SISOUPHANTHAVONG (Lao PDR)
Members	Mr. LOK Chan Wa (Macao, China)
	Mr. Jun GALANG (Phillippines)
	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 2024 (including 4 POPs, 12 AOPs and 1 PP) have been endorsed by 56th TC Session.

2. Progress of WGM operating plans (POPs, AOPs and PPs) in 2024

- The progress and the results of all the priority plans (include 4 POPs, 12 AOPs and 1 PP) since the 56th TC Session as well as the proposed plans for 2025 submitted by the respective coordinators, which were reported as shown in bullet 2.1 to 2.17.
- The implementation status of WGM operating plans in 2024 including the action plans and completion status; and the proposed operating plans in 2025 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 continued to provide the products of typhoon seasonal prediction for TC Members and distributed the forecasts to Members by email in June 2024.
- Four models were used in the forecasts, including one statistical model based on multiple linear regression model, one dynamical model based on Global seasonal forecasting system (GloSea6), and two hybrid models based on CFS and GloSea6.
- Forecast number of tropical cyclones for 2024 summer ranged from 6.1-9.3, and 8 tropical cyclone were observed.

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

- The tropical Cyclone Collaborative Discussion (CoDi) Platform provided realtime exchange of information between TC Members, especially for tropical cyclones over the South China Sea.
- After discussion with RSMC Tokyo which was running a similar platform, The CoDi will be combined with the new platform and the POP will be closed.

2.3 POP3: Tropical Cyclone Research and Review

• Since its launch in February 2012, 51 issues of Tropical Cyclone Research and Review (TCRR) have been published, with contributors from 34 countries and regions.

- 4/5 were international authors and 2/3 were international peer-reviewers.
- Readers spreaded over 126 Countries, and over 120,000 full-text downloads through ScienceDirect each year since 2021.
- The journal received an impact factor of 2.4 and Scopus CiteScore was 4.6 in 2024.

2.4 POP4: Verification of Tropical Cyclone Operational Forecast

- Forecast verification of 19 tropical cyclones over Western North Pacific in 2024 was performed for 9 numerical weather prediction (NWP) models and 7 artificial intelligence (AI) based models
- Track errors for NWP models in 2024 slightly increased compared to 2023. Some of the AI models had approached or even surpassed the performance of NWP models in 2024, especially at 48-96h.
- However the track errors of some individual forecasts using AI-based methods was extremely large, e.g. 2408 Wukong.
- AI-based methods severely under-estimated the intensity of typhoons, with the intensity forecast errors roughly twice as large as those in traditional NWP models.

2.5 AOP1: Enhanced Use of Ensemble Forecast

- JMA continued to provide current operational products using ensemble forecast in 2024, including tropical cyclone activity prediction, track forecast with probability circle, and multi-center ensemble TC track prediction.
- TC track and intensity guidance of NOAA's HAFS (Hurricane Analysis and Forecast System) was added on NTP website.

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

- The forecast performance of the CMA-TRAMS was generally similar between 2024 and 2023, with 48-h track error around 120 km and central pressure around 12hPa.
- Case studies of Maliksi, Prapiroon, Gaemi, Yagi, Bebinca, Pulasan and Krathon were discussed.
- Improvements in the model included physical process, data assimilation and ensemble forecasting.

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 BMKG, MET Malaysia, TMD and JMA. VNMHA and MSS newly participated in May 2022 and April 2023, respectively.
- The technical coordination for data exchange was processed between JMA and BMKG, MSS.
- The WMO/ASEAN training workshop was held in Bangkok from 29 January to 2 February 2024. The next radar workshop will be held in February 2025.

2.8 AOP4: Radar Nowcasting based on RaINS/SWIRL

- The 4th Attachment Training on RaINS was held from 14 to 25 October 2024 at MET Malaysia with participating Members from Singapore and Lao PDR.
- The next Attachment Training on RaINS will be held in 2025 with modules 1) radar QPF/nowcasting; 2) NWP blended with radar QPF; 3) nowcast verification and 4) satellite-derived reflectivity.

2.9 AOP5: Storm Surge Watch Scheme

- No new points for storm surge time series was added in the first to third quarters of 2024. There were 78 points for storm surge time series from 10 Members in 2024.
- Verification of storm surge prediction in 2023 was being conducted for stations where sea level observations were available in University of Hawaii Sea Level Center (UHSLC) and Global Sea Level Observing System (GLOSS) database.
- Members are encouraged to provide sea-level observations during storm surge events for verification of storm surge predictions.

