ESCAP/WMO Typhoon Committee
Forty-ninth Session
21- 24 February 2017
Yokohama,
Japan

FOR PARTICIPANTS ONLY
WRD/TC.49/8.4
13 January 2017

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; and
(c) endorse the future plans of TRCG as outlined in Section 6 and Annexes VI and IX of the APPENDIX B.

APPENDICES :
A : Draft text for inclusion at Session Report
B : TRCG Annual Report 2016

APPENDIX A

DRAFT TEXT FOR INCLUSION IN THE SESSION REPORT

8.4. Training and Research Coordination Group

The Committee took note of the progress made in training and research activities as presented in the TRCG Report 2016 (Appendix ???)

The Committee expressed its appreciation to the National Hydro-Meteorological Service of Viet Nam (NHMS) for hosting the Roving Seminar in Ha Noi, Viet Nam and the support of resource persons by Japan, USA and Hong Kong, China.

The Committee thanked China, Hong Kong, China and Republic of Korea for hosting research fellowship programs in 2016.

The Committee took note of the successful completion of the RSMC Tokyo training attachment of six forecasters from TC and PTC Members, including Lao PDR, the Philippines, Viet Nam, Oman, Pakistan and Sri Lanka, and expressed its appreciation to JMA and WMO TCP for continuously supporting this capacity-building initiative.

The Committee thanked China for offering Typhoon Forecaster Training for four forecasters from Thailand, Viet Nam and DPRK.

The Committee took note the proposal of organizing the 3rd TRCG Forum in the form of a "technical conference like" event in conjunction with the 50th Session of the Typhoon Committee (TC50) in 2018 with the main theme on "Embracing new technologies and knowledge to meet the challenges in the 21st century".

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

RECOMMENDATIONS of TRCG:

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

a. To re-appoint Dr. T.C. LEE (Hong Kong, China) and Mr. Roger EDSON (USA) as Chairperson and Vice Chairperson of TRCG respectively.

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

c. To endorse the priority training and research areas as proposed in TRCG Report 2016.

d. To endorse the organization of Technical Conference (TECO) in conjunction with the TC50 to be held in Viet Nam in 2018 and the proposed main theme of "Embracing new technologies and knowledge to meet the challenges in the 21st century".

e. To endorse the TRCG AOP and budget request which are included in the budget proposal to be submitted by AWG.

APPENDIX B
TRAINING & RESEARCH COORDINATION GROUP (TRCG)
ANNUAL REPORT 2016

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 various KRAs of the Committee's Strategic Plan.

2. Membership

2.1 The composition and members list of TRCG (as at 31 December 2016) 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 2016

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 2016 was successfully held on 15-17 November 2016 in Ha Noi of Viet Nam. The seminar was kindly hosted by the National Hydro-Meteorological Service of Viet Nam. The theme of this seminar was on "Storm Surge" with sub-topics and speakers of the seminar as follows :

Topic A – Advances in Operational Storm Surge and Coastal Inundation Prediction
Mr Nadao Kohno and Mr Masaki Itoh of Japan Meteorological Agency, Japan

Topic B – SLOSH - Storm Surge Modelling and Applications for Decision Support
Mr Arthur Taylor of National Weather Services, U.S.A.

Topic C – Development of an Operational Storm Surge Prediction System for a Coastal City - Hong Kong Experience
Mr Dickson Lau, Hong Kong Observatory, Hong Kong, China

3.3 The Seminar was attended by 39 participants from Cambodia (2); China (2); Macao, China (1); Hong Kong, China (1); Philippines (1); Singapore (1); Thailand (1); Republic of

Korea (1); Lao PDR (1) and Viet Nam (28). Four resource persons came from Hong Kong, Japan and USA and one representative came from the Typhoon Committee Secretariat (TCS). The participants considered the lectures and advice provided by the four resource persons are useful and examples of good practices on the relevant topics. Participants also indicated that they acquired useful knowledge on storm surge modelling and forecasting which would be helpful in handling the increasing risk of storm surge due to sea level rise and climate change. The new hand-on exercise session was also well received. There were also suggestions that more time could be assigned to the hand-on exercise and its IT preparation aspects. A summary report of the seminar can be found in Annex II.

Forecasters' Training Attachment

3.4 The 16th Training Attachment course was held at JMA Headquarters from 15 to 26 August 2016. The attachment was participated by six forecasters respectively from Lao PDR, the Philippines, Viet Nam, Oman, Pakistan, and Sri Lanka. As of this year, two-day lectures on warning coordination were newly introduced into the curriculum to enhance capacity in warning development through coordination with disaster risk reduction (DRR) stakeholders. The content of the training include satellite analysis and viewer program (SATAID), tropical cyclone analysis and forecasting, storm surges, quantitative precipitation estimation (QPE) and quantitative precipitation forecasting (QPF), and warning development. Further training needs on analysis/forecast techniques for severe weather phenomena associated with tropical cyclones were also identified in this attachment. While further extension of time slots of QPE/QPF and storm surges could be preferable, this may be practically challenging due to the already tightly packed lecture schedules.

