ESCAP/WMO Typhoon Committee
Fifty-second Session
25-28 February 2020
Hong Kong, China

FOR PARTICIPANTS ONLY
WRD/TC.52/9.4
30 January 2020

ENGLISH ONLY

TRAINING & RESEARCH COORDINATION GROUP (TRCG)

(submitted by TRCG Chair)

Summary and Purpose of Document**:**

This document reviews past activities, progress and future plans of TRCG.

Action Proposed

The Committee is invited to:

(a) note the major activities and development progress of TRCG as summarized in the APPENDIX B;

(b) endorse the training and research priority areas as outlined in Section 5 of the APPENDIX B;

(c) endorse the proposed increases in the budget for the RSMC Tokyo Training Attachment and Roving Seminar as outlined in Section 6 and Annex VIII of the APPENDIX B; and

(d) endorse the future plans of TRCG as outlined in Section 6 and Annexes VII and VIII of the APPENDIX B.

APPENDICES :
A : Draft text for inclusion at Session Report
B : TRCG Annual Report 2019

APPENDIX A
DRAFT TEXT FOR INCLUSION IN THE SESSION REPORT

9.4. Training and Research Coordination Group

The Committee took note of the progress made in training and research activities as presented in the TRCG Report 2019 (Appendix ???)

The Committee expressed its appreciation to the China Meteorological Administration for hosting the Roving Seminar 2019 in Beijing, China and the support of resource persons by Hong Kong, China, Japan and USA.

The Committee thanked China, Hong Kong, China and Republic of Korea for hosting research fellowship programs in 2019.

The Committee took note of the successful completion of the RSMC Tokyo Training Attachment of nine forecasters from TC and PTC Members, including China, Hong Kong, China, Lao PDR, Macao, China, Malaysia, Thailand, and Vietnam of the Typhoon Committee as well as two forecasters in the Panel on Tropical Cyclone and thanked Japan and WMO TCP for continuously supporting this capacity-building initiative.   The Committee also noted that newly introduced self-funded approach was well received by some of the Members.

The Committee expressed its appreciation to China for offering the Typhoon Forecaster Training for twenty-eight forecasters from TC and PTC including China, Hong Kong, China, Thailand, Viet Nam, Bangladesh, Myanmar, Maldives, and Sri Lanka.

The Committee appreciated TRCG's inputs in support of training and research activities in connection with TC's cross-cutting projects.

The Committee also noted Dr. Kang Nam-young of the Republic of Korea has left the TRCG and stepped down from the Vice Chair position and thanked Dr. Kang for his valuable contributions to the Committee over the years.

RECOMMENDATIONS of TRCG:

On the basis of the conclusions reached by the deliberation of Members, the TRCG made the following recommendations :

   a. To request Members to confirm their respective focal points as members of TRCG and update the list of resource persons as appropriate.

   b. To endorse the priority training and research areas as proposed in TRCG Report 2019.

   c. To endorse the proposal of increasing the funding support for the RSMC Tokyo Training Attachment from US10,000 to US11,000 and for the budget of the Roving Seminar from US16,000 to US17,000, starting from 2020.

   d. To endorse the TRCG AOP 2020 (including the first quarter of 2021) including the hosting of the roving seminar under the support of TCTF and other budget requests which are included in the budget proposal to be submitted by AWG.

TRAINING & RESEARCH COORDINATION GROUP (TRCG)
Annual Report 2019

T C Lee (TRCG Chair)
Hong Kong, China

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 at 31 December 2019) are:

Chair: Dr. T C Lee (Hong Kong, China)
Vice Chair: Dr. Namyoung Kang (Republic of Korea) [Up to September 2019]
Members: Mr. So Im Monichoth (Cambodia)
                    Mr. QIAN Chuanhai (China)

Mr. Kang Bom Jin (DPR Korea)

Dr. EITO Hisaki (Japan)

Dr. Cha Eun Jeong (Republic of Korea)

Dr. Mayphou Mahachaleun (Lao PDR)

Mr. IAN Vai Kei, Brian (Macao, China)

Mr. Ambun Dindang (Malaysia)

Dr. Bonifacio G. Pajuelas (Philippines)

Ms Patricia Ee (Singapore)

Ms. Patchara Petvirojchai (Thailand)

Mr. Dinh Thai Hung (Viet Nam)

Mr Eric Lau (USA)

3. Major TRCG Activities in 2019

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 2019 was successfully held on 11-13 November 2019 in Beijing, China. The Roving Seminar was kindly hosted by the China Meteorological Administration (CMA) of China.   In order to encourage knowledge sharing , this seminar was organized in conjunction with the 4th CMA Typhoon Training Programme which was held on 11-21 November 2019 with the participants of the Typhoon Training Programme also joining the seminar.   The theme of this seminar is on "Quantitative Precipitation Estimation and Forecasting (QPE/QPF)", which will include the following three topics:

