

**ESCAP/WMO Typhoon Committee**

Fiftieth Session

28 February – 3 March 2018

Hanoi,

Viet Nam

FOR PARTICIPANTS ONLY

WRD/TC.50/9.4

**3 March 2018**

ENGLISH ONLY

**TRAINING & RESEARCH COORDINATION GROUP (TRCG)**

*(submitted by TRCG Chair)*

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**Summary and Purpose of Document:**

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

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**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; and
- (c) 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 2017

## **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 2017 and the progress of the organization and completion of the Technical Conference (TECO) in conjunction with the 50th Session of the Typhoon Committee (TC50) in 2018 (Appendix ???). The Committee expressed its appreciation to NHMS of Viet Nam for hosting the TECO in Hanoi and the contribution of speakers in the event.

The Committee took note of the planning and recommendations made in the 3<sup>rd</sup> TRCG Meeting held on 31 October and 1 November 2017, particularly with respect to the revised priority research and training areas, the proposed themes of roving seminars in 2018-2020 and the formulation of a new 4-year work plan of TRCG for 2018-2021. The Committee thanked TRCG Members for their continuing effort and commitment in support of TRCG activities.

The Committee thanked China, Hong Kong, China and Republic of Korea for hosting research fellowship programs in 2017.

The Committee took note of the successful completion of the RSMC Tokyo training attachment of six forecasters from TC and PTC Members and expressed its appreciation to JMA and WMO TCP for continuously supporting this capacity-building initiative.

The Committee thanked China for offering the International Training Course on Typhoon Monitoring and Forecasting for three forecasters from TC.

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

#### **RECOMMENDATIONS of TRCG:**

Based on the discussion in the 3<sup>rd</sup> TRCG Meeting on 30 October – 1 November 2017 and as presented in the TRCG Report 2017, the TRCG made the following recommendations :

- a. To re-appoint Dr. T C LEE (Hong Kong, China) as the Chairperson of TRCG.
- b. To appoint Dr. Nam-young Kang (Republic of Korea) as the new Vice Chairperson of TRCG, replacing Mr Roger Edson (USA) for the remainder of the term.
- c. To request Members to confirm their respective focal points as members of TRCG and update the list of resource persons as appropriate.
- d. To endorse the revised priority training and research areas as proposed in TRCG Report 2017.
- e. To endorse the new TRCG Work Plan for 2018-2021.
- f. To endorse the TRCG AOP 2018 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.

**APPENDIX B**  
**TRAINING & RESEARCH COORDINATION GROUP (TRCG)**  
**ANNUAL REPORT 2017**

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 2017) are:

Chair: Dr. T C LEE (Hong Kong, China)  
Vice Chair: Mr. Roger Edson (USA)

Members: Mr. So Im Monichoth (Cambodia)  
Mr. QIAN Chuanhai (China)  
Mr. Kang Bom Jin (DPR Korea)  
Mr. Chiashi Muroi (Japan)  
Dr. Mayphou Mahachaleun (Lao PDR)  
Mr. IAN Vai Kei, Brian (Macao, China)  
Mr. Muhammad Helmi Abdullah (Malaysia)  
Dr. Bonifacio G. Pajuelas (Philippines)  
Dr. Namyoung Kang (Republic of Korea)  
Ms Patricia Ee (Singapore)  
Ms. Patchara Petvirojchai (Thailand)  
Mr. Dinh Thai Hung (Viet Nam)

### **3. Major TRCG Activities in 2017**

#### ***Roving Seminar / Visiting Lecturers Programme***

3.1 As a technical conference will be held in conjunction with the 50<sup>th</sup> Session of the Typhoon Committee in February 2018, there is no scheduled roving seminar in 2017.

#### ***Technical Conference of Typhoon Committee***

3.2 To celebrate the 50th anniversary of the Typhoon Committee in 2018, Typhoon Committee decided in its 49<sup>th</sup> Session that a Technical Conference (TECO) will be held in conjunction with the 50th Session of the Typhoon Committee (TC50) in Viet Nam in 2018. The overarching theme of the TECO will be “Embracing new technologies and knowledge to meet the challenges in the new era of tropical cyclone forecasting”. Nine Keynote Speakers from China, Hong Kong, China, Japan, Republic of Korea, United States and Viet Nam have been invited for the TECO. Nominations for Technical Presentations from Members have also been received. Further details of the theme and sub-themes and the list of Keynote Speakers as well as the draft programme of the 2-day TC50 TECO are included in Annex I.

#### ***Forecasters’ Training Attachment***

3.4 The RSMC-Tokyo Attachment Training in 2017 was held at JMA Headquarters from 11 to 21 December 2017. In addition to the three forecasters from Thailand, Viet Nam and Hong Kong, China of the Typhoon Committee, as part of the project of SSOP-II, JMA also accepted three forecasters from Bangladesh, Maldives and Myanmar in the Panel on Tropical Cyclone. The contents of the training included:

- (i) The satellite analysis and viewer program (SATAID)
- (ii) Tropical cyclone analysis (Dvorak technique)
- (iii) Interpretation of microwave imagery
- (iv) Tropical cyclone forecasting
- (v) Storm surge forecasting
- (vi) Public Weather Service

Especially, lectures and exercises on public weather service included setting of warning criteria using quantitative precipitation estimation and forecasting techniques and evaluation of forecast skills to enhance capacity in developing and implementing effective warning system in collaboration with disaster risk reduction partners.