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

- Typhoon wind observations were carried out for Gaemi, Yagi and Bebinca in 2024.
- S4000 wind lidar was installed in Macao, China since 13 September 2024 and provided 3-D wind profile with 25m resolution to SMG for real time.
- STI and HKO flew into Typhoon Trami on 25 and 26 October for the first time.

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 by analyzing 10-min cloud images to detect areas of rapidly developing cumulus, cumulonimbus or unknown mid/low-level cloud.
- PASAGA, Philippines expressed interest to join the project and an online technical meeting was held on 7 March 2024 to enhance NMHS utilization of observation data from the Himawari 8/9 satellites
- JMA reviewed the development status of each country after providing the source code and supported them as needed.

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

- The international workshop was held in Shanghai from 29 to 30 May 2024 with 12 overseas representatives from 6 TC Members and 10 domestic representatives.
- scientific reports were given including FY and GK2A satellite products and applications and TC monitoring technique and methods.
- Another workshop will be organized in 2025 for further collaboration among TC Members.

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

- JMA provided 1-month ensemble NWP model data and was arranged to provide 3-month ensemble NWP model data to ICHARM.
- At RSMC Tokyo attachment training in 2024, ICHARM talked about the hydrology related to typhoon by introducing joint press conferences of JMA and 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 TC Members.

2.14 AOP10: GK2A Utilization for Tropical Cyclone

- One rapid scan about typhoon Krathon was carried out in 2024. To support national and international services over RA II and RA V in Asia-Pacific region, official requests for rapid scan were made available on the designated webpage of NMC/KMA.
- Rapid-scan atmospheric motion vectors (RS-AMV) were derived from GK2A as well as ocean products (sea surface temperature, ocean heat content) for typhoon analysis.

2.15 AOP11: Prepare for the 4th Assessment Report on Impacts of Climate Change on Tropical Cyclones in the Typhoon Committee Region

- Along with the start of the 7th IPCC assessment cycle and considering the increasing attention from scientific community, public and policy makers on impacts of climate change on tropical cyclones, the 4th TC assessment report was started with the cooperation with TC Members.
- A circular letter was sent to TC Members to invite nominations for joining the expert term, and the preliminary expert team consisted of experts from CMA, KMA, JMA and HKO.

2.16 AOP 12: Tropical Cyclone Monitoring using Drifting Buoys

- KMA deployed 8 drifting buoys and shared real-time observation data with TC Members through the GTS.
- A webpage was set up for sharing observation data including sea surface temperature and pressure recorded at 30-minute intervals.
- The expected operating period of each buoy was about 3 months.

2.17 PP1: Promoting Technical Exchange of AI Applications in Tropical Cyclone Analysis and Forecasting

- A kick-start workshop was held at the Hong Kong Observatory from 21 to 22 May 2004. A total of 29 experts from 11 Typhoon Committee Members, Chair of TRCG as well as TC Secretariat participated in the workshop.
- The workshop also invited leading AI development teams from WMO World Meteorological Centre, academia and information technology company to share the latest advancements in AI applications in weather forecasting.
- The workshop discussed user requirements for promoting technical exchange of AI applications in TC analysis and forecasting in Typhoon Committee and concluded with recommendations.

3. Conclusions and the proposed operating plans for 2025

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 2024.
- b. Members made significant progress during 2024 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 sincere cooperation of all Members and the effective efforts of the WGM focal points, WGM has successfully completed the tasks in 2024 as listed in Annex I of Appendix C.
- d. Based on the discussion on the operating plans for 2024 during the 19th IWS, it was concluded to adopt the operating plans as follows:
 - i. POP item 2 will be closed. POP items 1, 3 and 4 will continue in 2025 as POP1-3.
 - ii. AOP items 1-12 will continue in 2025.
 - iii. PP item 1 will continue and will be moved to AOP item 13 in 2025.
 - iv. A new PP1 titled "Utilization of FengYun Satellite for High Frequency Observation of Tropical Cyclone" will start in 2025.
- e. The total budget proposed by WGM, which will be concurred at the AWG meeting, for undertaking the operating plans (AOPs, POPs and PPs) including the 8th WGM annual meeting in 2025 is US\$47,000.
- f. The proposed WGM 2025 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in Annex II of Appendix C.