Topic A -   Nowcasting system and related QPF forecasting products
(Mr W C Woo from the Hong Kong Observatory, Hong Kong, China)
Topic B –   Raingauge and radar data processing for QPE/QPF
(Mr Erik Becker from National Environment Agency, Singapore)
Topic C –   Radar and typhoon related rainfall prediction and their applications in flood forecasting
(Prof. NAKAKITA Eiichi from the Kyoto University, Japan)

3.3   The Seminar was attended by 34 participants from Bangladesh(1), China (21), Hong

Kong, China (2), Macau, China (1), Lao PDR (1), Maldives (1), Myanmar (1), Singapore (1), Sri Lanka (1), Thailand (3), Viet Nam (1). Three resource persons came from Hong Kong, China, Japan and Singapore and one representative came from Typhoon Committee Secretariat (TCS). The advice and information shared by the three resource persons on relevant topics were well received and considered very useful by the participants. A number of participants indicated that there are foreseeable opportunity for using the knowledge gained from this seminar in future operational implementation. A summary report of the seminar can be found in Annex II.

Forecasters' Training Attachment

3.4   The RSMC-Tokyo Attachment Training in 2019 was successfully held at Japan Meteorological Agency (JMA) Headquarters from 18 to 29 November 2019. With a view to meeting the increasing needs of Members for participating in the Attachment Training, it was adopted in the 51st Session of the Typhoon Committee that, starting from 2019, the number of TCTF supported Typhoon Committee trainees will increase from 3 to 4 and self-funded participation will also be considered. Moreover, forecasters from the Member countries of the Panel on Tropical Cyclones have been invited since 2015. In 2019, nine forecasters from Bangladesh, China, Hong Kong, China, Lao P.D.R., Macao, China, Malaysia, Myanmar, Thailand and Viet Nam attended the attachment training.

3.5   The training focused on practical knowledge and skills related to operational TC analysis and forecasting via lectures and exercises. Presentations and exercises were also provided on public weather services, including the setting of warning criteria based on disaster statistics, key roles of quantitative precipitation estimation and forecasting techniques, appropriate provision of disaster risk reduction (DRR) information, and forecast skill evaluation, to enhance capacity in the development and implementation of effective warning systems in collaboration with DRR operators. Moreover, Dr. Balachandran Sethurathinam from the India Meteorological Department joined the training as guest lecturer. He gave a lecture on the South Asian Monsoon and TCs in the Indian Ocean area. Furthermore, all attendees gave presentations to help JMA staff understand the current status of their meteorological and hydrological services, including those relating to TCs and warnings.

3.6   To promote the Typhoon Committee's regional cooperation and enhance members' typhoon monitoring and early warning capability, CMA kindly organized the Typhoon Forecaster Training Programme on 11-21 November 2019. The training course covered a range of areas, including the latest developments on satellite imagery based tropical cyclone and marine weather analysis, quantitative precipitation forecast, severe weather forecast, sea wave and storm surge forecast, in addition to Dvorak practices and operations. Professor Mark

A. Lander and Professor Wang Yuqing were invited to participate in the training course as tutors.   Twenty eight trainees from China (20), Hong Kong, China (1), Thailand (2), Viet Nam (1), Bangladesh (1), Myanmar (1), Maldives (1), and Sri Lanka (1) attended the training

Research Fellowship Scheme

3.7   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 experienced scientists 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.

3.8   In 2019, fellowships were offered by China, Hong Kong, China and Republic of Korea.   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.

(a)   KMA Fellowships

The National Typhoon Center (NTC) of Korea Meteorological Administration (KMA) hosted the Typhoon Research Fellowship Program of the TRCG for the Typhoon Committee Members from 20 May to 14 June 2019.   Two forecasters from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), National Center for Hydro-Meteorological Forecasting (NCHMF) of Vietnam participated in this program.   The program included a practice session on tropical cyclone analysis and forecast using Typhoon Operation System (TOS). Participants conducted research to develop the multi-model ensemble forecast of TC track using Bayesian model averaging and visited the National Meteorological Satellite Center (NMSC) and National Center for Meteorological Supercomputer as well as the KMA headquarters.

(b)   STI Fellowship

A visiting editor from USA, Prof. Kimberly Wood of the Mississippi State University, participated the Typhoon Committee fellowship for visiting editor on 24-29 March, 2019. Prof. Shishir Dube from Indian Institute of Technology also visited the TCRR editorial office on 13-19 October, 2019.

(c) HKO Fellowship

The Hong Kong Observatory (HKO) offered the fellowship on a topic entitled "Integrated Precipitation Estimator using Radar and Satellite (IPERS) for Tropical Cyclone Rainfall (TC) Analysis and Nowcasting" in 2019.   A forecaster from the Philippines will participate in the fellowship.   Tentatively, the fellowship will be conducted in the first quarter of 2020.

