ESCAP/WMO Typhoon Committee The Fifty-seventh Session 17-20 February 2025 Manila, Philippines

REPORT on Activities of Working Group on Training and Research Coordination Group (TRCG) of TC in 2024 (Item 8 of Tentative Programme for TC 57th Session) (Submitted by WGDRR)

ACTION REQUIRED:

The Working Group is invited to:

A. Review the activities of TRCG conducted in 2024

B. Approve the recommendations and AOPs with the related budget of TRCG in 2025

APPENDICES:

1) DRAFT TEXT FOR INCLUSION AT SESSION REPORT 2) TRCG ACTIVITIES REPORT 2024

APPENDIX A

7.4. Training and Research Coordination Group

- 1. The Committee took note of the progress made in training and research activities as presented in the TRCG Report 2024.
- 2. The Committee thanked Hong Kong Observatory for hosting research fellowship programs in 2024.
- 3. The Committee expressed gratitude to Thai Meteorological Department for hosting the Typhoon Committee Roving Seminar in December 2024.
- 4. The Committee took note of the successful RSMC Tokyo training attachment of forecasters in January 2025, and thanked JMA and WMO TCP for continuously supporting this capacity-building initiative.
- 5. The Committee took note of the successful CMA's Typhoon Forecaster Training Programme in 2024, and thanked CMA for continuously supporting this capacity-building initiative.
- 6. The Committee took note of the successful 1st AP-TCRC forum in 2024 and thanked AP-TCRC for continuously supporting this capacity-building initiative.
- 7. The Committee appreciated TRCG's input in support of training and research activities in connection with TC's cross-cutting projects.
- 8. The Committee expressed gratitude to Dr. Eun Jeong Cha, co-vice-chair of TRCG, for her invaluable contributions to TRCG over the years.

RECOMMENDATIONS of TRCG:

- 9. Based on the discussion in the TRCG Meeting on 13 February 2025 and as presented in the TRCG Report 2024, TRCG recommended the Committee to:
 - a. Take note of TRCG Report 2024.
 - b. Endorse the TRCG Work Plan for 2024 2027.
 - c. Endorse TRCG AOP 2025.
 - d. Appoint Ms. Seonghee Won to be co-vice-chair of TRCG
 - e. Reappoint Dr Anh Tien DO and Mr CHOY Chun-wing to be Chair and co-vice-chair of TRCG

APPENDIX B

TRAINING & RESEARCH COORDINATION GROUP (TRCG) Annual Report 2024

Anh Tien DO (TRCG Chair) Vietnam

1. Introduction

- 1.1 According to the Terms of Reference, TRCG is to promote research and training activities on various aspects of tropical cyclone analysis and forecasting, including assessment of tropical cyclones' impacts on Members' socio-economic development processes, and to encourage cooperation of efforts among Members. Towards this end, TRCG is expected to assist in:
 - (a) identifying scientific and technical problems in the analysis and forecasting of tropical cyclones and their impacts on water resources and measures for disaster prevention and preparedness;
 - (b) facilitating the exchange of experience and knowledge on the latest development and techniques related to the above problems;
 - (c) coordinating training and research programmes, including activities in support of cross-cutting initiatives and other collaboration programmes among Members such as twinning and mentoring arrangement, aimed at improving the technical capacity and capability of Members to better serve the people in the region;
 - (d) evaluating the effectiveness of training and research activities undertaken by TRCG, and providing support to other working groups in performing such evaluation; and
 - (e) recommending to the Committee priority areas and long-term plans for cooperation in research and training in support of the targets and various KRAs of the Committee's Strategic Plan.

2. Membership

2.1 The composition and members list of TRCG (as of 13 February 2025) are:

Dr Anh Tien DO (Vietnam)
Dr Eun Jeong CHA (Republic of Korea)
Mr CHOY Chun-wing (Hong Kong, China)
Mr So Im Monichoth (Cambodia)
Dr QIAN Qifeng (China)
Mr SONG Yong Choi (DPR Korea)
Dr ISHIHARA Koji (Japan)
Dr SHIMADA Udai (Japan)
Dr Mayphou Mahachaleun (Lao PDR)
Mr HO Kuok Hou (Macao, China)

Dr Fariza binti Yunus (Malaysia) Ms Shirley David (Philippines) Ms Kyungho Lee (Republic of Korea) Mr Eugene Chong (Singapore) Ms Sotharat Insawang (Thailand) Mr Eric Lau (USA)

3. Major TRCG Activities in 2024

Roving Seminar / Visiting Lecturers Programme

3.1 Roving seminars have been arranged for capacity building purposes on both research and operational aspects. Knowledgeable experts travel to Members' countries and deliver lectures focused on subjects of current interest to operational centers. A record of all roving seminars previously organized can be found in Annex I.

3.2 The Typhoon Committee Roving Seminar 2024 was successfully held on 17 – 19 December 2024 in Bangkok of Thailand. The seminar was kindly hosted by the Thai Meteorological Department (TMD). The theme of this seminar was on "Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response" with speakers of the seminar as follows:

Торіс	Speaker
1. Introduction to Artificial Intelligence	Professor Dr. Chidchanok Lursinsap Chulalongkorn University, Thailand
2. Machine Learning Algorithms for Prediction	Professor Dr. Chidchanok Lursinsap Chulalongkorn University, Thailand
3. AI Tools and Platforms for Tropical Cyclone Prediction	Associate Professor Dr. Chanh Kieu Indiana University, Bloomington, USA
4. AI in Meteorological Data Analysis	Associate Professor Dr. Chanh Kieu Indiana University, Bloomington, USA
5. Al-driven Weather Forecasting at National Meteorological Center of CMA	Dr. ZHOU Kanghui, China Meteorological Administration (online)
6. AI-powered Hydrological Modeling for Operational Flood Forecasting	Dr. MIYAMOTO Mamoru WGH Typhoon Committee from International Centre for Water Hazard and Risk Management (ICHARM)
7. Fast Storm Detection and Flood Simulation Using Hard Computing and AI Approach	Assistant Professor Dr. Somporn Chuai-Aree Prince of Songkla University, Pattani Campus, Thailand
8. Household Level Disaster Risk Assessment and a Smartphone-based Pin-point Alert	Prof. ONO Yuichi Tohoku University, Japan

<image/>	
System to Save Lives from Typhoon-related Disasters	
9. The application and performance of Al- based global weather forecasting models in typhoon	Mr. Nie Gaozhen, China Meteorological Administration (online)

Figure 1. Roving Seminar 2024: Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response (17 – 19 December 2024, Bangkok, Thailand)

3.3 The seminar was attended by 82 participants from China (4); Hong Kong, China (10); Japan (2); Lao PDR (1); Macao, China (5); Malaysia (3); Philippines (1); Thailand (46); Viet Nam (1) and India (9). Seven resource persons came from China (2); Japan (2); Thailand (2) and USA (1) and one representative came from the Typhoon Committee Secretariat (TCS). The participants considered that the lectures and advice provided by the speakers are useful. They also gained knowledge and ideas how to apply AI on their tropical cyclone forecasting in the future. A summary report of the seminar can be found in Annex II.

Forecasters' Training Attachment

3.4 The RSMC Tokyo successfully hosted its Attachment Training course on operational tropical cyclone forecasting from 14 to 23 January 2025. The Regional Specialized Meteorological Centre (RSMC) Tokyo - Typhoon Center has organized ESCAP/WMO Typhoon

Committee Attachment Training courses annually since 2001 with the support of the WMO Tropical Cyclone Programme and the Typhoon Committee in order to advance the tropical cyclone (TC) analysis and forecasting capacity of the Typhoon Committee Members. The course has been set out under Category 2 Unit of the Tropical Cyclone Forecast Competency given in the Typhoon Committee Region specifications in the Typhoon Committee Operational Manual (TOM). Seven forecasters from China, Hong Kong, China, Lao PDR, the Philippines, Republic of Korea, Thailand and Vietnam in the Typhoon Committee as well as four forecasters from Bangladesh, Maldives, Oman and Pakistan in the Panel on Tropical Cyclone attended the training. In this training, not only researchers but also Japanese experts from the Typhoon Committee's Hydro and Disaster Risk Reduction group were invited as lecturers, with the expectation that the training would give forecasters a broader perspective and contribute to the UN's EW4ALL initiative.



Figure 2. RSMC Tokyo Attachment Training in 2025 (14-23 January 2025, Tokyo, Japan)

3.5 CMA's Typhoon Forecaster Training Programme, namely the 2024 International Training Course on Tropical Cyclone Monitoring and Forecasting Operation and Advanced Management, has been successfully conducted at the Guangdong-Hong Kong-Macao subcenter of the World Meteorological Center Beijing, Guangzhou, China on 25 November – 5 December 2024. A total of 35 participants from over 33 countries and regions joined the training workshop, including 6 trainees from TC. The course covers China's practice of meteorological disaster prevention and reduction, the latest strategic development initiatives of WMO, China's practice of meteorological disaster prevention and reduction, and related topics. The training workshop and programme design were well appreciated by the participants, most of them reflected that the training materials are highly useful and practical for operational applications.



Figure 3. CMA's Typhoon Forecaster Training Programme (25 November – 5 December 2024, Guangzhou, China)

Research Fellowship Scheme

3.6 The Research Fellowships are awarded to Members to promote joint research through the exchange of visiting scientists on a short-term basis with voluntary funding and logistic support by host Members. One of the merits of the scheme is that the visiting fellow has a chance to work closely with forecasters, experienced scientists or forecast system developers at the host centre, providing an opportunity to transfer knowledge and latest research findings to operational applications. The scheme has worked well on the basis of bilateral cooperation mutually agreed between the host and the applicant.

3.7 Hong Kong, China offered a fellowship research project in Q1 2024 on the topic entitled "A study on analogue forecasting for track and intensity of tropical cyclones using deeplearning techniques". A research fellow from Thai Meteorological Department (TMD) joined the fellowship programme. The fellow had shown a proof of concept that the model in the enhanced AFS system can be further fine-tuned for purpose of analogue forecasting for TC tracks. Hong Kong, China will host a fellowship research project in Q1 2025 on the topic entitled "Deep Learning Model of Tropical Cyclone Rainfall Nowcasting Using Satellite and Radar Data". The fellowship has been awarded to two research fellows from TMD and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

3.8 For future research fellowship arrangement, opportunities in coordination with AP-TCRC under time-bound pilot projects or related on-going research initiatives would also be explored. Information of the latest projects under the scheme, as well as a summary of previous fellowships awarded, can be found in Annex III. Publications and papers published in connection with the scheme are listed in Annex IV.