Status of Perennial Operating Plans (POPs) of WGM in 2024

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator (please add email address)	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 	/	КМА	/	Ms. Seonghee Won (KMA)	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)	Completed and closed
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	СМА	Members	Dr. Wang Dongliang, (CMA) Mr. Fang Zheqing (CMA)	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 2022 typhoon and report to Committee session. (b) To further improve the verification methodologies of 	 (a) Submission of the post-season verification report for TC Session (b)Progress report on the improvement of evaluation system for 	-	СМА, НКО	Members	Mr. Chen Guomin (CMA), Mr. Wong Wai-Kin (HKO)	Completed

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator (please add email address)	Status of Completion
			evaluation system for typhoon forecast. (c) To offer fellowship for training on (b).	tropical cyclone forecast					

Status of Annual Operating Plans (AOPs) of WGM in 2024

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participant s	Coordinator (please add email address)	Status of Completion
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	1	JMA	/	Dr. ISHIHARA Koji (JMA) k- ishihara@met. kishou.go.jp	Completed
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.	Submission of the assessment of performance report of model	/	СМА	Viet Nam, PAGASA, MET Malaysia	Dr. Chen Zitong (CMA)	Completed

SP's					Funding			Coordinator	Status of
KRA &SG	No.	Objective	Action	Success Indicators	(Req. & S.)	Organizer	Participant s	(please add email address)	Completion
			 (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. 						
KRA2 KRA5	3	Development of regional radar network	 (a) To further refine quality control techniques applied to the participants' radar networks, including dual pol. radars, to improve their quality of radar composites. (b) To implement and refine MET Malaysia and TMD's QPE calibration using rain-gauge with technical assistance of JMA. (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. (d) Submission of progress reports by participants. 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\$8,00 0	TMD, MET Malaysia, JMA	Lao PDR, Viet Nam, Philippines	Mr. Tanya THONGNUNU I (TMD) krootan@gm ail.com; Mr. Asmadi Abdul Wahab(MET Malaysia) asmadi@met. gov.my; Mr. HAGIYA Satoshi (JMA) hagiya@met. kishou.go.jp	Completed

SP's					Funding			Coordinator	Status of
KRA &SG	No.	Objective	Action	Success Indicators	(Req. & S.)	Organizer	Participant s	(please add email address)	Completion
KRA1 KRA2 KRA3	4	Radar nowcasting based on RaINS/SWIRL	 Training for two participants from two ESCAP/WMO TC Member Countries. Topics of training are: (a) Composite radar reflectivity from multiple radars (b) Retrieve radar reflectivity from satellite data using AI. (c) Blending radar data with satellite derived radar reflectivity. (d) Nowcasting of Radar- Satellite Blend (e) Preparation of progress report 	Presentation and Submission of the progress report	US\$5,00 0	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)	Completed
KRA 2 KRA 3 KRA 5 KRA 7	5	Storm surge watch scheme	 (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	/	ЈМА	/	Dr. ISHIHARA Koji (JMA) k- ishihara@met. kishou.go.jp	Completed
KRA1 KRA2 KRA6	6	Contribution for the <u>Ex</u> periment <u>o</u> n <u>T</u> yphoon <u>I</u> ntensity <u>C</u> hange in <u>C</u> oastal	(a) To implement the field campaign collaboration among participating Members by using	Submission of the progress report	/	СМА, НКО	Participant Members (KMA, TMD)	Dr. TANG Jie (STI)	

SP's					Funding			Coordinator	Status of
KRA &SG	No.	Objective	Action	Success Indicators	(Req. & S.)	Organizer	Participant s	(please add email address)	Completion
		<u>A</u> rea (EXOTICCA- II)	aircraft, Unmanned Surface Vessel (UAS), airship, rocket, high-					Mr. WONG Wai-Kin (HKO)	
			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					Dr. LEI Xiaotu (CMA)	Completed
			WMO-TLFDP (to be included in the TC Fellowship Scheme).						
								Mr. HAGIYA Satoshi (JMA)	
								Hagiya@met. kishou.go.jp;	
			(a) To improve RDCA algorithm through the					Mr. Asmadi Abdul Wahab	
			joint development with technical assistance by					(MET Malaysia)	Completed
KDV 3		Enhancing	JMA to MET Malaysia. (b) To provide supports for development of RDCA by	Submission of the	11540 00		MET	asmadi@met. gov.my;	
KRA 5	7	Himawari 8/9 Products	 MSS, TMD and VNMHA. (c) Submission of progress reports by the participants. Upon the receipt of the reports, holding follow-up technical machine (c) to 	progress report.	0	ЈМА	Malaysia, MSS, TMD, VNMHA	Mr. Lim Yi Xiang (MSS) lim_yi_xiang @nea.gov.sg; Mr. Tanya THONGNUNU I (TMD)	
			identify a way forward.					krootan@gm ail.com;	
								Mr. Nguyen Vinh Thu	
								(VNMHA)	