3.5 To promote the Typhoon Committee's regional cooperation and enhance members' typhoon monitoring and early warning capability, the China Meteorological Administration staged in 2017 International Training Course on Typhoon Monitoring and Forecast. This 10-day training course was held during 18-27 September 2017. Three forecasters from Viet Nam, Thailand and the Philippines participated in the training course. The course is designed to help trainees to learn how to utilize meteorological satellite information in tropical cyclone and marine weather analysis. The course also introduced the latest forecasting techniques in QPF, severe convective weather, as well as marine weather like gale wind, sea waves and storm surge. A practical session on Dvorak technique was also arranged.

### ***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 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.

3.7 In 2017, 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 II. Publications and papers published in connection with the scheme are listed in Annex III.

- (a) KMA Fellowships

The National Typhoon Center (NTC) of KMA provided a training and research program to four participants: one from the Philippines, and two from the Thailand for two weeks (From 16 to 29 April, 2017), and one from the Viet Nam for 12 days (From 16 to 27 April, 2017). The program consists of theoretical lectures on typhoon track and intensity forecast, numerical weather prediction, and typhoon re-analysis methods. Moreover, the trainees were given opportunities for hands-on practice in generating typhoon information and analyzing typhoon cases, with Typhoon Analysis and Prediction System (TAPS). They also visited the National Meteorological Center (NMC) and the National Meteorological Satellite Center (NMSC) for weather forecast and the acquisition of how to interpret satellite images.

(b) STI Fellowships

The Shanghai Typhoon Institute offered the following four fellowships in 2017:

(i) Two forecasters from Thailand and Viet Nam participated in the fellowship on “Observational Study on Intensity and Structure of Offshore Typhoon for EXOTICCA” which was conducted from 1 to 30 September 2017 in Shanghai Typhoon Institute (STI). The research project aims to identify the intensity, wind structure and heavy precipitation of offshore typhoons and the role of boundary layer structure in the rapid intensification of typhoons.

(ii) The fellowship on “Benefit evaluation of Typhoon disaster prevention and preparedness” was offered to a forecaster from Malaysia (4-17 September 2017). The objective of the fellowship is introducing the techniques for evaluating benefits of tropical cyclone disaster prevention and preparation to the Members.

(iii) The fellowship for the Visiting Editor for Tropical Cyclone Research and Review offered by STI will be conducted in February 2018. Two experts, Mr. Somkuan Tonjan from TMD and Dr. Doan Quang Tri from the National Hydro-Meteorological Service of Viet Nam will be invited to as visiting editors.

(iv) There was no nomination from Members for the fellowship on “Tropical Cyclone Precipitation Verification”.

(c) HKO Fellowships

HKO offered the fellowship on a topic entitled “Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products”. Due to unforeseeable issues, the applicant who was accepted for the HKO Fellowship withdrew from the offer.

### ***WMO International Training Course on Tropical Cyclone***

3.8 The WMO International Training Course on Tropical Cyclone 2017 organized by the WMO Regional Training Centre Nanjing and sponsored by CMA was held in Nanjing, China between 13 and 24 November 2017. Through theoretical study and practices, the course is designed to assist participants to master the basic theory and principles of tropical cyclone. The training course will include lectures on a wide range of topics including tropical cyclone formation, intensity change, and motion, advancements of tropical cyclone monitoring and forecasting, storm surge associated with tropical cyclones, and climate change and tropical cyclone activities.

### ***Development of tropical cyclone forecaster competency***

3.9 In response to a request from the WMO Executive Council, RSMC Tokyo is collaborating with RSMC Honolulu in developing a draft version of tropical cyclone forecaster competency framework. The Tropical Cyclone Forecaster Competency Task Team met in Honolulu, Hawaii, on 14-16 March 2017 to discuss how to use the competency framework and to produce the final draft, which will be finalized by incorporating Members' feedback. The competency framework includes requirements for dedicated and specialized TC forecasters at TC forecast agencies (Category 1) and those for general forecasters providing TC forecast services based on information provided by the parent RSMC or other agencies (Category 2). This framework is considered part of WMO's Competency Standards, which are a key element of a broader ambition to implement the WMO Quality Management System (QMS), and will be used as guidance in Typhoon Committee Attachment Training at RSMC Tokyo and other training activities.

### **Other training activities**

3.10 Training Workshop for Typhoon Committee Community Weather Station Project (iCoWIN) 2017 was successfully held in Hong Kong on 1-3 November 2017. The main theme of the training will be on "Setting up of community weather stations for raising public awareness on climate change and extreme weather". The training aims to enhance Members' capacities in setting up community weather stations for raising public awareness on weather and climate change and promote the use of new communication technology to facilitate sharing of weather information among community. Two participants from Lao PDR and Guam, US attended the training workshop.