Asia-Pacific Typhoon Collaborative Research Centre (AP-TCRC)

3.9 The 54th Session of TC (TC54) endorsed the theme of the time-bound pilot project, namely, "Advances in application of new observations and technologies for improving tropical cyclone prediction in various time scales and related disaster prevention activities". Three research topics have been considered that AP-TCRC has planned to commence a first phase of attachment around / after mid-2023, preferably in-person visits, subject to COVID-19 situation by that time. A couple of online discussion meetings were conducted by the Chair and Vice Chair of TRCG with Dr TANG Jie and Dr FANG Zheqing of STI / AP-TCRC to formulate the attachment programme and related logistical arrangement. Updates on the development of attachment programme were presented at the 17th IWS. Draft documents of the attachment visits including the application / nomination procedures and selection criteria, etc., would be available from AP-TCRC for seeking comments from TRCG and other WGs, and for reporting at TC55 about the progress. Discussions on Time-bound Pilot Project between AP-TCRC and TRCG were conducted. The research topic "Understanding of rapid intensification mechanism of tropical cyclone and influence of climate change" was included in the "Priority Funding Missions for 2023" of the International Tropical Cyclone Collaborative Research Guide (2023-2025). Under this project, Prof. Porpattama Hammachukiattikul of Thailand, Dr. Ayesha Kanwal of Pakistan Meteorological Department, and Dr. Wahiduzzaman MD. of Australia as well as Dr. Alea Yeasmin of Australia visited AP-TCRC engaged in this project. Three research teams have been established, each comprising internationally-acclaimed meteorologists: Typhoon Scientific Experiments, Digital Typhoon Technology, and Typhoon Disaster Prevention Strategies, along with a comprehensive management office team. These three teams together with several research institutions, carried out the field experiment on the impact of typhoons on coastal megacities for the first time in China. On the basis of the experiment, the typhoon modeling and digital application for coastal megacities were explored. Other studies on typhoon climate have also been conducted, and results have been published in several international journals.

3.10 The 1st AP-TCRC Forum was held in conjunction with the 19th Integrated Workshop (19th IWS) in Shanghai, China on November 19, 2024. The main theme of the 1st AP-TCRC Forum is "Embracing New Technologies for Achieving Early Warnings for All". Over 100 international experts convened to discuss the evolving characteristics of typhoon hazards in the Asia-Pacific and beyond, advancements in observation and forecasting technologies, and innovative strategies for managing typhoon risks across different nations.



Figure 4. The 1st AP-TCRC Forum in Shanghai, China on November 19, 2024.

4. Resource Support for Research and Training

4.1 The available resource persons on specialized research subjects provided by Members are tabulated for reference in Annex V.

4.2 The Pacific International Training Desk (PITD) (website: <u>http://pacificdesk.org</u>), funded by the USA's National Weather Service as part of the US contribution to the WMO Voluntary Cooperation Program (VCP) is currently managed by the Telecommunications and Social Informatics (TASI) Research Program at the University of Hawaii.

4.3 Up until 2016, all the PITD training were conducted at the RSMC Honolulu. In 2016, the PITD training reached out to include the Weather Service Offices in Micronesia. The training continued in a virtual capacity in 2022 due to the ongoing global pandemic. There are two levels of training offered: Basic (I) and Intermediate (II). The introductory training itself consists of four components: (a) basic forecaster training, to be implemented through use of e-learning modules that will be readily available to anyone; (b) a month long, instructor led onsite training program carried out at RSMC Honolulu and/or WFO Guam; (c) training on use of communications equipment, also to be funded by the VCP: and (d) in-Island workshops on severe weather event topics.

4.4 An intermediate course was started in 2018 and is offered as a supplemental, more indepth course for returning students. This allows students from the Micronesia Weather Service Offices and from other Pacific Islands national meteorological services to continue their development in the field of Meteorology, Hydrology and Disaster Preparedness. It also offers an insight into other Pacific Islands national meteorological services and their operations. The PITD curriculum includes introductory and intermediate weather analysis and forecasting topics, as well as communications systems training. The PITD programs include partners such as NOAA National Weather Service-Pacific Region, City and County of Honolulu Emergency Management, Joint Typhoon Warning Center, UH School of Ocean and Earth Science and Technology, and KHON2. In 2024, PITD hosted a smaller group of participants, but from smaller met services we hadn't served in a while. There were two (2) cohorts, both Level 1. (Cook Islands - 2 students, Kiribati - 2 students, Nauru - 1 student, Tokelau - 2 students, Tuvalu - 1 student). In 2025, three (3) intermediate courses are planned.

5. Prioritization of Training and Research Areas

5.1 Based on the discussion during the 4th TRCG Meeting held in conjunction with the 18th Integrated Workshop (IWS) in Bangkok, Thailand on 28 November – 1 December 2023. The priority and needs for training and research activities have been reviewed by TRCG Members and updated as follows:

(A) Meteorology

<u>Monitoring</u>

- (i) application of new technologies, especial artificial intelligence in TC analysis;
- (ii) application of IoT in observation network;
- (iii) application of Dvorak and microwave satellite image analysis techniques;
- (iv) application of radar-based analysis/products for landfalling tropical cyclones and monsoon depressions; and
- (v) application of new observation technologies (such as aircraft reconnaissance, weather buoys, automatic weather network and mobile observations) in tropical cyclone monitoring and forecasting;

Forecasting and warning

- (i) application of new technologies, especially artificial intelligence, in TC track and intensity forecasting;
- (ii) development and enhancement of tropical cyclone analysis and forecast techniques from nowcast to medium range, and seasonal to long-range predictions;
- (iii) development of tropical cyclone structure and intensity forecasting techniques such as rapid intensification and wind structure;
- (iv) application of ensembles of guidance from global and regional dynamical models, ensemble prediction systems, conceptual models, statistical models and systematic knowledge-based approach;
- (v) use of high-resolution numerical models with advanced data assimilation techniques;
- (vi) rainfall forecasting: development of nowcasting and very short range forecasting techniques, and understanding of interaction between tropical cyclones and monsoon;
- (vii) development of probability forecasting and extended outlook;
- (viii) development of impact-based forecast and risk-based warnings; and

(ix) better understanding of wave, storm surge and marine forecasting;

(B) Meteorology and Hydrology

- (i) application of new technologies, especially artificial intelligence, for forecasting of river flooding and urban flash flood;
- (ii) application of meteorological and hydrological information for forecasting of river flooding and urban flash flood; and
- (iii) geological hazards associated with heavy rain and tropical cyclones such as flash flood, mudslides and landslides;

(C) Meteorology and DRR

- (i) development of technical procedures to quantify forecast uncertainties and to convert probabilistic information into effective warnings;
- (ii) development of decision-making tools for DRR purpose, including the integration of forecast information with GIS and the use of automated information processing systems;
- (iii) making use of new communication technology; and
- (iv) community response and outreach effort for mitigation of the societal impact caused by disasters.

(D) Other Cross Cutting Topics

- better understanding of tropical cyclone related issues, such as rapid intensification, and impacts across different spatial and time scales, from mesoscale and synoptic analysis arising from El Nino/La Nina and global warming / climate change;
- (ii) forecasting and warning systems for better coastal protection from multi-hazards such as storm surge, high winds, heavy rain, river delta inundation and urban flooding;
- (iii) effective communication of warning messages to stakeholders, DRR users and communities at risk; and
- (iv) utilization of Big Data, social media, crowdsourcing and artificial intelligence in tropical cyclone and weather monitoring, impact assessment, DRR and public education.

6. Future Directions and Strategies

6.1 Review of the TRCG AOP 2024 can be found in Annex VI.

6.2 The provisional TRCG work plan for 2024 to 2027/28 and Annual Operating Plan of 2025 are in Annex VII and VIII respectively. Research projects and training opportunities arising from the time-bound Pilot Project under the collaboration of the Committee with the Asia-Pacific Typhoon Collaborative Research Centre (AP-TCRC) have been incorporated in the TRCG's work plan and Annual Operating Plan. The 3rd online meeting of International Science

Steering Committee (ISSC) was held on 17 January. Prof. Johnny C.L. CHAN and Dr. Robert Fulton ROGERS, Science Director of AP-TCRC, reported the (1) 2024 Progresses; (2) International Tropical Cyclone Collaborative Research Guide (2023-2025); and (3) AP-TCRC Work Plan for 2025 and ISSC members discussed the 2025 work plan. The AP-TCRC plans Typhoon Structure and Intensity Change and Associated Impacts, Subseasonal, seasonal, and climate-scale prediction for landfalling typhoons, and Typhoon Early Warning multidisciplinary research in 2025. The provisional TRCG and AP-TCRC work plan for 2025 to 2026 and Annual Operating Plan of 2025 are in Annex VII and VIII respectively.

6.3 In accordance with the approval of at the 56th session of the Typhoon Committee, the 13 Members regularly attending the Roving Seminar are divided into three sub-regions: (1) China; DPR Korea; Hong Kong, China; Macao, China and Republic of Korea; (2) Cambodia; Philippines, U.S.A and Viet Nam; and (3) Lao PDR; Malaysia; Singapore and Thailand; and the seminars will normally be organized by rotation in the three sub-regions. Priority of TCTF support will be given to on-site participants from Members within the same sub-region (other than the host Member). This will help to minimize long travels and will provide more opportunities for local forecasters to attend. Consider the higher travel cost the TCTF budget will be adjusted for the year when U.S.A. hosts of the roving seminar to cater similar number of keynote lecturers and participants.