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participant s	Coordinator (please add email address)	Status of Completion
								vinhthu73@g mail.com	
	8	Parallel analysis of satellite data in operational tropical cyclone monitoring (Available data used in operational tropical cyclone analysis)	 (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\$7,00 0	СМА	Members interested in this project	Ms. XIANG Chunyi (CMA)	Completed
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	 (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	/	ЈМА	Philippines	Dr. ISHIHARA Koji (JMA) k- ishihara@met. kishou.go.jp	Completed

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participant s	Coordinator (please add email address)	Status of Completion
KRA1 KRA4	10	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	-	КМА	-	Dr. Jinho Shin (KMA)	Completed
	11	Assessment Report on Regional Influence of Anomalous Tropical Cyclone Activity in the Western North Pacific (WNP)	 (a) Review latest climate research on typhoons activity and related regional influence since finalization of the third assessment report. (b) Enhance scientific understanding of the impact of climate change on typhoon activities and related regional influence. (c) Promote research collaboration with the Typhoon Committee Members to assess and understand the impact of climate change on typhoons from history to future. (d) Develop the fourth assessment report and prepare to contribute to the seventh IPCC assessment cycle. 	Submission of the progress report	-	СМА	Scientists and forecasters from Members	Dr. Xin Huang(CMA) huangx@typh oon.org.cn	Completed

SP's KRA &SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participant s	Coordinator (please add email address)	Status of Completion
	12	Tropical Cyclone Monitoring using Drifting Buoys	 (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 decisionmaking process for tropical cyclone forecasting in realtime (c) Produce the observed ocean data (Pressure, SST) and share with TC members the data in real-time (d) Promote the inter-national 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	-	КМА	Members interested in this project	Ms. Seonghee Won (KMA)	Completed

Status of Preliminary Projects (PPs) of WGM in 2024

SP's KRA & SG	No.	Objective	Action	Success Indicators	Funding (Req. & S.)	Organizer	Participants	Coordinator (please add email address)	Status of Completion
	1	Promoting Technical Exchange of AI Applications in Tropical Cyclone Analysis and Prediction	Organize a "kick-start" workshop to further discuss the pilot project and articulate Members' needs	Workshop successfully held by end of 2024 Reviewed latest capabilities and activities of AI Articulated user requirements from Members, and understood shortcomings and gaps in current capabilities Proposed recommendations to WGM in promoting and facilitating AI applications	TCTF support (USD 1,500 for 2-3 TCS staff participati on) AI developme nt teams – self- funding	НКО	Representativ es of interested TC Members Representativ es of leading AI development teams Chairs of WGs - TCS	Mr. K. K.Hon (kkhon@hko. gov.hk)	Completed and will be moved to AOP13

Annex II: Proposal for Perennial Operating Plans (POPs), Annual Operating Plans (AOPs) and Preliminary Projects (PPs) of WGM in 2025

Proposal for Perennial Operating Plans (POPs) of WGM in 2025

SP's KRA	POP/AOP	Objectives	Actions	Success Indicators	Funding (Regular/	Organizer	Partici-	Coordinator (with email	Remarks
&SG	PP No.			multators	Special)		pants	Address)	
KRA1 KRA2 KRA6	POP1	Improve the algorithm of typhoon summer prediction	 (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 members on early June (b) Submission of the progress report 	-	КМА	-	Ms. Seonghee Won (shwon11@k orea.kr)	Continued (2021-)
	POP2	Tropical Cyclone Research and Review	 (a) To publish the journal quarterly in 2025. (b) Improvement of the editorial procedure and the journal's influence 	Submission of the progress report	US\$8,000	СМА	Members	Mr. Fang Zheqing (CMA) fangzq@typho on.org.cn Ms. Lin Yutong (CMA) Dr. Wang Dongliang, (CMA)	Continued (2013-) Change from POP3 to POP2 in 2025
KRA1 KRA2 KRA6 SG 6b SG 6c	POP3	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 and conjunction with WMO-TLFDP. (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. 	/	СМА, НКО	Members	Ms. Mengqi YANG (CMA) yangmq@typh oon.org.cn	Continued (2015-) Change from POP4 to POP3 in 2025