3.11 The SSOP-II workshop on mechanism of establishing and preparing SSOP for coastal multi-hazards EWS for DRR experts and warning experts of beneficiary countries was

conducted in WMO RTC Nanjing from 24 to 26 October 2017.

#### **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 IV.

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, a 15-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 3<sup>rd</sup> 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 2017 concluded the 4-year plan for the 4-year period of 2014 -2017. Review of the TRCG AOP 2017 can be found in Annex V.

6.2 The 3rd TRCG Meeting was successfully held on 31 October and 1 November 2017 during 12th Integrated Workshop (IWS) in Jeju, Republic of Korea. The meeting notes of the TRCG Meeting is in Annex VI. New plans for TRCG in the next 4-year period from 2018 to 2021 has been formulated in the TRCG meeting. The provisional TRCG work plan for 2018 – 2021 and Annual Operating Plan of 2018 are in Annex VII and VIII respectively.

6.3 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. As suggested by some Members in the 3<sup>rd</sup> TRCG Meeting, 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 in the future. Moreover, training and research opportunities will also be explored in collaboration with WGM, WGH, WGD RR and WMO Training Centre in Nanjing as well as various interested Members as appropriate.

6.4 The new arrangement in RSMC Forecasters' Training Attachment operated smoothly in 2016 and 2017. After review and discussion in the 3<sup>rd</sup> TRCG Meeting, RSMC Tokyo will continue to offer this training attachment in 2018-2021 and the current content and nomination procedures will generally be maintained in the next four years. The budget of USD 2500 for supporting each participant from TC member is considered appropriate based on the latest assessment. In the future, RSMC-Tokyo will consider incorporating the forecast competency aspects in arranging the future contents of the training. Moreover, RSMC Tokyo will consider accepting self-funded nominations from TC Members.

6.5 CMA will continue to support the forecaster training programme in 2018-2021. CMA will also explore the possibility of incorporating a short period of attachment to CMA's forecasting center in the future training courses.

6.6 Mr Roger Edson of USA has indicated to leave the TRCG and step down from the Vice Chair position. Nomination for Dr Kang Nam-young of Republic of Korea to serve as the new Vice Chair was received during the 3<sup>rd</sup> TRCG Meeting and supported by the meeting participants.

**Typhoon Committee Technical Conference (TC50 TECO) on  
"Embracing new technologies and knowledge to meet the challenges in the  
new era of tropical cyclone forecasting"  
In conjunction with the 50th Session of the Typhoon Committee**

**26-27 February 2018  
Ha Noi, Viet Nam**

**Background**

Established in 1968, the ESCAP/WMO Typhoon Committee and its Members have been working together to enhance forecast and warning capability and coordinate the planning and implementation of disaster risk reduction measures to minimize the loss of life and material damage caused by tropical cyclones and related severe weather in the region. Over this half-century, benefiting from various technological advancements and the concerted efforts of the Typhoon Committee Members, there were significant improvements in tropical cyclone prediction and related warning services in the Typhoon Committee region.

Stepping into the 21st century, the commencement of new remote sensing missions, tremendous increase in observational data, introduction of more complex computers models and upsurge of Big Data and social media analytics will bring about both opportunities and challenges for meteorological services to further enhance their services towards impact-based forecasting and risk-based warning with a view to meeting the emerging needs of various sectors in the society. Moreover, against the background of climate change, the plausible increase in tropical cyclone intensity and related extreme precipitation and the increasing risk of severe storm surge and coastal flood due to sea level rise will be of great concern for all the Members, in particular from the impact assessment, planning and disaster risk reduction (DRR) perspectives.

In this TECO, speakers from National Meteorological and Hydrological Services, international operational and research institutes and academia will be invited to share their knowledge/research findings and discuss issues related to the three topics under the main theme on "Embracing new technologies and knowledge to meet the challenges in the new era of tropical cyclone forecasting". Moreover, the TECO will serve as a platform to foster cross-cutting research and collaboration between the operational and research communities.

## **Topics**

### **(i) Moving towards impact-based forecasts and risk-based warnings**

- Riding on the upsurge of social media and Big Data analytics in recent years, this session will identify and discuss the opportunities and challenges in the development of risk-based warning products and impact-based forecast services in support of disaster risk reduction effort through stakeholder engagement.

### **(ii) Embracing new technologies and research findings**

- This session will review and discuss research findings and outcomes for advancing monitoring and forecasting techniques related to tropical cyclone and hydro-meteorological aspects, including satellite analysis, extended range predictions, NWP and ensemble prediction systems, etc., as well as new technologies in observational networks, data integration and processing (including Big Data) and the communication of forecasts and warnings.

### **(iii) Facing the challenges arising from climate change and rising sea level**

- To prepare for the impacts of climate change and sea level rise in the Typhoon Committee region, this session will review and discuss :
  - (a) the plausible influence of climate change on tropical cyclone activities and extreme hydro-meteorological events;
  - (b) the enhancement of forecasting and warning services related to extreme hydro-meteorological events (e.g. heavy rain, flooding, landslide, drought, salinity intrusion, storm surge, etc.) in the context of climate change; and
  - (c) climate change vulnerability assessment and natural disaster management.