6.4 The initial theme of the roving seminar in the coming three years were also discussed during the TRCG planning meeting in November 2023. They are (1) Application of Artificial Intelligence/Machine Learning (AM/ML) in Tropical Cyclone forecasting and Warning; (2) Application of remote sensing technologies in operational tropical cyclone monitoring and forecasting and (3) Tropical cyclone related hazards (Storm Surge/flooding/landslides) and the application of big data/social media in weather warning services/emergency management. Thailand hosted the roving seminar in 2024 with the topic "Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response" which is the combination of the theme (1) and (3). Therefore, the proposed theme of the roving seminar 2025 could be the theme (2): Application of remote sensing technologies in operational tropical cyclone monitoring and forecasting. China expressed interests to host the roving seminar and proposes to host the Seminar in November or December 2025, in Guangzhou City, Guangdong Province, China.

6.5. TRCG will continue to support plans to have more cross-cutting training and research initiatives in consultation with the meteorology, hydrology and DRR components. Members are in turn encouraged to promote such initiatives through proactive involvement of the appropriate meteorological, hydrological and DRR personnel in their countries/places.

6.6. The current arrangements in RSMC Forecasters' Training Attachment operated smoothly in the past few years and will generally be maintained. Starting from 2019, the self-funded participation by Members will be considered. For better allocation of manpower, the RSMC Attachment Training will continue to be conducted during the first quarter of the year. The possibility of involving hydrologists and DRR experts in RSMC Attachment Training, CMA Typhoon Forecaster Training, and TC Research Fellowship Schemes could be explored by corresponding Members. Moreover, training and research opportunities will be explored in

collaboration with WGM, WGH, WGDRR, AP-TCRC and WMO Training Centre in Nanjing as well as various interested Members if the opportunity arises.

6.7 TRCG plans to organize a meeting in Q2 2025 to review and update the research and training priorities, discuss topics for upcoming roving seminars, assess progress on the AOP 2025, and address other relevant matters

Summary of Roving Seminars

Year	Dates	Venue	Торіс	Lecturers
	20 – 21 Oct	Seoul	Interpretation of Typhoon Forecasts and Analyses	Dr. H-J Kwon Mr. MANNOJI Nobutaka
2003	22 – 24 Oct	Hong Kong	Interpretation of Satellite Data and Use of Radar Data in Operational Tropical Cyclone Forecasting	Dr. Mark Lander Dr. P.W. Li Dr. BJ. Sohn
	27 – 29 Oct	Shanghai	Interpretation of Satellite Data and Use of Radar Data in Operational Tropical Cyclone Forecasting	Dr. Mark Lander Dr. P.W. Li
2004	22 – 24 Nov	Beijing	Operational Application of Multi-model Ensemble Typhoon Forecasts	Prof. Johnny C.L. Chan Mr. MANNOJI Nobutaka
2004	25 – 27 Nov	Kuala Lumpur	Operational Application of Multi-Model Ensemble Typhoon Forecasts	Prof. Johnny C.L. Chan Mr. MANNOJI Nobutaka
2006	4 – 7 Sep	Ha Noi	Tropical Cyclone Motion and Intensity, and Principles of Dvorak Method	Prof. Johnny C.L. Chan Mr. Joe Courtney Dr. BJ. Kim
2007	5 – 8 Sep	Manila	Satellite and Radar Analysis Techniques, and Tropical Cyclone Interaction wit hMonsoon Systems	Mr. Roger Edson Mr. Bart Hagemeyer Dr. NAKAZAWA Tetsuo
2009	16 – 19 Nov	Nanjing	Forecasting of High-impact Weather associated with Tropical Cyclones, and Formulation and Communication of Warning Messages	Mr. S.T. Chan Mr. Chip Guard Mr. Sam Muchemi
2010	30 Nov – 3 Dec	Ubon Ratchathani	Tropical Cyclone Genesis and Large Scale Interaction	Mr. S.M. Lee Prof. Zhang Qinghong Dr. Mark Lander
2011	20 – 23 Sep	Petaling Jaya	Heavy Rain and Flood Hazards associated with Landfalling Tropical Cyclones	Dr. Siriluk Chumchean Mr. H.Y. Yeung Prof. Chen Charng-Ning
2012	30 Oct – 1 Nov	Seoul	Tropical Cyclone Damage Assessment and Impact Forecast	DRR experts from NDMI Ms. Xu Jing Mr. W.K. Wong
2014	3-5 Nov	Hong Kong	Warning communication	Mr. Chip Guard Mr. Ahmed Nadeem

			Ms. Sandy, M.K. Song
			Mr. K.L. Lee
			Mr. NAGAL Yoshiki
4-6 Nov		Elash flood and landslides	Prof Xu-dong Fu
4-01100	Laorbit		
			Mr. KOHNO Nadao
15-17 Nov	Viet Nam	Storm Surge	Mr. Author Taylor
13-17 100	Viet Nam		Mr. Dickson Lau
			Mr. VAMASHITA Koji
20-22 Nov	Singanore	Application of Remote Sensing Technologies	Dr Viang Fang
20-22 1000	Singapore		Mr. Pay Kong
			Mr. W.C. Woo
11-13 Nov	China	Quantitative precipitation estimation and forecasting (QPE/QPF)	Mr. Frik Besker
2019 11-13 100			Prof NAKAKITA Fiichi
	30 Jun Ha Noi, Viet Nam	loi, Viet Advances in Tropical Cyclone Monitoring and Prediction for Impact based forecasting	Assoc Prof Dr Pham Thi Thanh Nga
			Dr Zifeng Vu
			Prof Dong In Lee
			Dr. Chail Park
28-20 Jun			Dr. Hoang Phus Lam
20-30 Juli			Dr. Craig Farl-Spurr
		Prof Kosuke Ito	
			Dr. Senaka Basnavake
			Mr. Nadao Kobno
			Prof Dr. Chidchanok Lursinsan
			Assoc Prof Dr. Chanh Kieu
			Dr. 7HOLL Kanghui
17-19 Dec	9 Dec Bangkok, Thailand	kok, Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergenc and y Response	Dr. MIXAMOTO Mamoru
17-15 Dec			Assistant Prof Dr. Somporn Chuai-Aree
			Prof ONO Vuichi
			Mr. Nio Goozhon
	4-6 Nov 15-17 Nov 20-22 Nov 11-13 Nov 28-30 Jun 17-19 Dec	4-6 NovLao PDR15-17 NovViet Nam20-22 NovSingapore11-13 NovChina28-30 JunHa Noi, Viet Nam17-19 DecBangkok, Thailand	4-6 NovLao PDRFlash flood and landslides15-17 NovViet NamStorm Surge20-22 NovSingaporeApplication of Remote Sensing Technologies11-13 NovChinaQuantitative precipitation estimation and forecasting (QPE/QPF)28-30 JunHa Noi, Viet NamAdvances in Tropical Cyclone Monitoring and Prediction for Impact based forecasting17-19 DecBangkok, ThailandArtificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergenc y Response

SUMMARY OF TYPHOON COMMITTEE ROVING SEMINAR 2024 (Bangkok, Thailand, 17 – 19 December 2024)

I. Organization

1. The Typhoon Committee Roving Seminar (TCRS) 2024 with the theme "Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response" was successfully held in hybrid mode on 17 – 19 December 2024 in Bangkok, Thailand. It was organized by ESCAP/WMO Typhoon Committee (TC) and hosted by the Thai Meteorological Department (TMD).

2. The Seminar was attended by 82 participants from China (4); Hong Kong, China (10); Japan (2); Lao PDR (1); Macao, China (5); Malaysia (3); Philippines (1); Thailand (46); Viet Nam (1) and India (9). Seven resource persons came from China (2); Japan (2); Thailand (2) and USA (1) and one representative came from the Typhoon Committee Secretariat (TCS). The list of participants is given in Attachment A.

II. Opening

1. The representative of TMD, Dr. Wattana Kanbua, Director of Meteorological Development Division on behalf of the Chair of Local Organizing Committee gave a warm welcome and reported the numbers of the on-site and online participants attending the Roving Seminar 2024.

2. The representative of TCS, Mr. Clarence Fong in his address expressed his gratitude to Thailand for hosting the Roving Seminar as it was one of the main activities of the TC, coordinated by the TRCG since 2003. The goal of the seminar is to encourage members of the TC to share expertise and engage in capacity-building activities such as tropical cyclone analysis, forecast and warning as well as the effects of associated hazards. He also expressed his gratitude to Thailand government, TMD and the Local Organizing Committee for hosting the Roving Seminar. He further thanked all of the speakers to share their valuable expertise on the artificial intelligence for enhanced tropical cyclone prediction and emergency response.

3. The Roving Seminar 2024 was officiated by Dr. Sugunyanee Yavinchan, Director-General of TMD. She delivered the opening speech, extending warm welcome to the participants and lecturers attending the Seminar in person and online. She extended her gratitude to the Training and Research Coordination Group (TRCG) under the Typhoon Committee, as well as the Typhoon Committee Secretariat (TCS), for their invaluable assistance and financial support in organizing the Roving Seminar 2024. She hoped that this capacity-building initiative will provide significant advantages to all participants, strengthen collaboration among the members of the Typhoon Committee and the Panel on Tropical Cyclones, and contribute to the implementation of the "Early Warning for All."

III. Seminar Programme

- There were 3 days in the Seminar Programme. On Day 1, there were three lectures. Professor Dr. Chidchanok Lursinsap from Chulalongkorn University, Thailand delivered two lectures on "Introduction to Artificial Intelligence" and "Machine Learning Algorithms for Prediction".
- 2. Associate Professor Dr. Chanh Kieu from Indiana University, Bloomington, USA delivered a lecture on "AI Tools and Platforms for Tropical Cyclone Prediction".
- 3. Six on-site participants from China; Hong Kong, China; Lao PDR; Philippines; Thailand and Vietnam reported and shared their experiences on the use of AI, Numerical Weather Prediction (NWP), and tropical cyclone monitoring and prediction in their organizations.
- 4. On Day 2, there were four lectures. Associate Professor Dr. Chanh Kieu from Indiana University, Bloomington, USA delivered a lecture on "AI in Meteorological Data Analysis".
- 5. Dr. ZHOU Kanghui from China Meteorological Administration (CMA), delivered an online lecture on "AI-driven Weather Forecasting at National Meteorological Center of CMA".
- 6. Dr. MIYAMOTO Mamoru, Chairperson, WGH Typhoon Committee from International Centre for Water Hazard and Risk Management (ICHARM) delivered a lecture on "Alpowered Hydrological Modeling for Operational Flood Forecasting".
- 7. Assistant Professor Dr. Somporn Chuai-Aree from Prince of Songkla University, Pattani Campus, Thailand delivered a lecture on "Fast Storm Detection and Flood Simulation Using Hard Computing and AI Approach".
- 8. On Day 3, there were two lectures. Prof. ONO Yuichi, Tohoku University, Japan delivered a lecture on "Household Level Disaster Risk Assessment and a Smartphone-based Pinpoint Alert System to Save Lives from Typhoon-related Disasters".
- 9. Mr. Nie Gaozhen, National Meteorological Center, CMA delivered an online lecture on "The application and performance of AI-based global weather forecasting models in typhoon".
- 10. Technical visits to the Thai Meteorological Department Headquarters were conducted in the afternoon of 19 December 2024.
- 11. The Roving Seminar Programme is given in Attachment B.