4.   Resource Support for Research and Training

4.1   Resource persons or contact points on specialized research subjects provided by some Members are tabulated for reference in Annex V.

4.2   The Pacific International Training Desk (PITD), funded by the USA National Weather Service as part of the US contribution to the WMO Voluntary Cooperation Program (VCP), and is now managed by the Telecommunications and Social Informatics (TASI) Research Program at the University of Hawaii. The PITD provides one-on-one basic weather forecast training with an emphasis on the tropics. The training program is focused on operational forecasting to enable its participants to prepare and disseminate locally-produced meteorological, hydrologic and climate products for their home countries. There are four components to the training: 1) eLearning Prerequisite Course, a15-hour course implemented through the use of e-learning modules; 2) On-Site Training Program, a 4-week long, instructor-led on-site training programme carried out at the US Weather Forecast Offices in Honolulu and Guam (this is the first year that training was conducted on Guam); 3) Communications Training, a training on the use of communication systems; and 4) Advanced In-Island workshops on severe weather event topics. Priority is given to Regional Association V (RA V) of the World Meteorological Organization (WMO). However, subject to space availability, Typhoon Committee Members may also apply.

5.   Prioritization of Training and Research Areas

5.1   Based on the discussion during the 3rd TRCG Meeting held in conjunction with the 12th Integrated Workshop (IWS) in Jeju on 31 October – 1 November 2017.   The priority and need for training and research activities have been reviewed and updated as follows:

(A) Meteorology

Monitoring

(a)   application of Dvorak and microwave satellite image analysis techniques;

(b) application of radar-based analysis/products for landfalling tropical cyclones and monsoon depressions;

(c) 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

(a) development of tropical cyclone structure and intensity forecasting techniques such as rapid intensification and wind structure;

(b) application of ensembles of guidance from global and regional dynamical models, ensemble prediction systems, conceptual models, statistical models and systematic knowledge-based approach;

(c) use of high resolution numerical models with advanced data assimilation techniques;

(d) rainfall forecasting: development of nowcasting and very short range forecasting techniques, and understanding of interaction between tropical cyclones and monsoon;

(e) development of probability forecasting and extended outlook; ;

(f) development of impact-based forecast and risk-based warnings;

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

(B) Meteorology and Hydrology

(h) application of meteorological and hydrological information for forecasting of river flooding and urban flash flood;

(i) geological hazards associated with heavy rain and tropical cyclones such as flash flood, mudslides and landslides;

(C) Meteorology and DRR

(j) development of technical procedures to quantify forecast uncertainties and to convert probabilistic information into effective warnings;

(k) development of decision-making tools for DRR purpose, including the integration of forecast information with GIS and the use of automated information processing systems;

(l) making use of new communication technology;

(m) community response and outreach effort for mitigation of the societal impact caused by disasters.

(D) Other Cross Cutting Topics

  (n) better understanding of tropical cyclone related issues and impacts across different spatial and time scales, from mesoscale and synoptic analysis arising from El Nino/La Nina and global warming/climate change;

  (o) 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;

  (p) effective communication of warning messages to stakeholders, DRR users and communities at risk; and

  (q) 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 Following the new 4-year plan approved in the 50th Session of the Typhoon Committee (Annex VII), TRCG will continue to support plans to have more cross-cutting training and research initiatives in consultation with the meteorology, hydrology and DRR components, including the proposed WGM project on "Workshop on typhoon forecasting techniques and WGM project progress review". Members are in turn encouraged to promote such initiatives through proactive involvement of the appropriate meteorological, hydrological and DRR personnel in their countries.

6.2 The current arrangement in RSMC Forecasters' Training Attachment operated smoothly in past few years and will generally be maintained in the next year. The possibility of involving hydrologists and DRR experts in RSMC Attachment Training, CMA Training Programme, 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 and WMO Training Centre in Nanjing as well as various interested Members if the opportunity arises.

6.3 With a view to catering for the inflation over the years and meeting the increasing needs of Members for participation in the Roving Seminar, it is proposed to increase the budget of the Roving Seminar from US16,000 to US17,000, starting from 2020. Moreover, it is proposed to increase the budget for the RSMC Forecasters' Training Attachment from US10,000 to US11,000 to partially cover the reduction in WMO TCP support and the inflation in recent years. In view of the relocation of the JMA Headquarters in 2020, the RSMC

Forecaster's Training Attachment originally for 2020 will be tentatively scheduled to Q1 of 2021.

6.4   Review of the TRCG AOP 2019 can be found in Annex VI and the proposed AOP 2020 (including the first quarter of 2021) is in Annex VIII.

6.5   In view of personal career change, Dr. Kang Nam-young of the Republic of Korea has left the TRCG and stepped down from the Vice Chair position.   TRCG would like to thank Dr. Kang for his valuable contributions to the Typhoon Committee over the years.