SP's	POP/AOP /PP No	Objectives	Actions	Success	Funding (Pogular/	Organizer	Partici-	Coordinator (with omail	Remarks
&SG	/ F F NO.			mulcators	Special)		pants	Address)	
KRA2	AOP1	Enhanced use of ensemble forecast	 (a) To continue providing the current operational products using ensemble forecast. (b) To research probabilistic forecast products using ensemble forecast. (c) To update the Global Ensemble Prediction System (GEPS) for improving probabilistic forecasts. 	Submission of the progress report	/	ЈМА	/	Dr. ISHIHARA Koji (JMA) k- ishihara@met.kisho u.go.jp	Continued (2011-)
KRA1 KRA2 KRA6	AOP2	Improve the performances and impacts of South China Sea typhoon model	 (a) Improving the long-term forecast performance of CMA- TRAMS in terms of TC track. Expanding the model domain of CMA-TRAMS. (b) Upgrading the physical parameterizations, especially the convection parameterization. (c) Use of AI techniques in improving the surface analysis and model integration. (d) Improving the perturbation methods in ensemble forecasting. 	Submission of the assessment report for the forecast performance of CMA-TRAMS	/	СМА	SMG	Dr. Xubin Zhang (CMA) xbzhang@gd121.c n	Continued (2012-)
KRA2 KRA5	AOP3	Development of regional radar network	 (a) To further refine quality control techniques applied to the participants' 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 raingauge or other suitable techniques with technical assistance of JMA. (c)Aiming for contribution to RBON, to support applicants to join the experimental radar data exchange in 	Submission of the progress report by involved Members	US\$8,000	TMD, MET Malaysia, JMA	Lao PDR, Viet Nam, Philippin es	Mr. Tanya THONGNUNUI (TMD) krootan@gmail.co m; Mr. Asmadi Abdul Wahab(MET Malaysia) asmadi@met.gov. my; Mr. HAGIYA Satoshi(JMA) hagiya@met.kisho u.go.jp	Continued (2011-)

SP's KRA &SG	POP/AOP /PP No.	Objectives	Actions	Success Indicators	Funding (Regular/ Special)	Organizer	Partici- pants	Coordinator (with email Address)	Remarks
			 the near future, and to share the progress with the Regional WIGOS project in Southeast Asia. (d) Submission of progress reports by participants. Upon the receipt of the reports, holding follow-up technical meeting(s)/workshop(s) to identify a way forward. 						
KRA1, KRA2, KRA3, KRA4, KRA5, KRA6, KRA7	AOP4	Radar nowcasting based on RaINS/SWIRL	 (a) To promote sharing of knowledge on radar-based nowcasting system (b) To introduce operational implementation of radar-based nowcasting system in participants' National Hydrological and Meteorological Services (NHMSs). (c) Lectures and practical (hands-on) training basis with a focus on the modules of: i. Introduction and concept of Nowcasting based on WMO Guideline ii. Introduction to RaINS iii. Running Radar Nowcast iv. Radar Nowcast Verification v. Blending Numerical Weather Prediction (NWP) data with Radar Nowcast 	 (a) A Training Attachment Report (b) Progress report on the feasibility of operating the RaINS at the Participants' NHMSs 	Regular (USD5,000 for two participants)	MET Malaysia HKO	All Members of the ESCAP/ WMO TC	Mr. Muhammad Firdaus Ammar bin Abdullah (kumar@met.gov. my, antarabangsa@me t.gov.my)	Continued (2019-)
KRA-2 KRA-3 KRA-5 KRA-7	AOP5	Storm surge watch scheme	 (a) To add storm surge time series prediction points if requested by Members. (b) To publish verification results of storm surge predictions. (c) Request Members to provide complete hourly sea level data of at least one year to provide accurate astronomical tides at the stations. 	Submission of the progress report	/	JMA		Dr. ISHIHARA Koji (JMA) k- ishihara@met.kisho u.go.jp	Continued (2012-)