IV. Proposals and Recommendations

- 1. The participants gave a warm appreciation to the seven resource persons for their presentations and useful advice as well as examples of good practices on the relevant topics.
- 2. Dr. Eun Jeong CHA, Co-Vice Chairpersons of TRCG (Training and Research Coordination

Group), summarized that the roving seminar is very informative and useful for tropical cyclone forecast and research group and hoped all participants will apply the AI techniques derived from the seminar to their work. The feedbacks and recommendations collated from the participants are summarized in Attachment C.

- 3. Suggestions from the resource persons and organizers for future reference:
 - (a) Discussion when PDE (Partial Differential Equation) models versus AI approach wins as well as the constraints of both approaches.
 - (b) Would love to hear more about how regional centers deploying/developing AI models for TC forecast.
 - (c) Integrating GIS data and risk map for online accessing application for whole Asian.
 - (d) Running the open source well-trained data-driven weather forecasting models, such as Pangu, Graphcast, Gencast, etc., will be feasible and helpful.

V. Closing

- 1. The resource persons and participants expressed their gratitude to the TMD for hosting this seminar and for the warm hospitality.
- 2. Mr. Thanasith Iamananchai, Deputy Director-General (TMD), Dr. Wattana Kanbua, Director of Meteorological Development Division (TMD), Assistant Professor Dr. Somporn Chuai-Aree, Associate Professor Dr. Chanh Kieu, Dr. MIYAMOTO Mamoru, Prof. ONO Yuichi, and Mr. Clarence Fong, Representative from TCS presented the attendance certificates to the on-site participants.
- 3. The Roving Seminar was closed on 19 December 2024.

Members	Name of Participants
China	Mr. Niu Zeyi Dr. Huang Xiaoyan (online) Ms. Pan Ning (online) Dr. Teng Daigao (online)
Hong Kong, China	Dr. Chow Wang Dr. Cheng Chung-choi (online) Mr. Cheung Chun Ngai (online) Mr. Cheung On Pong (online) Mr. Kok Mang-hin, Macro (online) Mr. Lee Sung-ho (online) Mr. Leung Ka Fai (online) Ms. Leung Yan Yu Christy (online) Dr. Tam Hiu Ching (online) Ms. Tse Shuk-mei (online)
Japan	Mr. Masaaki Ikegami (online) Dr. Yamaguchi Munehiko (online)
Lao PDR	Ms. Phetlasy Somchanmavong
Macao, China	Mr. Fong Kin Sio (online) Mr. Ho Kuok Hou (online) Mr. Lao Hou Lun (online) Mr. Lei Heng-Wai (online) Ms. Leong Un Kei (online)
Malaysia	Mr. Mohd Hazril Zamberi (online) Mr. Johnson Soumin (online) Mr. Abdul Aizat Nazmi A Azmi (online)
Philippines	Ms. Jehan FE Serrano Panti
Thailand	Mr. Somprat Srithagon Mr. Olan Naowkraisorn Mr. Wuttisak Ratinonsakul Mr. Chatchai Chaiyasaen Mr. Nuthakit Singhaphet Ms. Pantaree Nongnut Mr. Peeranat Longsombun Mr. Fatah Masthawee Ms. Kamolrat Saringkarnphasit Mr. Pattara Sukthawee Mr. Abhisorn Nathong Ms. Nichanun Trachow Mr. Attasit Phakam Ms. Ariya Chanmanin Mr. Pakornpop Boonyuen Mr. Charkrit Thongbai Mr. Wirachart promta Mr. Tharakorn Jamvitheelerd (online) Mr. Pongkhun Maneesri (online)

List of Participants of the Typhoon Committee Roving Seminar 2024 (Bangkok, Thailand, 17 – 19 December 2024)

	Ms. Paweena Panikodom (online)
	Ms. Plaidao Khumchaiyaphum (online)
	Mr. Watchara Thintalang (online)
	Mr. Narathep Sakunnithimetha (online)
	Mr. Putchaphan Sirisap (online)
	Mr. Veerawat Limsurat (online)
	Ms. Pattraporn Teeraket (online)
	Ms. Kullanit Suebvisai (online)
	Ms. Sasithron Maynasin (online)
	Ms. Araya Chinnawong (online)
	Ms. Chanattha Saengrattanayon (online)
	Ms. Theeraluk Pianmana (online)
	Ms. Watcharaporn Moonsap (online)
	Mr. Wira Samalee (online)
	Mr. Kriangsak Thaijai-un (online)
	Mr. Peeradech Suykradueng (online)
	Ms. Chuanpit Ngernchalad (online)
	Mr. Raksapol Porchit (online)
	Mr. Visit Seesutuem (online)
	Mr. Aphinya Chitchaeng (online)
	Mr. Kritsakorn Pothaworn (online)
	Ms. Nalinee Kosasang (online)
	Mr. Tanintorn Thuekhunthot (online)
	Mr. Uchukorn Phimsin (online)
	Ms. Phiraya Lueangsophaphan (online)
	Mr. Pachapon Kampeera (online)
	Mr. Yutthaphong Sawaengwong (online)
Viet Nam	Mr. Tran Anh Duc
	Dr. Amit Bhardwaj (online)
	Dr. BUSHAIR M.T (online)
	Bibraj Raj (online)
	S.Prayek (online)
India	Dr. S. D. Sanap (online)
	Ms. Monica Sharma (online)
	Dt. Arulalan Thanigachalam (online)
	Dr. Dushmanta Ranjan Pattanaik (online)
	Dr. V.Reval Durai (online)
	Professor Dr. Chidchanok Lursinsap

	Professor Dr. Chidchanok Lursinsap
	Associate Professor Dr. Chanh Kieu
	Dr. ZHOU Kanghui (online)
Resource persons	Dr. MIYAMOTO Mamoru
-	Assistant Professor Dr. Somporn Chuai-Aree
	Prof. ONO Yuichi
	Mr. Nie Gaozhen (online)
TCS	Mr. Clarence Fong
TRCG/TCS	Dr. Eun Jeong CHA, Co-Vice Chair(online)

Attachment B

Typhoon Committee Roving Seminar 2024 Seminar Programme

Theme: Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response

Time	Content	
Day 1, Tuesda	ay, 17 December 2024	I
08:30-09:00	Registration	Organizing Committee
09:00-10:00	 Opening Workshop 1. Welcome speech, Dr. Wattana Kanbua, Director of Meteorological Development Division, TMD 2. Mr. Clarence Fong, Typhoon Committee Secretariat (TCS) 3. Opening Message by Dr. Sugunyanee Yavinchan, Director-General, TMD 	Organizing Committee
	Group photo	All participants
10:00-10:30	Break	
10:30-12:00	Introduction to Artificial Intelligence1. Basics of AI and Machine Learning2. Overview of AI applications in meteorology	Professor Dr. Chidchanok Lursinsap
12:00-13:30	Lunch	
13:30-15:00	 Machine Learning Algorithms for Prediction Supervised and unsupervised learning techniques Introduction to neural networks and deep learning Case studies on prediction models 	Professor Dr. Chidchanok Lursinsap
15:00-15:20	Break	
15:20-16:00	 AI Tools and Platforms for Tropical Cyclone Prediction 1. Overview of popular AI tools and platforms (TensorFlow, Keras, PyTorch, etc.) 2. Data visualization and interpretation 	Associate Professor Dr. Chanh Kieu
16:00-17:00	 Report and experience sharing by the participants 1. China 2. Hong Kong, China 3. Lao PDR 4. Philippines 5. Thailand 6. Vietnam 	All participants
Day 2, weult	-suay, Detember 10, 2024	1
09:00-10:20	 AI in Meteorological Data Analysis Data collection and preprocessing Feature selection and engineering 	Associate Professor Dr. Chanh Kieu

	3. Techniques for handling large datasets	
10: 2 0-10:40	Break	
10:40-12:00	AI-driven Weather Forecasting at National Meteorological Center of CMA	Dr. ZHOU Kanghui, China Meteorological Administration (online)
12:00-13:30	Lunch	
13:30-14:50	AI-powered Hydrological Modeling for Operational Flood Forecasting	Dr. MIYAMOTO Mamoru
14:50-15:10	Break	
15:10-16:40	Fast Storm Detection and Flood Simulation Using Hard Computing and AI Approach	Assistant Professor Dr. Somporn Chuai-Aree
Day 3, Thursd	ay, December 19, 2024	
09:00-10:20	Household Level Disaster Risk Assessment and a Smartphone-based Pin-point Alert System to Save Lives from Typhoon-related Disasters	Prof. ONO Yuichi Tohoku University, Japan
10:20-10:40	Break	
10:40-11:40	The application and performance of AI-based global weather forecasting models in typhoon	Mr. Nie Gaozhen, China Meteorological Administration (online)
11:40-11:50	Quiz	All participants
11:50-12:00	Evaluation of the Seminar	All participants and Lecturers
12:00-12:15	Presentation of Certificates	All participants
12:15-12:30	Summary and Closing 1. TRCG's representative, Dr. Eun Jeong CHA, Co-Vice Chair(online) 2. Mr. Thanasith Iamananchai, Deputy Director- General, TMD	
12:30-13:30	Lunch	
14:00-16:00	Technical Visit at TMD Headquarters	All participants

Attachment C

TRCG ACTIVITIES EVALUATION FORM Roving Seminar 2024 (Bangkok, Thailand, 17 – 19 Dec 2024)

51 responses (out of **45** participants + 6 lecturers) (not all questions answered by responders)

Part A: Event Logistics

Expectation levels as indicated number of responders		low tation	M Expec	let station	Exce expec	eded tation	no res	ponse
(P = participants; R = resource persons)	Р	R	Р	R	Р	R	Р	R
1. Overall administration/organization	0	0	8	3	9	3	0	0
2. Pre-event arrangement and liaison	0	0	4	2	12	4	1	0
3. Venue facilities	0	1	7	2	10	3	0	0
4. Information announcements and instructions	0	0	3	3	14	3	0	0
5. Travel arrangements	0	1	6	2	11	2	0	1
6. Funding arrangements	0	0	6	3	10	2	1	1
7. Accommodation	0	0	6	2	11	3	0	1
8. Refreshments	2	0	5	2	10	3	0	1
9. Social events and visitors' information	0	0	5	2	11	3	1	1
10. Helpfulness and friendliness of organizers	0	0	3	2	13	4	1	0

Specific points for improvement, if any:

Cannot find any further improvement. Superb organization.