Summary of Roving Seminars

Year	Dates	Venue	Topic	Lecturers
2003	20 – 21 Oct	Seoul	Interpretation of Typhoon Forecasts and Analyses	Dr. H-J Kwon Mr. MANNOJI Nobutaka
	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. B.-J. 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
	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. B.-J. Kim
2007	5 – 8 Sep	Manila	Satellite and Radar Analysis Techniques, and Tropical Cyclone Interaction with Monsoon 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
2015	4-6 Nov	Lao PDR	Flash flood and landslides	Mr NAGAI Yoshiki Prof. Xu-dong Fu Dr. Dong-ryul Lee
2016	15-17 Nov	Viet Nam	Storm Surge	Mr. KOHNO NadaoMr. Author Taylor Mr. Dickson Lau
2018	20-22 Nov	Singapore	Application of Remote Sensing Technologies	Mr. YAMASHITA Koji Dr. Xiang Fang Mr. Ray Kong
2019	11-13 Nov	China	Quantitative precipitation estimation and forecasting (QPE/QPF)	Mr. W C Woo Mr. Erik Beaker Prof. NAKAKITA Eiichi

SUMMARY OF TYPHOON COMMITTEE ROVING SEMINAR 2019
(Beijing, China, 11-13 November 2019)

I.   Organization

1.   The Typhoon Committee Roving Seminar (TCRS) 2019 with the theme on "Quantitative Precipitation Estimation and Forecasting (QPE/QPF)" was successfully held on 11-13 November 2019 in Beijing, China.   It was organized by ESCAP/WMO Typhoon Committee (TC) and hosted by the China Meteorological Administration (CMA) of China.

2.   The Seminar was attended by 34 participants from Bangladesh(1), China (21), Hong Kong, China (2), Macau, China (1), Lao PDR (1), Maldives (1), Myanmar (1), Singapore (1), Sri Lanka (1), Thailand (3), Viet Nam (1). Three resource persons came from Hong Kong, China, Japan and Singapore and one representative came from Typhoon Committee Secretariat (TCS). The list of participants is given in Attachment A.

II.   Opening

1.   The opening ceremony of TCRS 2019 was hosted by Mr. Zong Zhiping, Deputy Director of National Meteorological Center, CMA, Mr. Wang Zhiqiang, Deputy Director of CMA Training Center and Mr. Clarence Fong, Meteorologist of TCS.

2.   Mr. Zong and Mr. Wang welcomed all participants from China and other countries. In order to encourage knowledge sharing, TCRS 2019 was organized in conjunction with the 4th CMA Typhoon Training Programme which was held on 11-21 November 2019. The two events shared the same programme in the first three days.

3.   Mr. Fong expressed his gratitude to CMA for hosting the Roving Seminar as it was one of the main activities of the TC which has been coordinated by the TRCG since 2003. He also expressed his gratitude to the resource persons for sharing valuable experience in QPE/QPF among TC Members.

III. Seminar Programme

1.   Mr. Woo Wang-chun from the Hong Kong Observatory of Hong Kong, China presented Topic A on "Nowcasting system and related QPF forecast products".

2.   Mr. Erik Becker from National Environment Agency of Singapore presented Topic B on "Raingauge and radar data processing for QPE/QPF".

3.   Prof. NAKAKITA Eiichi from Kyoto University of Japan presented Topic C on "Radar and typhoon related rainfall prediction and their applications in flood forecasting".

4.   A technical visit to National Meteorological Centre (NMC), CMA Public Meteorological Service Centre (PMSC) and National Satellite Meteorological Centre (NSMC) was conducted in the afternoon of 13 November 2019.

5.   The Roving Seminar Programme is given in Attachment B.

IV. Proposals and Recommendations

1. The participants gave a warm appreciation to the three resource persons for their presentations and useful advice on the relevant topics.

2. During the wrap up discussion, participants shared their experience in their forecasting office for QPE/QPF and expressed gratitude to the resource persons. The resource persons encouraged the participants for further collaborations and assistance, for example, to download and set up the SWIRLS nowcasting system. 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) Climate change topics;
   (b) Some lectures on new and upcoming technologies like phased array radar.

V. Closing

1. The resource persons and participants expressed their gratitude to CMA and TCS for hosting this seminar and for their warm hospitality.