3.5 As approved by the Committee during the 48th TC Session, China offered the CMA Typhoon Forecaster Training Programme in 2016. The CMA Typhoon Forecaster Training Programme 2016 consisted of two stages and was conducted in Beijing during the period of October to December 2016. Four forecasters (one from Viet Nam, one from Thailand and two from DPRK) attended this training programme. The main content includes typhoon monitoring, analysis and forecast, numerical typhoon modeling, sea wave and storm surge, desktop practices, case study of rapid intensification over South China Sea, etc.

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 2016, 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

Three experts respectively from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) and the Thailand Meteorological Department (TMD) participated in KMA's fellowship scheme from 1 May to 14 May 2016. The training course consisted of lectures on typhoon track and intensity forecast, analysis of ocean data/modeling, and tropical depression or extra-tropical transition. Furthermore, the typhoon forecast training using the typhoon analysis and prediction system enabled participants to have an opportunity of applying and practicing what they learned through the session. 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 imageries of satellite.

(b) CMA Fellowships

Two experts from DPRK participated in the fellowship scheme offered by Shanghai Typhoon Institute to undertake the research project "Tropical Cyclone Genesis Forecast Technique" in October and November 2016.

Two experts, Mr. Kamol Promasakha na Sakolnakhon from TMD, Thailand USA and Dr. Chen Yi-Leng from USA participated in the fellowship as visiting editors for TC's journal "Tropical Cyclone Research and Review (TCRR)" in October 2016.

(c) HKO Fellowships

The HKO hosted the Typhoon Committee Research Fellowship in 2016 on a topic entitled "Tropical Cyclone Size Climatology". One expert from the Fujian Meteorological Bureau of the China Meteorological Administration undertook the research project for two months starting from mid-December 2016.

WMO International Training Course on Tropical Cyclone

3.8 The WMO International Training Course on Tropical Cyclone organized by the

WMO Regional Training Centre Nanjing and sponsored by CMA was held in Nanjing, China between 21 November and 2 December 2016. The training course was attended by 13 participants from nine countries/regions, namely China, Hong Kong, China, Malaysia, Maldives, Mozambique, Pakistan, Papua New Guinea, Saudi Arabia and Yemen. The two week training covered the basic theories and the latest research on tropical cyclones, including structure, genesis, intensity change, and motion of tropical cyclones, climate change and tropical cyclone activities, tropical cyclone track and structure forecast, seasonal forecasts of tropical cyclone activities, application of satellite and radar in tropical cyclone early warning, socio-economic impacts of tropical cyclones, and disaster mitigation. A short trip to the Shanghai Typhoon Institute of CMA was also arranged.

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 Taking into account the discussions during the 48th Session of Typhoon Committee in February 2016 and the inputs by the Members of TRCG, the list of priority research topics is as follows:

(A) Meteorology

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

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

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

(d) application of ensembles of guidance from dynamical models, conceptual models, statistical models and systematic knowledge-based approach;

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

(f) better understanding of TC-related issues across different spatial and time scales, from mesoscale and synoptic analysis for track prediction, to climatological impact arising from El Nino/La Nina and global warming/climate change;

(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, including implementation of UFRM guidelines;

(i) mudslides and landslides associated with heavy rain;

(C) Meteorology and DRR

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

(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; and

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

5.2 In view of the devastating impacts of tropical cyclones that affected Members in recent years, attention should also be given to capacity-building in the following aspects:

(a) assessment of rain-induced geological hazards such as landslides and mudflow;

(b) forecasting and warning systems for better coastal protection from hazards such as storm surge, river delta inundation and urban flooding; and

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

6. Future Directions and Strategies

6.1 The 4-year plan for 2014 -2017 is entering the final stage (Annex VI). New plans for the next 4-year period will be formulated in the next TRCG meeting, which will be held in conjunction with the 12th Integrated Workshop (IWS) in Republic of Korea in 2017.

6.2 According to TRCG 4-year plan, the 3rd TRCG Forum is originally scheduled to be held in late 2017 during the 12th IWS. To celebrate the 50th anniversary of the Typhoon Committee in 2018, after discussing with AWG and TCS, it is proposed to consider organizing the event in conjunction with the 50th Session of the Typhoon Committee (TC50) in 2018 in the form of a "technical conference like" event (called TC50 TECO). The tentative plan is to have a 2-day TECO and then followed by a 4-day TC50 Session. AWG explored with Viet Nam, the host of TC50, on this possibility and received a positive response. The proposed overarching theme of the TC50 TECO will be "Embracing new technologies and information to face the challenges of the 21st Century". Further details of the proposed theme and sub-themes of the 2-day TC50 TECO are included in Annex VII. Moreover, Typhoon Committee is going to celebrate its 50th anniversary in 2018. Grasping this opportunity, AWG plans to organize a special thematic forum on "From a half century of collaboration to the challenges of the 21st Century" on the 1st day of the 50th Session of the Typhoon Committee.