It was indeed a very informative yet friendly workshop. I hope to have a chance to participate more in the future.

Keep going for good collaboration.

The internet connection needs to be improved. Poor connections effected the online lectures.

Keynote Present ation	Interest in Topic (1-5)	Topic Contents (1-5)	Topic Organization (1-5)	Lecture/ Workshop Presentation (1-5)	Training or Practical Material (1-5)	Language (1-5)	Effectiveness (1-5)	Average
	12345	12345	12345	12345	12345	1 2 3 4 5	12345	
1	6/A 4/A						10 AN	4.28
2	41	45. 45	40			40 40 17		4.38
3	66	50 UN	46	8.75. 8.75.		155	10	4.49
4	50 50		10.	47. 47.	50 50	85	ï	4.52
5	10	**			:	845 845	638 849	4.41
6		10 AA				105 HAS	an an	4.37
7	<u> </u>	10 AA	50 M	ï	ï			4.34
8	45			9.R NO.		8.75 8.75	5.6	4.43
9	40 UN		an 100	**		, Î		4.43

Part B: Technical Contents (from participants only)

Part 1:

Interest in Topic:1=disinterested, 5=nTopic Contents:1=irrelevant, 5=mostTopic Organization:1=loosely structuredLecture/Workshop Presentation:1=poor, 5=excellentTraining or Practical Material:1=ill-prepared, 5=wetLanguage:1=hard to understandEffectiveness:1=little understandir

1=disinterested, 5=most interested 1=irrelevant, 5=most relevant 1=loosely structured, 5=well-structured 1=poor, 5=excellent 1=ill-prepared, 5=well-prepared 1=hard to understand, 5=easy to follow 1=little understanding gained, 5=much understanding gained

Keynote Presentation	Objective and Scop (L, M, R)	e	Emphasis (L, M, R)		Length (L, M, R)		Technical Level (L, M, R)		cal I R)		
	L M	R	L	м	R	L	м	R	L	м	R
1			-	14	-	•	2			na.	u.
2			5			-					-
3		1.1	5		1	1			1		
4		2	IR		5	in		1	5		
5		1	-		5	in		5	5		un.
6	85				5	in		5	5		un.
7		1	1		1	474	8.0	1	1		**
8			in		1				-	8.5	un.
9					671			18			

Part 2:

Objectives and Scope:	L = too narrow; M = just right; R = too wide
Emphasis:	L = too theoretical; M = just right; R = too practical
Length:	L = too short; M = just right; R = too long
Technical Level:	L = too elementary; M = just right; R = too difficult

Lectures:

- 1. Introduction to Artificial Intelligence by Professor Dr. Chidchanok Lursinsap
- 2. Machine Learning Algorithms for Prediction by Professor Dr. Chidchanok Lursinsap
- 3. AI Tools and Platforms for Tropical Cyclone Prediction by Associate Professor. Dr. Chanh Kieu
- 4. AI in Meteorological Data Analysis by Associate Professor. Dr. Chanh Kieu
- 5. Al-driven Weather Forecasting at National Meteorological Center of CMA by Dr. ZHOU Kanghui
- 6. Al-powered Hydrological Modeling for Operational Flood Forecasting by Dr. MIYAMOTO Mamoru
- 7. Fast Storm Detection and Flood Simulation Using Hard Computing and AI Approach by Assist. Prof. Dr. Somporn Chuai-Aree
- 8. Household Level Disaster Risk Assessment and a Smartphone-based Pin-point Alert System to Save Lives from Typhoon-related Disasters *by Prof. ONO Yuichi*
- 9. The application and performance of AI-based global weather forecasting models in typhoon by Mr. Nie Gaozhen

Part C: Follow-ups

1. What operational benefits (new ideas, skills or methodology) you think would be gained from your experience in the event?

• Additional field of knowledge of machine learning to improve capabilities of NHMS

• Discovering how AI can be used to analyze satellite imagery, social media data, and other sources to quickly assess the extent of damage after a TC makes landfall, enabling more efficient deployment of resources.

- Apply AI for forecast TC and TC track
- New knowledge about AI forecasting in the future.
- Get a good understanding of the requirements to design an AI model and limitations of it
- The experience shared by the speakers would be useful in developing operational products in the future
- Get a lot of ideas from the research of the lecturers in ROVING 2024, especially the published works from CMA.
- 2. Any foreseeable opportunity for operational implementation of the above benefits?

□ No foreseeable opportunity

□ Yes, benefits likely to be felt in about _____ years' time.

- (a) a couple of years or less 3
- (b) in 2-4 years 4 (c) in 4-6 years 2
- (d) no foreseeable opportunity 33



Figure 5. The participants, lecturers and distinguished guests of the Roving Seminar took a group photo with the Director-General of Thai Meteorological Department, Dr. Sugunyanee Yavinchan (the lady in purple dress, middle)



Figure 6. The participants, lecturers and distinguished guests of the Roving Seminar

Summary of Awarded Research Fellowships

Subject	Fellow	Host	Period
Analysis of evolution of landfalling tropical cyclones with a view to developing forecast guidance for wind and rain	Mr. XUE, Jianjun (China)	Hong Kong Observatory	1 Feb – 31 Mar. 2001
TC track forecasting with use of super-ensemble	Dr. PENG, Taoyong (China)	Korea Meteorological Administration	15 Jun – 15 Nov 2001
Near real-time analysis of the wind structure of tropical cyclones	Dr. Nathaniel T. SERVANDO (Philippines)	Hong Kong Observatory	5 May – 4 Jul 2002
Numerical modelling on typhoon intensity change	Ms. YU, Hui (China)	Kongju National University and Korea Meteorological Administration	15 Jul –15 Sep 2002
Tropical cyclone track forecasting method	Dr. KANG, Bom Jin Dr. KIM, Tae Jin (DPR Korea)	Shanghai Typhoon Institute	Feb – Mar 2001 Oct – Nov 2002
Analyses on the responses of extratropical transition of tropical cyclone to its environment	Dr. Vicente B. MALANO (Philippines)	Korea Meteorological Administration	Jun – Aug 2004
Effect of tropical cyclone bogussing on model analysis and forecasts	Ms. WANG, Dongliang (China)	Hong Kong Observatory	11 Oct – 10 Dec 2004
Evaluation of the model performance in typhoon prediction in the high-resolution global model (T426L40)	Ms. Sugunyanee YAVINCHAN (Thailand)	Kongju National University and Korea Meteorological Administration	1 Aug – 30 Oct 2005
Impact study of Moisture Data on TC forecasting in South China Sea and Western North Pacific	Dr. Vicente B. MALANO (Philippines)	Hong Kong Observatory	20 Sep – 19 Nov 2005

Using ensemble prediction system (EPS) information in tropical cyclone forecasting	Ms. CHEN, Peiyan (China)	Hong Kong Observatory	13 Oct – 12 Dec 2006
Numerical simulation of Typhoon RUSA with a very high resolution mesoscale model, and calibration of intensity of typhoon with Kalman filtering	Mr. HOA, Vo Van (Viet Nam)	Korea Meteorological Administration	Jun – Aug 2006
Use of EPS information in TC forecasting	Mr. NGUYEN, Dang Quang (Viet Nam)	Hong Kong Observatory	15 Sep – 14 Nov 2007
Seasonality of Tropical Cyclone Activities over the Western North Pacific	Ms. YING, Ming	Korea Meteorological Administration	22 Sep – 20 Dec 2008
Study of high resolution non- hydrostatic model in prediction of landfalling tropical cyclones	Mr. Santi SUMDIN (Thailand)	Hong Kong Observatory	20 Oct – 19 Dec 2008
Tropical cyclone bogus in NHM and its impact on forecast track and intensity	Mr. QU, Anxiang (China)	Hong Kong Observatory	29 Oct – 28 Dec 2009
Typhoon Vortex Initialization Scheme and typhoon Ensemble Forecast Techniques	Ms. NGUYEN Thi Minh Phuong (Viet Nam) and Mr. Chatchai CHAIYASAEN (Thailand)	National Meteorological Center, China Meteorological Administration	Early Dec 2009 – Early Feb 2010
Improvement of typhoon analysis and forecast with KMA's TAPS	Mr. TRAN Quang Nang (Viet Nam)	Korea Meteorological Administration	1 Sep – 27 Nov 2010
Study on the tropical cyclone genesis in the northwestern Pacific	Mr. Kamol Promasakha Na SAKOLNAKHON (Thailand)	Korea Meteorological Administration	1 Sep – 27 Nov 2010
Typhoon Information Processing System	Mr. NGUYEN Manh Linh (Viet Nam) and Ms. Kamolrat SARINGKARNPHASIT (Thailand)	National Meteorological Center, China Meteorological Administration	8 Oct – 8 Dec 2010
Can the extreme rainfall associated with Typhoon Morakot (0908) happen in Hong Kong?	Mr. HUANG, Yiwu (China)	Hong Kong Observatory	29 Oct – 28 Dec 2010