SP's KRA &SG	POP/AOP /PP No.	Objectives	Actions	Success Indicators	Funding (Regular/ Special)	Organizer	Partici- pants	Coordinator (with email Address)	Remarks
			 (d) Request Members to provide sea level observations during storm surge events for verification of storm surge predictions. (e) To improve the storm surge watch scheme model. 						
KRA1 KRA2 KRA6	AOP6	Contribution for the EXperiment On Typhoon Intensity Change in Coastal Area (EXOTICCA)-II	 (a)Activities conducted in past 5 years: (b)Flight observation during Typhoon Trami in 2024 (c)Lidar observation With Macao,China (d) Radiosonde observation and Microphysics observation during Typhoon Gaemi in 2024 	Submission of the progress report	-	CMA/STI	HKO SMG AP-TCRC	Dr. Jie TANG (CMA) tangj@typhoon.or g.cn;	Continued (2014-)
KRA 2 KRA 5	AOP7	Enhancing Utilization of Himawari 8/9 Products	 (a) Joint development to improve RDCA algorithm product verification with technical assistance by JMA to MMD, MSS, TMD and VNMHA. (b) To provide supports for operating of RDCA by PAGASA. (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\$8,000	ЈМА	MMD, MSS, PAGASA, TMD, VNMHA	Mr. YASUI Kazuki (JMA) k_yasui@met.kish ou.go.jp; Ms. Norasmawati Shahlal (MET Malaysia) asmawati@met.go v.my; Mr. Lim Yi Xiang (MSS) lim_yi_xiang@nea. gov.sg; Ms. Samantha Christine V. Monfero (PAGASA) cham@pagasa.dos t.gov.ph; Mr. Jaral Yiemwech (TMD) mywebcenter@ho tmail.com and copy to: manoonon2510@	Continued (2018-)

SP's KRA &SG	POP/AOP /PP No.	Objectives	Actions	Success Indicators	Funding (Regular/ Special)	Organizer	Partici- pants	Coordinator (with email Address)	Remarks
								hotmail.com, tmd_inter@tmd.m ail.go.th ; Mr. Nguyen Vinh Thu (VNMHA) vinhthu73@gmail. com	
	AOP8	Parallel analysis of satellite data in operational tropical cyclone monitoring	 (a) enhance regional early warning capabilities based on multiple satellite data in strengthening international exchanges (b) Hold the 2rd international workshop by the end to 2025 	Submission of the progress report	US\$7,000	National Meteorologi cal Center, CMA	China	xiangcy@cma.gov. cn	Continued
KRA1 KRA2 KRA3 KRA4 KRA5	AOP9	Enhancement of disaster risk reduction against heavy rain in collaboration of AOP7 of WGH	 To support AOP7 of WGH through (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	Philippin es	Dr. ISHIHARA Koji (JMA) k- ishihara@met.kisho u.go.jp	Continued (2019-)
KRA1 KRA4	AOP10	GK2A Utilization for Tropical Cyclone	(a) Introduce GK2A products related typhoon forecast and share the technique using GK2A data	Submission of the progress report	-	КМА	-	Dr. Geunhyeok Ryu (geunhyeokryu@k orea.kr)	Continued (2021-)
	AOP11	Prepare for the fourth assessment report on impacts of climate change on tropical cyclones in the	 (a) Review latest climate research on typhoons activity and related regional influence since finalization of the third assessment report. (b) Enhance scientific understanding of the impact 	Submission of the progress report	US\$3,000	СМА	HKO JMA KMA AP-TCRC	Dr. Xin HUANG (CMA) huangx@typhoon. org.cn	Continued (2023-)

SP's KRA	POP/AOP /PP No.	Objectives	Actions	Success Indicators	Funding (Regular/	Organizer	Partici- pants	Coordinator (with email	Remarks
&SG KRA1 KRA4	AOP12	Typhoon Committee region Tropical Cyclone Monitoring using Drifting Buoys	 of climate change on typhoon activities and related regional influence. (c) Promote research collaboration with the Typhoon Committee Members to assess and understand the impact of climate change on typhoons from history to future. (d) Develop the fourth assessment report and prepare to contribute to the seventh IPCC assessment cycle. (a) To provide real-time ocean observation data using drifting buoys for monitoring tropical cyclones (b) To enhance the use of ocean data in analyzing its impact on TC activities 	(a) Sharing ocean observatio ns to members (b) Submission of the progress	Special)	KMA	-	Address) Ms. Seonghee Won (shwon11@korea. kr)	Continued (2023-)
	AOP13	Promoting Technical Exchange of AI Applications in Tropical Cyclone Analysis and Forecasting	 (a) Establish an Expert Team (ET) under TC WGM (b) Decide the scope and implementation plan regarding the R20 initiative on TC forecasting and verification (c) Develop a summary report (d) Organize a workshop if resources available 	report Submission of progress report	US\$5,000	(Members - TBD)	Members of the Expert Team	Chair/Co-chairs of the Expert Team	Continued (2024-) Moved from PP1 to AOP13 in 2025