## List of Keynote Speakers for TECO

### Moving towards impact-based forecasts and risk-based warnings

Speaker	Institute, Member	Presentation Title
Prof. Tran Thuc	Viet Nam Panel on Climate Change, Viet Nam	Managing Disaster Risk and Climate Extremes in Viet Nam to advance Climate Change Adaptation
Dr WEI Li	China Meteorological Administration, China.	Impact-based Forecast and Risk Warning Induced by Typhoon Gale and Torrential Rainfall
Mr Y F Tong	Hong Kong Observatory, Hong Kong, China	Planning of WMO Global Multi-hazard Alert System in relation to Tropical Cyclones

### Embracing new technologies and research findings

Speaker	Institute, Member	Presentation Title
Mr. Yoshiaki Takeuchi	Japan Meteorological Agency, Japan	Advanced Technology Developed in Tropical Cyclone Observation, Analysis and Forecast
Dr. Avichal Mehra	NOAA National Weather Service, USA	Advancing the State of the Art in Tropical Cyclone Modeling at NOAA's National Weather Service National Center for Environmental Prediction (NWS/NCEP)
Dr TANG Jie	Shanghai Typhoon Institute, China	Horizontal Transition of Turbulent Cascade in the Near-surface Layer of Tropical Cyclones

### Facing the challenges arising from climate change and rising sea level

Speaker	Institute, Member	Presentation Title
Dr Nam-young KANG	National Typhoon Center, Korea Meteorological Administration, Republic of Korea.	A review of the environmental connection to 2015 typhoon intensity
Prof. Kazuhisa Tsuboki	Nagoya University, Institute for Space-Earth, Environmental Research, Japan	High-resolution simulations and aircraft observations of typhoons for future typhoon disaster prevention
Prof. Mai Trong Nhuan	Vietnam National University Key Lab of Geo-environment and Climate change response, Vietnam.	Climate change vulnerability assessment and natural disaster management in the tropical area for sustainable development: case study of Vietnam

## Draft Programme for TECO (26-27 February 2018)

### Venue : Daewoo Hotel, Hanoi, Viet Nam

- The TECO will be conducted in English.
- Keynote presentations (plenary) - each presentation is 30 min, including 3-5 min Q&As.
- Technical presentations (parallel sessions) - each presentation is 15 min, including 2-3 min Q&As.

### Day 1 (26 February 2018)

Time	Event
08:00-08:30	Registration
08:30-09:15	Opening Ceremony <ul style="list-style-type: none"><li>• Welcome remarks</li><li>• Opening address</li><li>• Group Photo</li></ul>
	<b>Session 1</b> <b>Moving towards impact-based forecasts and risk-based warnings</b> <i>Chair by Mr Yoshiaki Takeuchi</i>
09:15-09:45	Keynote presentation #1 Managing Disaster Risk and Climate Extremes in Viet Nam to advance Climate Change Adaptation <i>by Prof. Tran Thuc, Viet Nam Panel on Climate Change, Viet Nam</i>
09:45-10:15	Keynote presentation #2 Impact-based Forecast and Risk Warning Induced by Typhoon Gale and Torrential Rainfall <i>by Dr WEI Li, China Meteorological Administration, China</i>
10:15-10:45	Keynote presentation #3 Planning of WMO Global Multi-hazard Alert System in relation to Tropical Cyclones <i>by Mr Y F Tong, Hong Kong Observatory, Hong Kong, China</i>
<b>10:45-11:00</b>	<b>Tea break</b>
11:00-12:40	<u>Parallel Sessions</u> Technical Presentations 1A-1 to 1A-5 ( <i>Chair by Dr Wei Li</i> ) Technical Presentations 1B-1 to 1B-5 ( <i>Chair by Mr Y F Tong</i> )
<b>12:40-14:00</b>	<b>Lunch</b>
	<b>Session 2</b> <b>Embracing new technologies and research findings</b> <i>Chair by Dr KANG Nam-young</i>
14:00-14:30	Keynote presentation #4 Advanced Technology Developed in Tropical Cyclone Observation, Analysis and Forecast <i>by Mr. Yoshiaki Takeuchi, Japan Meteorological Agency, Japan</i>

14:30-15:00	Keynote presentation #5 Advancing the State of the Art in Tropical Cyclone Modeling at NOAA's National Weather Service National Center for Environmental Prediction (NWS/NCEP) <i>by Dr. Avichal Mehra, NOAA National Weather Service, USA</i>
15:00-15:30	Keynote presentation #6 Horizontal Transition of Turbulent Cascade in the Near-surface Layer of Tropical Cyclones <i>by Dr TANG Jie, Shanghai Typhoon Institute, China</i>
15:30-15:45	<b>Tea break</b>
15:45-18:00	<u>Parallel Sessions</u> Technical Presentations 2A-1 to 2A-6 ( <i>Chair by Dr. Avichal Mehra</i> ) Technical Presentations 2B-1 to 2B-6 ( <i>Chair by Dr TANG Jie</i> )