2. The resource persons and Mr. Clarence Fong of TCS presented the attendance certificates to the participants.

3. The Roving Seminar was closed on 13 November 2019.

List of Participants of the Typhoon Committee Roving Seminar 2019
(Beijing, China, 11-13 November 2019)

Members	Name of Participants
Bangladesh(1) China (21)	Ms. Kawsar Parvin 柳龙生 刘达 胡海川 刘爽 崔园园 李杨 张喜平 蔡晓杰 杨茜茜 许琪 孙莎莎 刘春霞 郭春迓 刘乐 李玉梅 胡田田 严睿恺 付超 吕润清 吴琼 孙舒悦
Hong Kong, China (2)	Mr. Chong Man Lok Ms. Yum Ka Yee
Macau, China (1)	Mr. Mui Hong Kei
Lao PDR (1)	Ms. Chao Khaemeuy
Maldives (1)	Mr. Ahmed Nazeer
Myanmar (1)	Ms. Cho Lwin Thu
Singapore (1)	Mr. Boh Wei Ze, Darryl
Sri Lanka (1)	Mr. P. G. Yasarathna
Thailand (3)	Mr. Kamol Promasakha Na Sakolnakhon Ms. Prapaporn Wongsaming Ms. Duangporn Kaewbungwan
Viet Nam (1)	Ms. Ngo Thi Kim Duyen

Resource persons	Mr. Woo Wang Chun Mr. Erik Becker Prof. Eiichi Nakakita
TCS	Mr. Clarence Fong

Typhoon Committee Roving Seminar 2019
Final Programme

Dates and Venue: 11-13 November 2019, CMA Headquarters, Beijing

Main Theme: Quantitative precipitation estimation and forecasting (QPE/QPF)

Topic A – **Nowcasting System and related QPF forecasting products**
      (Mr. W C Woo from the Hong Kong Observatory, Hong Kong, China)
Topic B – Raingauge and radar data processing for QPE/QPF
      (Mr. Erik Becker from National Environment Agency, Singapore)
Topic C –Radar and typhoon related rainfall prediction and their applications in
      flood forecasting   *(Prof. NAKAKITA Eiichi from the Kyoto University, Japan)*

Seminar Schedule:

	Day 1 (11 Nov, Mon)	Day 2 (12 Nov, Tue)	Day 3 (13 Nov, Wed)
AM	Opening Ceremony & Group Photo (0900 - 0945)	**C1: Early Detection of Baby-Rain-Cell Aloft in a Severe Storm and Risk Projection for Urban Flash Flood** (0900 - 1030)	**B3 : Radar-Based Nowcasting and Verification Techniques** (0900 - 1000)
	Tea Break (0945 - 1015)	*Tea break (1030 - 1100)*	*Tea Break (1000 - 1030)*
	Experience Sharing by Member Representatives[a] (1015 - 1200	**A2 : Probabilistic QPF & Impact-based Forecasting/Warning** (1100 - 1200)	**C3: Hybrid Ensemble Forecast of Typhoon Related Rainfall and Its Applications into Flood Forecast** (1030 - 1130)
			Wrap-up Discussion (1130 - 1230)
	Lunch (1200 – 1330)		*Lunch (1230-1400)*
PM	**A1 : RSMC for Nowcasting & SWIRLS Nowcast System** (1330 - 1500)	**B2 : Radar Precipitation and Rain-Gauge Adjustment Techniques** (1330 - 1500)	Technical Visit to CMA facilities/sites (to be confirmed)
	Tea Break (1500 - 1515)		
	B1 : Radar and Rain-Gauge Data Quality and Processing (1515 - 1615)	**C2 : Radar Based Nowcast of Typhoon Related Rainfall and its Orographic Effects** (1515 - 1615)	
	Tea Break (1615 - 1630)		
	Key operational technology of the QPE and QPF in CMA (1630 - 1730)	**A3 : Nowcast of Thunderstorm, Hail and Gust and Satellite Nowcast Applications** (1630 - 1730)	

(a) One of the participants from each Member will be invited to represent his/her weather services to deliver a 10 minutes presentation regarding the use of QPE/QPF in his/her

Service.

Day 1   11 November 2019 (Monday)

Time	Tasks
0830-0900	Registration and Greeting
0900-0945	Opening speech: - Representative(s) from CMA Welcome speech: - Mr. Clarence Fong, Meteorologist, UN ESCAP/WMO Typhoon Committee Introduction of the program / speakers by TCS Group photos
0945-1015	*Tea break*
1015-1200	Participant self-introduction and experience sharing by Members Representatives (about 10 min each)
1200-1330	*Lunch*
1330-1500	Topic A1 : RSMC for Nowcasting & SWIRLS Nowcast System (W C Woo)
1500-1515	*Tea Break*
1515-1615	Topic B1 : Radar and Rain-Gauge Data Quality and Processing (Erik Becker)
1615-1630	*Tea Break*
1630-1730	Invited lecture : Key operational technology of the QPE and QPF in CMA (CAO Yong)

Day 2   12 November 2019 (Tuesday)

Time	Tasks
0900-1030	Topic C1 : Early Detection of Baby-Rain-Cell Aloft in a Severe Storm and Risk Projection for Urban Flash Flood (NAKAKITA Eiichi)
1030-1100	*Tea Break*
1100-1200	Topic A2 : Probabilistic QPF & Impact-based Forecasting/Warning (WC Woo)
1200-1330	*Lunch*
1330-1500	Topic B2 : Radar Precipitation and Rain-Gauge Adjustment Techniques (Erik Becker)
1500-1515	*Tea Break*
1515-1615	Topic C2 : Radar Based Nowcast of Typhoon Related Rainfall and its Orographic Effects (NAKAKITA Eiichi)
1615-1630	*Tea Break*
1630-1730	Topic A3 : Nowcast of Thunderstorm, Hail and Gust and Satellite Nowcast Applications (WC Woo)