SP's	POP/AOP/	Objectives	Actions	Success	Funding	Organizer	Participants	Coordinator	Remarks
KRA	PP No.			Indicators	(Regular/			(with email	
&SG					Special)			Address)	
	PP1	Utilization of	(a) Conducting FengYun satellite	Submission	/	National	TMD,	Mr.	New
		FengYun	high frequency typhoon targeted	of the		Satellite	Members	XIAN Di	
		Satellite for	observation and providing fast	progress		Meteorological	interested in	(xiandi@	
		High	sharing of observation data.	report		Center, CMA	this project	cma.gov.cn)	
		Frequency	(b) Enhancing the FengYun						
		Observation of	satellite QPE product utilization					Mr. Wattana	
		Tropical	in typhoon related rainstorm					KANBUA	
		Cyclone	disaster monitoring and warning.					(wattkan@	
			(c) Organizing a workshop to					gmail.com)	
			discuss the FengYun satellite data						
			application in typhoon.						

Report of the 7th Annual Meeting of Working Group on Meteorology (WGM)

I. Organization of the Meeting

- 1. The 7th Annual Meeting of Working Group on Meteorology (WGM) was hosted by Japan Meteorological Agency (JMA) at the headquarters of JMA in Tokyo, Japan from 30 to 31 October 2024. The Meeting was held in hybrid mode.
- 2. 11 Members from China; Hong Kong, China; Japan; Lao PDR; Macao, China; Malaysia; Philippines; Republic of Korea; Thailand; USA; Viet Nam; Typhoon Committee Secretariat (TCS) and World Meteorological Organization (WMO) participated in the Meeting. The agenda and participant list (with group photo) can be found in Annex I and II, respectively.
- 3. The opening speech was delivered by Mr. MUROI Chiashi, Director General, Atmosphere and Ocean Department, JMA. Dr. DUAN Yihong, Secretary of Typhoon Committee, Mr. YU Yun, Regional Office of WMO and Dr. TANG Jie, Chairperson of WGM, also gave the opening remarks.
- 4. The Meeting was moderated by Dr. Tang Jie, Chairperson of WGM. The main purpose of the Meeting was to review the progress of the annual priority plans of WGM in 2024, and to discuss the implementation plans in 2025.

II. Technical Presentations and Member's Reports

- 5. Five experts from China; Hong Kong, China and Japan gave technical presentations on tropical cyclones including satellite observations, seasonal and AI forecasts, Dvorak analysis, and collaboration between WGM and WGH.
- 6. Participating Members presented their Member's Reports in 2024.

III. WGM Annual Priority Plans in 2024 and Implementation Plans for 2025

- 7. In 2024, there were 17 annual priority plans in WGM (including 4 POPs, 12 AOPs and 1 PP). Project coordinators or their representatives reviewed the progress in the meeting.
- 8. Members also discussed the implementation plans for 2025. Except for POP2 which will be closed in 2025, all POPs and AOPs will continue. PP1 will be moved to AOP13. (A new PP1 was proposed by China during the 19th IWS)
- 9. The budget requirement for all priority plans in 2025 was discussed (and revised after the 19th IWS to be USD47,000). Details of the progress and plans for the annual priority plans were included in the Summary Report of WGM Parallel Meeting at the 19th IWS.

IV. Technical Tour

10. A technical tour to the Meteorological Operation room and Meteorological Science Museum of JMA was arranged in the afternoon of 31 October 2024.

V. Other Business

- 11. Re-appointment of the Chairperson and Vice-chairpersons of WGM was discussed. Dr. TANG Jie from CMA will continue as Chairperson of WGM, Mr.Ambun Dingdang from MMD and Mr.Jun Galang from PAGASA was nominated as the Vice-chairpersons.
- 12.
- 13. The date and place for the 8th Annual Meeting of WGM was discussed. (Hong Kong, China expressed interest after the 19th IWS and confirmed to host the meeting in January 2025.)
- 14. Being no other business, the meeting was closed at 4:00 pm on 31 October 2024.