## Day 2 (27 February 2018)

	<b>Session 3</b> <b>Facing the challenges arising from climate change and rising sea level</b> <b><i>Chair by Prof Tran Thuc</i></b>
08:30-09:00	Keynote presentation #7 A review of the environmental connection to 2015 typhoon intensity <i>by Dr Nam-young KANG, National Typhoon Center, Republic of Korea</i>
09:00-09:30	Keynote presentation #8 High-resolution simulations and aircraft observations of typhoons for future typhoon disaster prevention <i>by Prof. Kazuhisa Tsuboki, Nagoya University, Japan</i>
09:30-10:00	Keynote presentation #9 Climate change vulnerability assessment and natural disaster management in the tropical area for sustainable development: case study of Vietnam <i>by Prof. Mai Trong Nhuan, Vietnam National University Key Lab of Geo-environment and Climate change response, Viet Nam</i>
<b>10:00-10:15</b>	<b>Tea break</b>
10:15-12:30	<u>Parallel Sessions</u> Technical Presentations 3A-1 to 3A-6 ( <i>Chair by Prof. Kazuhisa Tsuboki</i> ) Technical Presentations 3B-1 to 3B-6 ( <i>Chair by Prof. Mai Trong Nhuan</i> )
<b>12:30-14:00</b>	<b>Lunch</b>
14:00-15:30	<u>Parallel Sessions</u> Break out group discussions Group 1 – “Impact-based forecasts and risk-based warnings” ( <i>Moderate by Mr YF Tong</i> ) Group 2 – “Embracing new technologies and research findings” ( <i>Moderate by Dr. Avichal Mehra</i> )



	Group 3 – “Challenges arising from climate change” (Moderate by Dr Nam-young KANG)
<b><i>15:30-16:00</i></b>	<b><i>Tea break</i></b>
16:00-17:00	Panel discussion - 9 Keynote Speakers (Moderate by Mr Raymond Tanabe)
17:00-17:30	Closing remark by Viet Nam NHMS

## *Annex II*

### 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	Miss 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 KIRTSANG (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 KIRTSANG (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

**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.



## List of Resource Persons

Member	Specialties	Name	E-mail	Affiliation
<b>(A) Data Assimilation</b>				
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	<a href="mailto:gaosz1129@sina.com">gaosz1129@sina.com</a> <a href="mailto:bingz@cma.gov.cn">bingz@cma.gov.cn</a>	National Meteorological Center
	Radar data quality control and assimilation scheme	GONG, Jiandong	<a href="mailto:gongjd@cma.gov.cn">gongjd@cma.gov.cn</a>	National Meteorological Center
Hong Kong, China	TC data assimilation	W.K. WONG	<a href="mailto:wkwong@hko.gov.hk">wkwong@hko.gov.hk</a>	Hong Kong Observatory
Japan	Satellite data assimilation	Kazumasa AONASHI	<a href="mailto:aonashi@mri-jma.go.jp">aonashi@mri-jma.go.jp</a>	Meteorological Research Institute
	Satellite data assimilation	Kozo OKAMOTO	<a href="mailto:kokamoto@mri-jma.go.jp">kokamoto@mri-jma.go.jp</a>	Meteorological Research Institute
	Data assimilation	Toshiyuki ISHIBASHI	<a href="mailto:ishibasi@mri-jma.go.jp">ishibasi@mri-jma.go.jp</a>	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	JUNG, Sung Hwa	shjung95@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	<a href="mailto:Lee@nrlmry.navy.mil">Lee@nrlmry.navy.mil</a> <a href="mailto:Peter.Black.ctr@nrlmry.navy.mil">Peter.Black.ctr@nrlmry.navy.mil</a> <a href="mailto:Paul.S.Chang@noaa.gov">Paul.S.Chang@noaa.gov</a>	NRL, Monterey, CA NRL, Monterey CA NOAA/NESDIS, Suitland MD

**(B) Modelling**

China	Numerical schemes of TC model	DUAN, Yihong	<a href="mailto:duanyh@mail.typhoon.gov.cn">duanyh@mail.typhoon.gov.cn</a>	Shanghai Typhoon Institute
	TC model physics and bogussing schemes	MA, Suhong	<a href="mailto:mash@cma.gov.cn">mash@cma.gov.cn</a>	National Meteorological Center
	Ensemble track forecasting	ZHOU, Xiaqiong	<a href="mailto:zhouxq@mail.typhoon.gov.cn">zhouxq@mail.typhoon.gov.cn</a>	Shanghai Typhoon Institute
	Typhoon modelling	LIANG, Xudong	<a href="mailto:Liangxd@mail.typhoon.gov.cn">Liangxd@mail.typhoon.gov.cn</a> <a href="#">n</a>	Shanghai Typhoon Institute
Hong Kong, China	TC modelling and bogussing schemes	W.K. WONG	wkwong@hko.gov.hk	Hong Kong Observatory