Day 3   13 November 2019 (Wednesday)

Time	Tasks
0900-1000	Topic B3 : Radar-Based Nowcasting and Verification Techniques (Erik Becker)
1000-1030	*Tea Break*
1030-1130	Topic C3 : Hybrid Ensemble Forecast of Typhoon Related Rainfall and Its Applications into Flood Forecast (NAKAKITA Eiichi)
1130-1230	Wrap-up Discussion (attended by all participants and lecturers)
1230-1400	*Lunch*
1400-1800	Technical Visit (TBC)

TRCG ACTIVITIES EVALUATION FORM
Roving Seminar 2019
(Beijing,China, 11 – 13 Nov 2019)

24 responses (out of 21 participants + 3 lecturers)
(not all questions answered by responders)

Part A: Event Logistics

Expectation levels as indicated number of responders	Below expectation ☹		Met expectation 😐		Exceeded expectation ☺	
(P = participants; R = resource persons)	P	R	P	R	P	R
1. Overall administration/organization	0	0	6	2	15	1
2. Pre-event arrangement and liaison	1	0	4	1	16	2
3. Venue facilities	2	0	8	2	11	1
4. Informative announcements and instructions	0	0	8	2	13	1
5. Travel arrangements	3	0	6	2	12	1
6. Funding arrangements	1	0	7	2	13	1
7. Accommodation	0	0	8	1	13	2
8. Refreshments	2	0	7	2	12	1
9. Social events and visitors' information	2	1	5	1	13	1
10. Helpfulness and friendliness of organizers	2	0	4	1	15	2

Specific points for improvement, if any:

Suggest reserving a table for lunch

More Q&A or discussion after each lecture/ showing

Need Tea or coffee serve during tea breaks

International breakfast we need coffee, snack break, etc.

Tourist spot visit for all

Hope to get a copy of the PPT for these lectures.

The projector screen is too small to see.

Field visit and practical work and some example.

Part B: Technical Contents (from participants only)

A – Lectures by Mr. W.C.WOO B – Lectures by Mr. Erik Becker C – Lectures by Prof. NAKAKITA Eiichi	A	B	C
Interest in Topic (1 to 5 ; from disinterested to most interested)			
Topic Contents (1 to 5 ; from irrelevant to topic to most relevant)			
Topic Organization (1 to 5 ; from loosely structured to well-structured)			
Lecture/Workshop Presentation (1 to 5 ; from poor to excellent)			
Training or Practical Material (1 to 5 ; from ill-prepared to well-prepared)			
Language (1 to 5 ; from hard to understand to easy to follow)			
Effectiveness (1 to 5 ; from little understanding gained to much understanding gained)			

	A	B	C
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)			

Part C: Follow-ups

1. (For Lecturers) Any views on considerations in selecting future lecturers and participants?

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

  - How to process make use of radar data
  - HKO SWIRLS system & deep learning
  - Nowcasting techniques currently implemented by HKO & JMA
  - Get the new method to develop for Radar-nowcasting
  - short-to-very short range nowcasting, QPE/QPF which can adapt for the future TMD project.
  - Get more experienced in rainfall forecast from radar, in the future, maybe applying now forecast for my region.
  - QPE and QPF techniques and case study on severe storm, heavy rain and flash flood.
  - Need more practice how to do QPE/QPF in the poor technique countries. The workshop a QPE/QPF will be very useful for the next organization of Roving Seminar.

- Learned some new skills about the supercell tracking, data revision methods. We should pay more attention to the details of operational businesses.
- Blending of the radar & NWP
- Application of radar to solve local problems
- Require a study on how to approach different weather system and postmodern case study and QPE and QPF

3. Any foreseeable opportunity for operational implementation of the above benefits?

Answer: Yes, benefits likely to be felt in about
           (a) a couple of years or less
           (b) in 2 – 5 years   7
           (c) in 5 years or more
           (d) no foreseeable opportunity   3

4. (For Lecturers) Any views on future topics that may generally help to improve Members' capacity in QPE/QPF?

- Climate Change
- Some lectures on new and upcoming technologies like phased array radar.

5. (For Lecturers) Any specific suggestions, assuming you have the opportunity to visit local forecasting offices, for host Member to enhance its capacity in QPE/QPF?

The participants of the Roving Seminar taking a group photo at the CMA Training Center of China Meteorological Administration with the resource persons and representative from Typhoon Committee Secretariat.