Improvement of typhoon analysis and forecast with KMA's TAPS	Mr. Jori J. LOIZ (Philippines)	Korea Meteorological Administration	Sep – Nov 2011
Improvement of typhoon analysis and forecast with KMA's TAPS	Mr. Chukiat THAIJARATSATIAN (Thailand)	Korea Meteorological Administration	Sep 2011
Implementation of Tropical Cyclone Intensity Forecast in the Tropical Cyclone Information Processing System (TIPS) of the Hong Kong Observatory	Mr. Nursalleh K. CHANG (Malaysia)	Hong Kong Observatory	24 Oct – 23 Dec 2011
Improvement of Prediction Method for the Rapid Intensification of Tropical Cyclones in the South China Sea	Dr. Sukrit KIRTSAENG (Thailand)	National Meteorological Center, China Meteorological Administration	2 Nov – 29 Dec 2011
Application of Numerical Ensemble Prediction in the Forecasting of Typhoon Sharp Turning Tracks	Mr. Raymond C. ORDINARIO (Philippines)	National Meteorological Center, China Meteorological Administration	14Nov 2011 – 13 Jan 2012
Typhoon Analysis and Prediction System (TAPS), genesis and dissipation of tropical cyclones, and change of typhoon characteristics due to climate change	Mr. Renito B. PACIENTE (Philippines), Ms. Plaidao KHUMCHAIYAPHUM (Thailand) and Mr. Bounteum SYSOUPHANTHAVONG (Lao PDR)	Korea Meteorological Administration	May – June 2012
Enhancement of rainfall nowcast in tropical cyclone situation	Mr. Maqrun Fadzli Mohd Fahmi (Malaysia) and Mr. Michael S. Bala (Philippines)	Hong Kong Observatory	22 Oct – 21 Dec 2012
Optimizing typhoon forecast using Typhoon Analysis and Prediction System (TAPS), and research on intensity and track forecasts using model ensemble, correction of track forecast bias according to synoptic patterns, and analysis of synoptic features and	Dr. Bonifacio Galt Pajulelas (Philippine) , Mr. Nguyen Huu Thanh (Vietnam), and Ms. Prapaporn Wongsaming (Thailand)	Korea Meteorological Administration	1 May – 30 June 2013

typhoon model forecast errors in anomalous typhoon tracks.			
Development of location-specific severe weather nowcasting techniques.	Dr. Sukrit KIRTSAENG (Thailand)	Hong Kong Observatory	21 Oct – 20 Dec 2013
Optimizing typhoon forecast using Typhoon Analysis and Prediction System (TAPS) and separate researches (typhoon-mid latitude pressure system interaction, study on the typhoon recurvature and moving speed, and study on the relationship between the central pressure and maximum sustained winds for typhoon)	Ms. Bai Lina (China) Mr. Nguyen Tung Thanh (Vietnam) Mr. Juanito S. Galang (The Philippines)	Korea Meteorological Administration	1 May – 30 June 2014
Tropical Cyclone Genesis Forecast Technique	Mr. Boonthum Tanglumlead (Thailand)	Shanghai Typhoon Institute	1 Jul – 31 Aug 2014
The utilization of ECMWF products in detecting storm tracks over the North Western Pacific	Mr. Pak Sang II and Mr Song Yong Chol (DPR Korea)	Shanghai Typhoon Institute	1-30 Sept 2014
Nationwide Nowcast of Tropical Cyclone Rainfall	Mr. Evan James K. Carlos (The Philippines)	Hong Kong Observatory	6 Oct – 5 Dec 2014
Optimizing typhoon forecast using Typhoon Analysis and Prediction System (TAPS), and research on typhoon monitoring, interpretation of satellite-based and radar images, typhoon track and intensity forecast and tropical	Ms. Akhom THAMALANGSY (Lao PDR) Mr. Aldczar D. Aurelio (The Philippines), Mr. Jose Frivaldo, JR. (The Philippines),	Korea Meteorological Administration	19 April - 2 May 2015

depression or extra-tropical transition	Mr. Somprat Srithagon (Thailand), and Ms. DO Thi Thanh Thuy (Viet Nam)		
Tropical cyclone genesis forecast technique	Mr. Pak Sang II (DPR Korea) Mr. Ri Hak II (DPR Korea)	Shanghai Typhoon Institute	26 Oct - 25 Nov 2015
Visiting editor for Tropical Cyclone Research and Review (TCRR)	Dr. Jason Sippel (USA) Dr. Nguyen Dang Quang (Viet Nam)	Shanghai Typhoon Institute	6-13 Dec 2015 20-26 Dec 2015
Development of objective guidance on tropical cyclone genesis forecast using global models	Mr. Wen FENG (China)	Hong Kong Observatory	Mid Nov 2015 – mid Jan 2016
Training for typhoon forecast - Typhoon genesis and analysis - Typhoon track and intensity forecast - TAPS* operations and products	Benison Jay N. Estareja(The Philippines) Boonthum Tanglumlead(Thailand) Narongpon Thongsang(Thailand)	Korea Meteorological Administration	1 May to 14 May 2016
Tropical cyclone genesis forecast technique	Mr. Pak Sang II and Mr. Kim Kum Song (DPR Korea)	Shanghai Typhoon Institute	24 October to 23 November 2016
Visiting editor for Tropical Cyclone Research and Review (TCRR)	Mr. Kamol Promasakha na Sakolnakhon (Thailand) Dr. Chen Yi-Leng (USA)	Shanghai Typhoon Institute	17-21 October 2016
Tropical Cyclone Size Climatology	Mr. Wei HONG (China)	Hong Kong Observatory	mid-Dec 2016 – 31 Jan 2017
Training for typhoon forecast - Typhoon genesis and analysis - Typhoon track and intensity forecast - TAPS* operations and products	Ms. Pensiri Trisataya and Ms. Chuanpit Ngernchalad (Thailand) Mr. Robert B. Badrina (The Philippines) Ms. Hoang Thi Mai (Viet Nam)	Korea Meteorological Administration	16-29 April 2017
Observational Study on Intensity and Structure of Offshore Typhoon for EXOTICCA	Mr. Jaral Yiemwech (Thailand) Ms. Khanh Hoa Bui Thi (Viet Nam)	Shanghai Typhoon Institute	September 2017

Benefit evaluation of Typhoon disaster prevention and preparedness	Mr. Nursalleh Chang (Malaysia)	Shanghai Typhoon Institute	September 2017
Visiting Editor for Tropical Cyclone Research and Review	Mr. Somkuan Tonjan (Thailand) Dr. Doan Quang Tri from (Viet Nam)	Shanghai Typhoon Institute	February 2018
Tropical Cyclone Precipitation Verification	No nomination was received	Shanghai Typhoon Institute	NA
Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products	Applicant who was accepted for the fellowship withdrew from the offer	Hong Kong Observatory	NA
Benefit evaluation of Typhoon disaster prevention and preparedness	Mr. Nursalleh K Chang (Malaysia)	Shanghai Typhoon Institute	2 May – 1 June 2018
Training for forecasters: - Tropical meteorology & climatology - Processing observed meteorological variables - Typhoon analysis and monitoring- - Producing typhoon information using TAPS and TOS - Seasonal typhoon prediction	Mr. Nuthakit Singhaphet, (Thailand) Mr. Tran Quang Nang, Typhoon (Viet Nam) Dr. Guanbo Zhou (China) Mr. Robb Prieto Gile (the Philippines) Mr. Wan Muhammad Hafiz Bin Husin, (Malaysia)	Korea Meteorological Administration	23 April to 4 May 2018
Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products	Ms. Nguyen Thu Hang (Viet Nam)	Hong Kong Observatory	January – March 2019
Training for forecasters: - Tropical meteorology & climatology - Processing observed meteorological variables - Typhoon analysis and monitoring- - Producing typhoon information using TAPS and TOS	Ms. Reyes Sheilla Mae R. (the Philippines) Mr. Tran Van Vu (Viet Nam)	Korea Meteorological Administration	20 May to 14 June 2019

- Seasonal typhoon prediction			
Visiting Editor for Tropical CycloneProf. Kimberly Wood (US.Research and ReviewProf. Shishir Dube (India)		Shanghai Typhoon Institute	24-29 March 2019 13-19 October 2019
Integrated Precipitation Estimator using Radar and Satellite (IPERS) for Tropical Cyclone Rainfall (TC) Analysis and Nowcasting	Mr. Benison Jay N Estareja (the Philippines)	Hong Kong Observatory	January – February 2020
Verification of tropical cyclone wind structure forecasts from global NWP models and ensemble prediction system	Ms Xiaoqin LU (China)	Hong Kong Observatory	Q1 2021
Study on the characteristics and model forecast performance of rapid intensification (RI) of near-landfall tropical cyclones (TCs)		Hong Kong Observatory	Q1 2022
Study on the characteristics and model forecast performance of rapid intensification (RI) of near-landfall tropical cyclones (TCs)	Ms Xiang Chunyi (China)	Hong Kong Observatory	Q1 2023
Characteristics Analysis of Binary TCMr. Jun Ezra M. BulquerinInteractionAnalysis of the(Philippines)Mechanism for Rapid IntensificationMr. Somprat Srithagon (Thailan)		Korea Meteorological Administration	11-24 June 2023
Understanding of rapid intensification mechanismof tropical cyclone and influence ofclimatechange.	Iderstanding of rapid ensification mechanismof tropical Prof. Porpattama clone and influence Hammachukiattiku (Thailand) climatechange.		2023
Study on analogue forecasting for track and intensity of tropical cyclones techniquesMr. Boonyuen Pakornpop (Thailand)		Hong Kong Observatory	Q1 2024

Deep Learning Model of Tropical Cyclone Rainfall Nowcasting Using Satellite and Radar Data	Ms Saowapak Buphu (Thailand) Mr Michael B. Simora (Philippines)		Q1 2025
--	--	--	---------

TRCG Publications / Papers

Xue, J.J., 2002: Structural and Diagnostic Analyses of Landfalling Tropical Cyclones near Hong Kong in 1999 and 2000. Typhoon Committee Annual Review 2001, pp. 153-161

Servando, N.T., P.W. Li and E.S.T. Lai, 2003: Near Real-time Analysis of the Wind Structure of Tropical Cyclones. Typhoon Committee Annual Review 2002 (in CD form)

Peng, T.-Y., H.-J. Kwon, W.-J. Lee, and J.-H. Lim, 2005: A systematic approach to tropical cyclone track. *The International Journal of Systems & Cybernetics.* **34**, 681-693.