<b>(B) Modelling (cont'd)</b>				
Japan	Ensemble track forecasting	Munehiko YAMAGUCHI	myamagu@mri-jma.go.jp	Meteorological Research Institute
	TC-ocean interaction (incl. mixed-layer ocean and ocean surface wave modelling)	Akiyoshi WADA	awada@mri-jma.go.jp	Meteorological Research Institute
	TC modelling	Masahiro SAWADA	<a href="mailto:msawada@mri-jma.go.jp">msawada@mri-jma.go.jp</a>	Meteorological Research Institute
	Storm surge modelling	Nadao KOHNO	nkono@met.kishou.go.jp	Japan Meteorological Agency
Republic of Korea	Global NWP model tracks	KIM, Yoon Jae	yoonjae@korea.kr	Korea Meteorological Administration
	Ensemble track forecasting	LEE, Seung Woo	redparis@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	<a href="mailto:James.Doyle@nrlmry.navy.mil">James.Doyle@nrlmry.navy.mil</a> ↓ <a href="mailto:paharr@nps.edu">paharr@nps.edu</a>  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
<b>(C) Forecasting</b>				
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	Ryo OYAMA	<a href="mailto:royama@mri-jma.go.jp">royama@mri-jma.go.jp</a>	Meteorological Research Institute
	Doppler radar data analysis	Udai SHIMADA	<a href="mailto:ushimada@mri-jma.go.jp">ushimada@mri-jma.go.jp</a>	Meteorological Research Institute
Republic of Korea	Track and intensity forecasting	KANG, Nam Young	kny@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
<b>(C) Forecasting (cont'd)</b>				

USA (western North Pacific)	TC analysis and forecasting, seasonal prediction, use of microwave imagery and scatterometer data, Dvorak technique	Mark LANDER Roger EDSON	<a href="mailto:mlander@uguam.uog.edu">mlander@uguam.uog.edu</a> <a href="mailto:Roger.Edson@noaa.gov">Roger.Edson@noaa.gov</a>	University of Guam (WERI) National Weather Service, Forecast Office Guam
	Satellite data analysis, use of microwave imagery	Jorel TORRES Dan LINDSEY	<a href="mailto:Jorel.Torres@colostate.edu">Jorel.Torres@colostate.edu</a> <a href="mailto:Dan.Lindsey@colostate.edu">Dan.Lindsey@colostate.edu</a>	NOAA/NESDIS at CIRA, Colorado State University
	Satellite data analysis, use of microwave imagery, automated Dvorak Technique, AMSU	Chris VELDEN Derrick HERNDON	<a href="mailto:chris.velden@ssec.wisc.edu">chris.velden@ssec.wisc.edu</a> <a href="mailto:dherndon@ssec.wisc.edu">dherndon@ssec.wisc.edu</a>	CIMSS, University of Wisconsin-Madison
	Satellite data analysis, use of microwave imagery, AMSU	John KNAFF	<a href="mailto:john.knaff@noaa.gov">john.knaff@noaa.gov</a>	NOAA/NESDIS at CIRA, Colorado State University
	Satellite-based rainfall estimates in TCs (eTRaP)	Bob KULIGOWSKI Shelden KUSSELSON	<a href="mailto:bob.kuligowski@noaa.gov">bob.kuligowski@noaa.gov</a> <a href="mailto:sheldon.kusselson@noaa.gov">sheldon.kusselson@noaa.gov</a>	NOAA/NESDIS Suitland, Maryland
<b><i>(D) Application</i></b>				
Hong Kong, China	TC warning systems and operations	L. S. Lee	<a href="mailto:lslee@hko.gov.hk">lslee@hko.gov.hk</a>	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

Training and Research Coordination Group (TRCG) Annual Operating Plan 2017											
Objective Number	KRA / SG	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 6 / SG 6b and 6c	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	TRCG planning meeting in conjunction with the 12 <sup>th</sup> IWS	WGM, WGH and WGDRR	Provision of administrative and logistic support.	4th	-	Formulating the 4-year plan of TRCG	USD 12,500	TCTF	Yes
2	KRA 6 / SG 6b and 6c	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 6 / SG 6b and 6c	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Attachment of 3 forecasters from TC and 3 forecasters from PTC to RSMC Tokyo	nil	Provision of administrative and logistic support.	4th	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 7,500 <sup>1</sup>	TCTF	Yes
4	KRA 6 / SG 6b and 6c	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Attachment of up to 4 forecasters from TC to CMA	nil	Provision of administrative and logistic support.	3 <sup>rd</sup> – 4 <sup>th</sup>	CMA	Assessment as given in CMA report.	Participation will be supported by CMA	CMA	Yes

**Remark:**

1. Additional financial supports for 2 day extension of the training (i.e., DSA for three trainees staying 2 days in Tokyo) provided by from WMO Secretariat (PWS)

**The Third TRCG Meeting Notes**  
**Jeju, Republic of Korea (31 October - 1 November 2017)**

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In attendance:

Chair:	LEE, Tsz cheung (Note-taker)	Hong Kong, China
Members:	QIAN, Chuan hai	China
	MUROI, Chiashi	Japan
	MAHAEHALEUN, Mayphou	Lao PDR
	ADDULLAH, Muhammad Helmi	Malaysia
	DAVID, J. Shirley (Ms)	Philippines
	KANG, Nam young	Republic of Korea
	PETVIROJCHZI, Patchara	Thailand
	DINH, Thai hung	Viet Nam

Other participants

WANG, Qian (Ms)	China
WON, Seong hee	Republic of Korea
CHOI, Min ju	Republic of Korea
YANG, Seh wan	Republic of Korea

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1. TRCG Chair thanked all present for making an effort to attend the third TRCG meeting in Jeju.