Date	Time	List	Remarks
	09:00-09:30	Registration	
	09:30-10:00	Opening Remarks 1. Dr. MUROI Chiashi , Director General, Atmosphere and Ocean Department, Japan Meteorological Agency	
		 Dr. DUAN Yihong, TC Secretary Mr. YU Jun, Regional Officer, WMO Dr. TANG Jie, Chairperson of WGM 	
	10:00-10:15	Participants introduction	
	10:15-10:45	Photos Session and Coffee Break	<u> </u>
Day 1		Technical presentations 5 titles Dr. LU Feng: Updates of CMA satellite observation capabilities for typhoon monitoring	for each includin g Q&A
Oct. 30		HKO: AI-based weather forecasts for tropical cyclones	
wea.	10:45-12:30	Dr. Miyamoto Mamoru: Collaboration between WGM and WGH	
		Mr. Uesawa Daisaku: Seasonal Tropical Cyclone Forecasts	
		Dr. Kawabata Yasuhiro: Research using the Dvorak reanalysis	
	12:30-14:00	Lunch Time	
	14:00-17:20	Member Report (20 min. break time at 15:00): Cambodia; China; DPR Korea; Hong Kong, China; Japan; Laos; Macao, China; Malaysia; Philippines; RO Korea; Singapore; Thailand; USA; and Vietnam	(15 min. For each including Q/A)
	18:00	Welcome Dinner	
	9:30-12:00	POP/AOP/PPs Presentations (20min. break at 11:00)	(10 min. For each including Q/A)
	12:00-12:30	New AOP Discussion	
D 2	12:30-14:00	Lunch Time	
Day 2 Oct. 31 Thu.	14:20-15:00	Tour of the Meteorological Operation room and Meteorological Science Museum	
i iiu.		Review of WGM 2024 Budget and Discussion for WGM 2025 Plans and Budget (20 min. break time at 15:00)	
	15:00-17:00	Reappointment of WGM Chairperson and Vice- Chairpersons	
		Date and Place for the 8 th Annual Meeting of WGM Closing	

Name	Organization	Member
Jie Tang	Shanghai Typhoon Institute / CMA	China
Guomin Chen	Shanghai Typhoon Institute / CMA	China
Feng Lu	National Satellite Meteorological Center / CMA	China
Chang LIU	National Satellite Meteorological Center / CMA	China
Suling REN	National Satellite Meteorological Center / CMA	China
Zhiqiang CAO	National Satellite Meteorological Center / CMA	China
Xubin Zhang	Guangzhou Institute of Tropical and Marine Meteorology, China Meteorological Administration	China
Chunyi Xiang	National Meteorological Center, CMA	China
Yuheng He	Hong Kong Observatory	Hong Kong, China
Yuk Sing Lui	Hong Kong Observatory	Hong Kong, China
Koji ISHIHARA	RSMC Tokyo, JMA	JAPAN
Masaaki IKEGAMI	RSMC Tokyo, JMA	JAPAN
Kenji TAKASU	RSMC Tokyo, JMA	JAPAN
Sakie HIRA	RSMC Tokyo, JMA	JAPAN
Satoshi HAGIYA	Japan Meteorological Agency	JAPAN
Kazuki YASUI	Japan Meteorological Agency	JAPAN
Daisaku UESAWA	Japan Meteorological Agency	JAPAN
Ryo OYAMA	RSMC Tokyo, JMA	JAPAN
Akira ANDO	RSMC Tokyo, JMA	JAPAN
Yasuhiro KAWABATA	Meteorological Research Institute, JMA	JAPAN
Munehiko YAMAGUCHI	Meteorological Research Institute, JMA	JAPAN
Mamoru MIYAMOTO	International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM)	JAPAN
Bounteum	Department of Meteorology and Hydrology	Lao PDR
Sysouphanthavong		(online)
Chan Wa LOK	Macao Meteorological and Geophysical	Macau, China
	Bureau	(online)
Ambun Dindang	Malaysian Meteorological Department	Malaysia
JUANITO GALANG	Astronomical Services Administration	Philippines
Seonghee WON	Korea Meteorological Administration	Republic of Korea
Wattana Kanbua	Thai Meteorological Department	Thailand
Chris Brenchley	RSMC Honolulu-USA NOAA	USA
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Group photo of participants taken at the Japan Meteorological Agency in Tokyo, Japan on 30 October 2024.