Wang, D.L., W.K. Wong and E.S.T. Lai, 2005: A Study on Tropical Cyclone Bogussing Strategies in NWP Model Analysis and Forecast. Typhoon Committee Annual Review 2004.

Yu, Hui and H. Joe Kwon, 2005: Effect of TC–Trough Interaction on the Intensity Change of Two Typhoons. *Weather and Forecasting.* **20**, 199–211.

Malano, V.B., W.K. Wong and E.S.T. Lai 2006: Effect of Moisture Data to the Numerical Simulation of Tropical Cyclone in the Western North Pacific. Typhoon Committee Annual Review 2005, pp. 242 – 251.

Chen, P.Y. and S.T. Chan, 2009: Use of the JMA Ensemble Prediction System for Tropical Cyclone Intensity Forecasting. Typhoon Committee Annual Review 2008, pp. 276-285.

Nguyen, D.Q. and S.T. Chan, 2009: Study on Application of Ensemble Prediction System Information in Tropical Cyclone Track Forecasting. Typhoon Committee Annual Review 2008, pp. 286-291.

Wong W.K., S. Sumdin, and E.S.T Lai 2010: Development of Air-Sea Bulk Transfer Coefficients and Roughness Lengths in JMA Non-hydrostatic Model and Application in Prediction of an Intense Tropical Cyclone. Scientific Online Letters on the Atmosphere (SOLA), **6**, 65-68.

Chan, S.T. and Y. Huang, 2012: Can the Extreme Rainfall Associated with Typhoon Morakot (2009) Happen in Hong Kong? Tropical Cyclone Research and Review, **1**, 1-15.

Chang, N.K., L.S. Lee and Y.S. Li, 2012: Comparison of Performance of Various Multiple-Model Ensemble Techniques in Forecasting Intensity of Tropical Cyclone. Tropical Cyclone Research and Review, **1**, 353-360.

Woo, W.C., K.K. Li and Michael Bala 2014: An Algorithm to Enhance Nowcast of Rainfall Brought by Tropical Cyclones Through Separation of Motions[J]. Tropical Cyclone Research and Review, 2014, 3(2): 111-121. doi:10.6057/2014TCRR02.04

Choi, K-S, Prapaporn Wongsaming, S. Park, Y. Cha, W. Lee, I. Oh, J-S Lee, S-B Jeong, D-J Kim, K-H Chang, J. Kim, W-S Yoon, and J-H Lee, 2013: An Analysis of Model Bias Tendency in Forecast for the Interaction between Mid-latitude Trough and Movement Speed of Typhoon Sanba. Jour. Korean Earth Science Society, 34, 303-312.

Feng, W, W K Wong, Y T Tam and CW Choy, 2016 : Tropical Cyclone Genesis Forecasting based on Thresholds of Multiple Physical Parameters and Verification of Performance using ECMWF Model, Journal of Tropical Meteorology, 32(6), 908-917.

Lee, T C and Edwin S T Lai, 2018: Training and Research under the Typhoon Committee. Tropical Cyclone Research and Review, 7(1), 23-30. DOI: 10.6057/2018TCRR01.03

Lu X., W.K. Wong, K.C. Au-Yeung, C.W. Choy, H. Yu, 2022: Verification of tropical cyclones (TC) wind structure forecasts from global NWP models and ensemble prediction systems (EPSs), Tropical Cyclone Research and Review, <u>https://doi.org/10.1016/j.tcrr.2022.07.002</u>

List of Resource Persons

Member	Specialties	Name	E-mail	Affiliation		
(A) Data Assimilation						
	TC vortex initialization	LIANG, Xudong	Liangxd@mail.typhoon.gov.cn	Shanghai Typhoon Institute		
China	TC intensity estimation by radar, satellite, SSMI and QuikScat	DONG, Lin ZHOU, Bing	donglin@cma.gov.cn bingz@cma.gov.cn	National Meteorological Center		
	Radar data quality control and assimilation scheme	GONG, Jiandong	gongjd@cma.gov.cn	National Meteorological Center		
Hong Kong, China	TC data assimilation, ensemble radar assimilation	K. K. HON	<u>kkhon@hko.gov.hk</u>	Hong Kong Observatory		
	Satellite data assimilation	OKAMOTO Kozo	<u>kokamoto@mri-jma.go.jp</u>	Meteorological Research Institute		
Japan	Data assimilation	ISHIBASHI Toshiyuki	<u>ishibasi@mri-jma.go.jp</u>	Meteorological Research Institute		

(A) Data Assimi	ilation (cont'd)			
	Typhoon bogussing	HA, Ji-Hyun	jhha80@korea.kr	Korea Meteorological Administration
Republic of Korea	Satellite data analysis	CHUN, Hyoung-Wook	<u>chunhw@korea.kr</u>	Korea Meteorological Administration
	Radar data analysis	HA, Jong-Chul	<u>bellfe@korea.kr</u>	Korea Meteorological Administration
USA (western North Pacific)	TC analysis, satellite interpretation, use of microwave imagery and scatterometer data	Tom LEE Peter BLACK Paul CHANG	Lee@nrlmry.navy.mil Peter.Black.ctr@nrlmry.navy.mil Paul.S.Chang@noaa.gov	NRL, Monterey, CA NRL, Monterey CA NOAA/NESDIS, Suitland MD
Viet Nam	TC vortex initialization; Typhoon bogussing	NGUYEN, Van Hiep	hiepwork@gmail.com	Viet Nam Meteorological and Hydrological Administration
(B) Modelling				
	Numerical schemes of TC model	DUAN, Yihong	duanyh@mail.typhoon.gov.cn	Shanghai Typhoon Institute
China	TC model physics and bogussing schemes	MA, Suhong	mash@cma.gov.cn	National Meteorological Center
China	Ensemble track forecasting	ZHOU, Xiaqiong	zhouxq@mail.typhoon.gov.cn	Shanghai Typhoon Institute
	Typhoon modelling	LIANG, Xudong	Liangxd@mail.typhoon.gov.cn	Shanghai Typhoon Institute
Hong Kong, China	Mesoscale and ensemble TC modelling	W.K. WONG	wkwong <u>@hko.gov.hk</u>	Hong Kong Observatory

(B) Modelling	(cont'd)				
	Ensemble track forecasting	KAWABATA Yasuhiro	kawabata@mri-jma.go.jp	Meteorological Research Institute	
Japan	TC-ocean interaction (incl. mixed-layer ocean and ocean surface wave modelling)	WADA Akiyoshi	<u>awada@mri-jma.go.jp</u>	Meteorological Research Institute	
	TC modeling	TSUJINO Satoki	<u>satoki@mri-jma.go.jp</u>	Meteorological Research Institute	
	Storm surge / wave modelling	KOHNO Nadao	<u>nkohno@mri-jma.go.jp</u>	Meteorological Research Institute	
	Global NWP model	CHOI, Hyun-Joo	<u>hjchoi81@korea.kr</u>	Korea Meteorological Administration	
Republic of Korea	Ensemble track forecasting	SHIN, Hyun Cheol	<u>sinhyo@korea.kr</u>	Korea Meteorological Administration	
	Storm surge / wave modelling	CHANG, Pil-Hun	phchang@korea.kr	Korea Meteorological Administration	
Thailand	Numerical ocean wave modelling	KANBUA, Wattana	wattkan@gmail.com	Thai Meteorological Department	

USA (western North Pacific)	estern Pacific) TC Modeling Extratropical Transition TC Genesis Pat HARR Sub-Tropical Systems Structure Jenni EVANS		<u>James.Doyle@nrlmry.navy.mil</u> <u>paharr@nps.edu</u> <u>evans@meteo.psu.edu</u>	NRL, Monterey CA Naval Postgraduate School, Monterey CA Pennsylvania State Univ		
(C) Forecasting	g					
China	Track and intensity forecasting	QIAN, Qifeng	qianqf@cma.gov.cn	National Meteorological Center		
China	Long-range prediction of typhoon	XU, Ming	Xum@mail.typhoon.gov.cn	Shanghai Typhoon Institute		
	TC climatology and best track analysis	Y.S.LUI	yslui@hko.gov.hk	Hong Kong Observatory		
	Radar and satellite nowcasting in TC	W.K. WONG	wkwong@hko.gov.hk	Hong Kong Observatory		
Hong Kong, China	TC intensity, structure and landfall impact	C.W.CHOY	cwchoy@hko.gov.hk	Hong Kong Observatory		
China	Long-range forecasting of TCs	W.P.TSE	wptse@hko.gov.hk	Hong Kong Observatory		
	TC motion, intensity, size, modelling and seasonal prediction	Johnny C.L. CHAN	Johnny.Chan@cityu.edu.hk	City University of Hong Kong.		
Japan	Satellite data analysis, use of microwave imagery, AMSU	OYAMA Ryo	oyama@met.kishou.go.jp	Japan Meteorological Agency		
	Doppler radar data analysis	SHIMADA Udai	ushimada@mri-jma.go.jp	Meteorological Research Institute		

Republic of Korea		Track and intensity forecasting		0	kblove1119@korea.kr	Karaa Mataaralagidal Administration	
Kor	еа	Long-range prediction of typhoon	ווויין בבב, געמוק-וונ	J	KIIIOVEIII9@KOFea.KI		
Singap	oore	Seasonal prediction of typhoon	CHOW Kwok Wah		CHOW Kwok Wah@nea.gov.sg	Meteorological Service Singapore National Environment Agency	
(C) Fore	castin	g (cont'd)					
USA (weste North	rn ar	TC analysis and forecasting, seasonal prediction, use of microwave imagery nd scatterometer data, Dvorak technique	Roger EDSON		<u>Roger.Edson@noaa.gov</u>	University of Guam (WERI) National Weather Service, Forecast Office Guam	
USA (weste North Pacific	rn S	Satellite data analysis, use of microwave imagery	Jorel TORRES Dan LINDSEY		<u>Jorel.Torres@colostate.edu</u> <u>Dan.Lindsey@colostate.edu</u>	NOAA/NESDIS at CIRA, Colorado State University	
	S	Satellite data analysis, use of microwave imagery, automated vorak Technique, AMSU	Chris VELDEN Derrick HERNDON		<u>chris.velden@ssec.wisc.edu</u> <u>dherndon@ssec.wisc.edu</u>	CIMSS, University of Wisconsin-Madison	