**RSMC Training Attachment**

2. Mr Murio of RSMC-Tokyo presented a review of RSMC Training Attachment in 2014-2017 and briefed the meeting the future plan for 2018-2021 (Appendix 1). RSMC Tokyo will continue to offer this training attachment in 2018-2021 and the current content and nomination procedures will generally be maintained in the next four years. The budget of USD 2500 for supporting each participant from TC member is considered appropriate based on the latest assessment.
3. In the future, RSMC-Tokyo will consider incorporating the forecast competency aspects in arranging the future contents of the training. Moreover, RSMC Tokyo will consider accepting self-funded nominations from TC Members. TRCG will notify TCS to mention this possibility in the invitation letter.



## **CMA Typhoon Forecaster Training Programme**

4. On behalf of Mr Qian of CMA, Ms Wang briefed the meeting about the CMA Typhoon Forecaster Training in 2016-2017 (Appendix 2). CMA will continue to support this forecaster training programme in 2018-2021.
5. It is proposed that a short period of attachment to CMA's forecasting center could be included in this training programme to further enhance the hand-on experience of the participants. CMA will explore the possibility of incorporating this suggestion in the future training courses.

## **Roving seminars in 2018-2020**

6. After reviewing a number of possible themes for the Roving Seminar in 2018-2020, participants identified three main themes covering meteorological, hydrological, and DRR components, namely "Application of remote sensing technologies", "QPE and QPF" and "Impact-based forecasting". Preliminarily, Japan, China, and Viet Nam expressed an interest in hosting roving seminars in 2018, 2019 and 2020 respectively.

## **Prioritization and need for training and research**

7. On the review of priority and need for training and research activities, it was suggested re-organizing and enriching the training and research topics as well as including an area for cross cutting topics. In particular, the application of new observation technologies and ensemble prediction systems, the development of impact-based forecasting, probability forecasting, extended outlook and tropical cyclone structure and intensity forecasting, and the utilization of big data, social media, crowdsourcing and A.I. have been incorporated in the updated priority and need for training and research.

## **TECO 2018**

8. The TECO will be held on 26-27 February 2018 in Vietnam, in conjunction with the 50th Session of Typhoon Committee. Dr Lee of HKO reported the proposed arrangements and preparation progress of the TECO. Participants provided useful suggestions on the programme arrangements of the TECO. Suggestions were made that, for technical presentations, parallel sessions could be arranged to accommodate more submissions from TC Members. Also, with the adoption of the parallel session approach, the proposed poster session would no longer be required. It was also suggested that a panel discussion among Keynote Speakers and moderator could be arranged to replace the proposed wrap up discussion.

9. Some participants indicated that about 1 to 1.5 month may be required for them to go through the administrative procedures in nominating participants to the TECO and TC50. The meeting encouraged Typhoon Committee Secretariat to issue the invitation and announcement as soon as possible, preferably in November 2017.

#### **Other items**

10. Participants exchanged views on potential initiatives to facilitate cross cutting collaboration among meteorological, hydrological and DRR communities based on existing TRCG activities and resources. It was considered that “Impact-based forecasting” is one of the important common areas of the three working groups for establishing collaboration and the concept of “Science for Services” could be incorporated as appropriate. Participants agreed that 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.
11. To further enhance the communication and planning of TRCG, participants generally agreed that TRCG Members should meet more frequently, say with a meeting time slot to be included in each TC session or IWS in addition to the scheduled quadrennial meeting. TC Members are encouraged to release TRCG members to the meeting as far as possible.
12. Mr Roger Edson of USA has indicated to leave the TRCG and step down from the Vice Chair position. The meeting thanked Mr Edson’s contribution to the TRCG over the years. TRCG will invite USA to nominate another expert to join the group later. Nomination for Dr Kang Nam-young of Republic of Korea to serve as the new Vice Chair was received and supported by the participants. The nomination will be submitted to the 50<sup>th</sup> Session for consideration and approval.

#### **Provisional work plan 2018-2021**

13. In consideration of the aforementioned discussion, provisional TRCG work plan for 2018 – 2021 (see Annex VII of TRCG Report) and Annual Operating Plan of 2018 (Annex VIII of TRCG Report) were prepared.