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	Mr. HOA, Vo Van (Viet Nam)	Korea Meteorological Administration	Jun – Aug 2006

model, and calibration of intensity of typhoon with Kalman filtering			
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 typhoon model forecast errors in anomalous typhoon tracks.	Dr. Bonifacio Galt Pajulelas (Philippine) , Mr. Nguyen Huu Thanh (Vietnam), and Ms. Prapaporn Wongsaming (Thailand)	Korea Meteorological Administration	1 May – 30 June 2013
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 Il 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 depression or extra-tropical transition	Ms. Akhom THAMALANGSY (Lao PDR) Mr. Aldczar D. Aurelio (The Philippines), Mr. Jose Frivaldo, JR. (The Philippines), Mr. Somprat Srithagon (Thailand), and Ms. DO Thi Thanh Thuy (Viet Nam)	Korea Meteorological Administration	19 April - 2 May 2015
Tropical cyclone genesis forecast technique	Mr. Pak Sang Il (DPR Korea) Mr. Ri Hak Il (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 Il 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 - Seasonal typhoon prediction	Ms. Reyes Sheilla Mae R. (the Philippines) Mr. Tran Van Vu (Viet Nam)	Korea Meteorological Administration	20 May to 14 June 2019
Visiting Editor for Tropical Cyclone Research and Review	Prof. Kimberly Wood (USA) Prof. 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

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

List of Resource Persons

Member	Specialties	Name	E-mail	Affiliation
(A) Data Assimilation				
China	TC vortex initialization	LIANG, Xudong	Liangxd@mail.typhoon.gov.cn	Shanghai Typhoon Institute
	TC intensity estimation by radar, satellite, SSMI and QuikScat	GAO, Shuanzhu ZHOU, Bing	gaosz1129@sina.com 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	W.K. WONG	wkwong@hko.gov.hk	Hong Kong Observatory
Japan	Satellite data assimilation	AONASHI Kazumasa	aonashi@mri-jma.go.jp	Meteorological Research Institute
	Satellite data assimilation	OKAMOTO Kozo	kokamoto@mri-jma.go.jp	Meteorological Research Institute
	Data assimilation	ISHIBASHI Toshiyuki	ishibasi@mri-jma.go.jp	Meteorological Research Institute

(A) Data Assimilation (cont'd)

Republic of Korea	Typhoon bogussing	JOO, Sang Won	swjoo@korea.kr	Korea Meteorological Administration
	Satellite data analysis	KIM, Ok Hee	koh@korea.kr	Korea Meteorological Administration
	Radar data analysis	NAM, Kyung Yeob	kynam@korea.kr	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

(B) Modelling

China	Numerical schemes of TC model	DUAN, Yihong	duanyh@mail.typhoon.gov.cn	Shanghai Typhoon Institute
	TC model physics and bogussing schemes	MA, Suhong	mash@cma.gov.cn	National Meteorological Center
	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	TC modelling and bogussing schemes	W.K. WONG	wkwong@hko.gov.hk	Hong Kong Observatory

(B) Modelling (cont'd)

Japan	Ensemble track forecasting	YAMAGUCHI Munehiko	myamagu@mri-jma.go.jp	Meteorological Research Institute
	TC-ocean interaction (incl. mixed-layer ocean and ocean surface wave modelling)	WADA Akiyoshi	awada@mri-jma.go.jp	Meteorological Research Institute
	TC modelling	SAWADA Masahiro	msawada@met.kishou.go.jp	Japan Meteorological Agency
	Storm surge / wave modelling	KOHNO Nadao	nkohno@mri-jma.go.jp	Meteorological Research Institute
Republic of Korea	Global NWP model tracks	KIM, Yoon Jae	yoonjae@korea.kr	Korea Meteorological Administration
	Ensemble track forecasting	SHIN, Hyun Cheol	sinhyo@korea.kr	Korea Meteorological Administration
	Typhoon modelling	JOO, Sang Won	swjoo@korea.kr	Korea Meteorological Administration
USA (western North Pacific)	TC Modeling Extratropical Transition TC Genesis Sub-Tropical Systems Structure	Jim DOYLE Pat HARR Jenni EVANS	James.Doyle@nrlmry.navy.mil paharr@nps.edu evans@meteo.psu.edu	NRL, Monterey CA Naval Postgraduate School, Monterey CA Pennsylvania State Univ
Viet Nam	Computational fluid dynamics and modelling	LE, Duc	leducvn@yahoo.com	National Hydro-Meteorological Service of Viet Nam

(C) Forecasting

China	Track and intensity forecasting	LEI, Xiaotu	Leixt@mail.typhoon.gov.cn	Shanghai Typhoon Institute