	Satellite data analysis, use of microwave imagery, AMSU	John KNAFF	john.knaff@noaa.gov	NOAA/NESDIS at CIRA, Colorado State University
	Satellite-based rainfall estimates in TCs (eTRaP)	Bob KULIGOWSKI Shelden KUSSELSON	bob.kuligowski@noaa.gov sheldon.kusselson@noaa.gov	NOAA/NESDIS Suitland, Maryland
Viet Nam	Track and intensity forecasting; Typhoon- terrain interaction and application in forecasting; TC related heavy rainfall and strong wind forecast.	NGUYEN, Van Hiep	<u>hiepwork@gmail.com</u>	Viet Nam Meteorological and Hydrological Administration
(D) Applica	tion			
Hong	TC warning systems and operations	S.M.TSE	smtse@hko.gov.hk	Hong Kong Observatory
Kong, China	TC information visualization and display systems	С.К. НО	ckho@hko.gov.hk	Hong Kong Observatory
USA (western North Pacific)	TC warning and disaster preparedness, seasonal prediction, Dvorak technique	Chip GUARD	<u>chip.guard@noaa.gov</u>	NOAA National Weather Service Guam

Annex VI

		Review of Training and R	esearch Coordin	ation Gr	oup (TRCG) A	nnual Ope	erating Plan	2024 (including	Q1 of 2025)	
Objective Number	KRAs	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Review and Target Met (Yes/No)
1	KRA 1-3	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Attachment of forecasters from TC Members to RSMC Tokyo	nil	Provision of administrative and logistic support.	Q1 of 2024 (15-26 Jan 2024)	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 11,000*	TCTF and Member self-funded	Yes
2	KRA 1-3	To facilitate technology transfer among TC Members through research and development initiatives.	Research Fellowship	WGM, WGH and WGDRR	Provision of administrative and logistic support.	Jan-March, 2024	нко	Publication of research findings and development output in TCRR or other journals.	Fellowship offered by voluntary hosts.	Yes	Yes, onsite (HKO)
3	KRA 1-3	To: (a) implement training initiatives in the priority operational and research areas as identified in the TRCG annual report; and (b) enhance Members' capability and capacity in the assessment of damage and pre- assessment of potential impact caused by landfalling TCs	Roving Seminar Theme: Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response	WGM, WGH and WGDRR	Provision of administrative and logistic support.	Q4 2024 (17-19 December, 2024)	TMD	Feedback from evaluation forms to be completed by a target audience of about 30 people.	USD 16,000	TCTF	Yes
4	KRA 1-3	To: conduct of international scientific workshop to raise the knowledge level of TC forecasters the ESCAP/WMO Typhoon Committee.	Invite international top scientists to participate in the 1 st AP-TCRC International Workshop	WGM, WGH and WGDRR	Provision of administrative and logistic support.	Q4 2024 (19 November 2024)	TRCG & AP- TCRC	Assessment as given in TRCG & AP-TCRC report	Self-funded	AP-TCRC	Yes
5	KRA 1-3	To: implement training initiatives Regular invitation of TC prevention and mitigation personnel to conduct technical training for members of the ESCAP/WMO Typhoon Committee.	Fellowship or Attachment of researchers from TC Members to AP- TCRC, Shanghai	WGM, WGH and WGDRR	Provision of administrative and logistic support.	Q4 2024 (December 2024)	TRCG & AP- TCRC	Assessment as given in TRCG & AP-TCRC report	Self-funded	AP-TCRC	Yes

6	KRA1- 3	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Up to 4 forecasters from TC to CMA Forecaster Training	nil	Provision of administrative and logistic support.	25 November -5 December 2024	СМА	Assessment as given in CMA report.	Participation will be supported by CMA	СМА	Yes
7	KRA 1-3	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Attachment of forecasters from TC Members to RSMC Tokyo	nil	Provision of administrative and logistic support.	Q1 of 2025 (14-23 Jan 2025)	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 11,000	TCTF and Member self-funded	Yes

Provisional TRCG Work Plan for 2024 – 2027 (including Q1 of 2028)

Year	Quarter	Typhoon Committee Activity	Training and Research Activities (*activities organized by parties other than TRCG)	Themes (if any) / Remarks
			RSMC Tokyo Attachment Training	15 – 26 January
	Q1	TC-56 (Malaysia)	Research Fellowship	HKO Fellowship in Jan - Mar. Theme: A study on analogue forecasting for track and intensity of tropical cyclones using deep-learning techniques
	Q2		Research Fellowship	Fellowship or attachment visit(s) hosted by STI
2024	Q4		Roving Seminar	17-19 December, Thailand Theme: Artificial Intelligence for Enhanced Tropical Cyclone Prediction and Emergency Response
		(China)	CMA Training Programme*	25 November – 5 December.
			1 st AP-TCRC Forum	19 November, China
			AP-TCRC Fellowship or Attachment Training	December, China
	01	TC-57	RSMC Tokyo Attachment Training*	14 - 23 January
	Q2	(Philippines)	- Research Fellowship	HKO Fellowship in Feb-Apr TRCG Research Fellowship hosted by KMA in June
	Q3		Research Fellowship	Fellowship or attachment visit(s) hosted by STI
2025			CMA Training Programme *	ТВС
	Q4	20 th IWS (TBC)	Roving Seminar	To be held in China. Proposed theme: Application of remote sensing technologies in operational tropical cyclone monitoring and forecasting
			2 nd AP-TCRC Forum	TBD
			AP-TCRC Fellowship or Attachment Training	TBD

			RSMC Tokyo	ТВС
	01	TC-58	Attachment Training*	
	1	(ТВС)	Research Fellowship	HKO Fellowship in Jan – Mar (TBC)
	Q2		Research Fellowship	Fellowship or attachment visit(s) hosted by KMA, STI
2026	Q3			and/or AP-TCRC.
	Q4	21 st IWS (TBC)	Roving Seminar	Hosted by: a member of Sub- group 2.Proposed theme: TBD (will be discussed in a TRCG meeting 2025)
			CMA Training Programme*	ТВС
	01	TC-59	RSMC Tokyo Attachment Training*	ТВС
	QI	(ТВС)	Research Fellowship	HKO Fellowship in Jan – Mar (TBC)
	Q2		Research Fellowshin	Fellowship or attachment
2027	Q3		Research renowship	and/or AP-TCRC
	Q4	22 nd IWS (TBC)	5 th TRCG Forum / TRCG Planning Meeting (in conjunction with 22 nd IWS)	Proposed theme: TBC
			CMA Training Programme*	ТВС
2028	01	TC-60	RSMC Tokyo Attachment Training*	ТВС
2028	ųΊ	(TBC)	Research Fellowship	HKO Fellowship in Jan – Mar (TBC)

Annex VIII

Trainin	Training and Research Coordination Group (TRCG) Annual Operating Plan 2025 (including Q1											
					of 20	026)						
Objectiv e Number	KRAs	Objective	Action	Other WGs Involve d	TCS Responsibilit Y	Expected Quarter Complete d	Other Organization s Involved	Success Indicators	Funding Required	Funding Sources		
1	KRA 1-3	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Attachment of forecasters from TC Members to RSMC Tokyo	nil	Provision of administrativ e and logistic support.	Q1 of 2025 (14-23 Jan 2025)	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 11,000*	TCTF and Member self- funded		
2	KRA 1-3	To facilitate technology transfer among TC Members through research and developmen t initiatives.	Research Fellowship	WGM, WGH and WGDRR	Provision of administrativ e and logistic support.	Q1-Q3	НКО, КМА	Publication of research findings and development output in TCRR or other journals.	Fellowship offered by voluntary hosts.	TC Member s		
3	KRA 1-3	To: (a) implement training initiatives in the priority operational and research areas as identified in the TRCG annual report; and (b) enhance Members' capability and capacity in the assessment of damage and pre- assessment of potential impact caused by landfalling TCs	Roving Seminar Proposed theme: Application of remote sensing technologie s in operational tropical cyclone monitoring and forecasting	WGM, WGH and WGDRR	Provision of administrativ e and logistic support.	Q4 2025	СМА	Feedback from evaluation forms to be completed by a target audience of about 30 people.	USD 16,000	TCTF		

4	KRA 1-3	To: conduct of internationa I scientific workshop to raise the knowledge level of TC forecasters the ESCAP/WM O Typhoon Committee.	AP-TCRC 2ND FORUM	WGM, WGH and WGDRR	Provision of administrativ e and logistic support.	Q4 2025	TRCG & AP- TCRC	Assessment as given in TRCG & AP- TCRC report	TBD	AP-TCRC
5	KRA 1-3	To: implement training initiatives Regular invitation of TC prevention and mitigation personnel to conduct technical training for members of the ESCAP/WM O Typhoon Committee.	Fellowship or Attachment of researchers from TC Members to AP-TCRC, Shanghai	WGM, WGH and WGDRR	Provision of administrativ e and logistic support.	Q4 2025	TRCG & AP- TCRC	Assessmen t as given in TRCG & AP-TCRC report	TBD	AP-TCRC
6	KRA1 -3	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Up to 4 forecasters from TC to CMA Forecaster Training	nil	Provision of administrativ e and logistic support.	Q3 – Q4 2025	СМА	Assessment as given in CMA report.	Participatio n will be supported by CMA	СМА
7	KRA 1-3	To enhance TC Members' capacity and knowledge	Attachment of forecasters from TC Members	nil	Provision of administrativ e and logistic support.	Q1 of 2026	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 11,000	TCTF and Member self- funded

in	to RSMC				
operational	Tokyo				
tropical					
cyclone					
forecasting.					