Presentation on RSMC Attachment Training - Summary of 2014-2017 and plan for 2018-2021

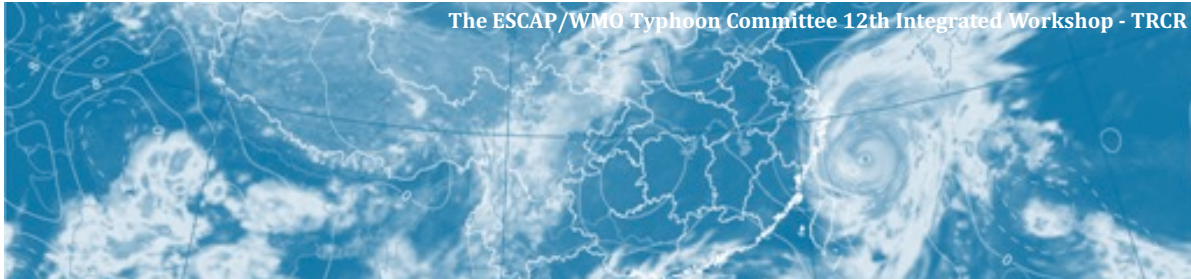


RSMC attachment training at RSMC Tokyo  
Summary of 2014-2017 and plan for 2018-2021

Chiashi Muroi  
RSMC Tokyo Typhoon Center  
Japan Meteorological Agency

Presentation of CMA Typhoon Training Activities in 2016-2017

The ESCAP/WMO Typhoon Committee 12th Integrated Workshop - TRCR



CMA Typhoon Training activities in 2016-2017



QIAN Chuanhai, WANG Qian  
National Meteorological Center, CMA  
October 31, 2017, Jeju

## Provisional TRCG Work Plan (2018 – 2021)

Year	Quarter	Typhoon Committee Activity	Training and Research Activities (*activities organized by parties other than TRCG)	Themes (if any) / Remarks
2018	Q1	TC-50 TECO	Technical Conference (TECO) in conjunction with the TC50	To be held in Viet Nam with the main theme on “Embracing new technologies and knowledge to meet the challenges in the new era of tropical cyclone forecasting”
	Q2		Research Fellowship	
	Q3		CMA Training Program	TBC
			Research Fellowship	
	Q4	13th IWS (Chiang Mai, Thailand)	Research Fellowship	
			RSMC Tokyo attachment	TBC
			Roving Seminar*	Theme on "Application of remote sensing technologies". Hosting venue is being coordinated and to be confirmed.
2019	Q1	TC-51		
	Q2		Research Fellowship	
	Q3		CMA Training Program	TBC
			Research Fellowship	
	Q4	14th IWS (Hawaii, USA)	Research Fellowship	
			RSMC Tokyo attachment	TBC
			Roving Seminar*	Proposed to be in China with theme on "QPE and QPF"
2020	Q1	TC-52		
	Q2		Research Fellowship	
	Q3		CMA Training Program	TBC
			Research Fellowship	
	Q4	15th IWS (TBC)	Research Fellowship	
			RSMC Tokyo attachment	TBC
			Roving Seminar*	Proposed to be in Vietnam with theme on "Impact-based forecasting"
2021	Q1	TC-53		
	Q2		Research Fellowship	
	Q3		CMA Training Program	TBC
			Research Fellowship	
	Q4	16th IWS (TBC)	Research Fellowship	
			RSMC Tokyo attachment	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 2018										
Objective Number	KRA / SG	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources
1	KRA 6 / SG 6b and 6c	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	TC50 TECO in conjunction with the TC50	WGM, WGH and WGDRR	Provision of administrative and logistic support.	1 <sup>st</sup>	-	Feedback and recommendations collected from the speakers and participants	USD 60,000 <sup>1</sup>	TCTF
			Roving Seminar [Application of remote sensing technologies]	WGM, WGH and WGDRR	Provision of administrative and logistic support.	4 <sup>th</sup>		Feedback from evaluation forms to be completed by a target audience of about 30 people.	USD 16,000	TCTF
2	KRA 6 / SG 6b and 6c	To facilitate technology transfer among TC Members through research and development initiatives.	Research Fellowship	WGM, WGH and WGDRR	Provision of administrative and logistic support.	2 <sup>nd</sup> - 4 <sup>th</sup>	TC Members	Publication of research findings and development output in TCRR or other journals.	Fellowship offered by voluntary hosts.	TC Members
3	KRA 6 / SG 6b and 6c	To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting.	Attachment of 3 forecasters from TC and 3 forecasters from PTC to RSMC Tokyo	nil	Provision of administrative and logistic support.	4 <sup>th</sup>	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 7,500 <sup>2</sup>	TCTF
4	KRA 6 / SG 6b and 6c	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.	3 <sup>rd</sup> - 4 <sup>th</sup>	CMA	Assessment as given in CMA report.	Participation will be supported by CMA	CMA

**Remarks :**

1. Including estimated budget for the proposed TC50 TECO to be held in conjunction with TC50 in early 2018
2. Additional financial supports for 2 day extension of the training (i.e., DSA for three trainees staying 2 days in Tokyo) provided by from WMO Secretariat (PWS)