	Long-range prediction of typhoon	XU, Ming	Xum@mail.typhoon.gov.cn	Shanghai Typhoon Institute
Hong Kong, China	TC climatology and best track analysis	C.W. CHOY	cwchoy@hko.gov.hk	Hong Kong Observatory
	TC rainfall nowcasting	W.C. Woo	wcwoo@hko.gov.hk	Hong Kong Observatory
	TC intensity, structure and landfall impact	S.T. Chan	stchan@hko.gov.hk	Hong Kong Observatory
	Long-range forecasting of TCs	S.M. LEE	smlee@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	CHA, Eun Jeong	cha@kma.go.kr	Korea Meteorological Administration
	Long-range prediction of typhoon			
Singapore	Seasonal prediction of typhoon	LIM, Tian Kuay	LIM_Tian_Kuay@nea.gov.sg	Meteorological Services Division, National Environment Agency

(C) Forecasting (cont'd)

USA (western North Pacific) USA (western North Pacific)	TC analysis and forecasting, seasonal prediction, use of microwave imagery and scatterometer data, Dvorak technique	Mark LANDER Roger EDSON	mlander@uguam.uog.edu Roger.Edson@noaa.gov	University of Guam (WERI) National Weather Service, Forecast Office Guam
	Satellite data analysis, use of microwave imagery	Jorel TORRES Dan LINDSEY	Jorel.Torres@colostate.edu Dan.Lindsey@colostate.edu	NOAA/NESDIS at CIRA, Colorado State University
	Satellite data analysis, use of microwave imagery, automated Dvorak Technique, AMSU	Chris VELDEN Derrick HERNDON	chris.velden@ssec.wisc.edu dherndon@ssec.wisc.edu	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

(D) Application

Hong Kong, China	TC warning systems and operations	L. S. Lee	lslee@hko.gov.hk	Hong Kong Observatory

	TC information visualization and display systems	S.T. CHAN	stchan@hko.gov.hk	Hong Kong Observatory
USA (western North Pacific)	TC warning and disaster preparedness, seasonal prediction, Dvorak technique	Chip GUARD	chip.guard@noaa.gov	NOAA National Weather Service Guam

| | | | | | | Review of Training and Research Coordination Group (TRCG) Annual Operating Plan 2019 | | | | | |
Objective Number	KRA	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: (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 [QPE/QPF]	WGM, WGH and WGDRR	Provision of administrative and logistic support.	4th	-	Feedback and recommendations collected from the speakers and participants	USD 16,000	TCTF	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.	2nd - 4th	TC Members	Publication of research findings and development output in TCRR or other journals.	Fellowship offered by voluntary hosts.	TC Members	Yes
3	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.	4th	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 10,000[1]	TCTF and Member self-funded	Yes
4	KRA 1-3	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.	4th	CMA	Assessment as given in CMA report.	Participation will be supported by CMA	CMA	*Yes*

Provisional TRCG Work Plan (2019 – 2021)

Year	Quarter	Typhoon Committee Activity	Training and Research Activities (*activities organized by parties other than TRCG)	Themes (if any) / Remarks
2019	Q1	TC-51	Research Fellowship	HKO fellowship in Jan-Mar STI Visiting Editor
	Q2		Research Fellowship	KMA
	Q3			
	Q4	14th IWS (Guam, USA)	CMA Training Program	Nov 2019
			RSMC Tokyo attachment	Held in Nov 2019
			Roving Seminar	Held in Beijing, China with the theme on "QPE and QPF"
2020	Q1	TC-52	Research Fellowship	HKO fellowship in Jan-Mar
	Q2		Research Fellowship	KMA
	Q3			
	Q4	15th IWS (TBC)	CMA Training Program	TBC
			Roving Seminar*	Proposed to be in Vietnam with theme on "Impact-based forecasting"
2021	Q1	TC-53	RSMC Tokyo attachment	TBC
			Research Fellowship	HKO fellowship in Jan-Mar
	Q2		Research Fellowship	TBC
	Q3			
	Q4	16th IWS (TBC)	CMA Training Program	TBC
			TRCG Forum / 4th TRCG Meeting	Proposed to be in conjunction with the 15th IWS

* The hosting venue of the roving seminar is still subject to the confirmation of the proposed hosting Member.

Training and Research Coordination Group (TRCG) Annual Operating Plan 2020 (including Q1 of 2021)
Objective Number	KRA	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources
1	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 [Impact-based forecasting]	WGM, WGH and WGDRR	Provision of administrative and logistic support.	Q4 2020	-	Feedback from evaluation forms to be completed by a target audience of about 30 people.	USD 17,000[1]	TCTF
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.	Q2-Q4 2020	TC Members	Publication of research findings and development output in TCRR or other journals.	Fellowship offered by voluntary hosts.	TC Members
3	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.	Q3-Q4 2020	CMA	Assessment as given in CMA report.	Participation will be supported by CMA	CMA
4	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 2021	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 11,000[2]	TCTF and Member self-funded

Remarks :

1. Proposed to increase the budget of Roving Seminar from US16,000 to US17,000 to cater for the inflation and the increasing needs of the Members.

2. Proposed to increase the budget of the RSMC Attachment Training from US10,000 to US11,000 to partially cover the reduction in WMO TCP support and the inflation in recent years.