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. Moreover, training and research opportunities will also be explored in collaboration with WGM, WGH, and WGDRR as well as WMO Training Centre in Nanjing.

6.4 The new arrangement in RSMC Forecasters' Training Attachment operated smoothly in 2016 and will be continued in 2017. The arrangement for the 4-year period in 2018-2021 will be reviewed later in 2017.

6.5 Review of the TRCG AOP 2016 can be found in Annex VIII and the proposed AOP 2017 (including the TC50 TECO in early 2018) is in Annex IX.

Annex I

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. Nobutaka Mannoji
	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. Nobutaka Mannoji
	25 – 27 Nov	Kuala Lumpur	Operational Application of Multi-Model Ensemble Typhoon Forecasts	Prof. Johnny C.L. Chan Mr. Nobutaka Mannoji
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. Tetsuo Nakazawa
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 Yoshiki Nagai Prof Xu-dong Fu Dr Dong-ryul Lee
2016	15-17 Nov	Viet Nam	Storm Surge	Mr Nadao Kohno Mr Author Taylor Mr Dickson Lau

Annex II

SUMMARY OF TYPHOON COMMITTEE ROVING SEMINAR 2016
(Viet Nam, 15-17 November 2016)

I. Organization

1. The Typhoon Committee Roving Seminar (TCRS) 2016 with the theme on Storm Surge was successfully held on 15-17 November 2016 in Viet Nam. It was organized by ESCAP/WMO Typhoon Committee (TC) and hosted by the National Hydro-Meteorological Service of Viet Nam (NHMS).

2. The Seminar was attended by 39 participants from Cambodia (2); China (2); Macao, China (1); Hong Kong, China (1); Philippines (1); Singapore (1); Thailand (1); Republic of Korea (1); Lao PDR (1) and Viet Nam (28). Four resource persons came from Hong Kong, China, Japan and USA and one representative came from the Typhoon Committee Secretariat (TCS). The list of participants is given in Attachment A.

II. Opening

1. The TCRS 2016 was officiated by Mr. Tran Hong Thai, Deputy Director of NHMS, Viet Nam. Mr. Tran delivered the opening speech, highlighting the message from Secretary General of the World Meteorological Organization, Mr. Petteri Taalas, that climate change is increasing the risk of heavy rain and flood, hence impact-based forecasts are necessary to empower emergency managers with information they could act on. He also hoped that the Roving Seminar could serve as a platform for scientists, researchers and forecasters to share and strengthen the hydro-meteorological forecasts and contribute to the prevention and mitigation of natural disasters, economic development in each Member in the context of global climate change.

2. The Meteorologist of TCS, Mr. Fong Chi Kong in his address expressed his gratitude to Viet Nam for hosting the Roving Seminar as it is one of the main activities of the TC, coordinated by the TRCG since 2003. He also expressed his gratitude to the speakers from Japan, USA and Hong Kong for sharing valuable experiences in storm surge modelling and forecasts which help Members better understand the topic and improve their forecasts to provide a more effective disaster risk reduction approach.

III. Seminar Programme

1. Mr. Nadao Kohno from Japan Meteorological Agency presented Topic A on "Advances in Operational Storm Surge and Coastal Inundation Prediction".

2. Mr. Arthur Taylor from National Weather Services, USA presented Topic B on "SLOSH - Storm Surge Modeling and Applications for Decision Support".

3. Mr. Dickson Lau from Hong Kong Observatory presented Topic C on "Development of an Operational Storm Surge Prediction System for a Coastal City - Hong Kong Experience".

4. Dr. Nguyen Ba Thuy from National Center for Hydro-Meteorological Forecasting, NHMS of Viet Nam delivered an invited lecture on "Storm surge prediction considering the effect of wave".

5. A technical visit to National Center for Hydro-Meteorological Forecasting and Ba Vi Weather Station were conducted on the afternoon of 17 November 2016.

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

IV. Proposals and Recommendations

1. The participants gave a warm appreciation to the four resource persons for their presentations and useful advice as well as examples of good practices on the relevant topics.

2. During the wrap up discussion, most participants indicated that they gained knowledge on storm surge modelling and forecasting, although some of them might not have immediate threats. The participant from Republic of Korea mentioned that climate change might change the path of typhoons so storm surge risk for Korean Peninsula might increase; and participant from Cambodia suggested that it would benefit more if the storm surge models could cover the southern part of the South China Sea and Golf of Thailand. 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) more time could be given to hand-on exercise for participants to get more involved into the SLOSH and JMA Storm Surge Model;
(b) more details on how to use the new model for operational prediction;
(c) a training on SLOSH model should be given a priority;
(d) desirable to have more discussion about PC setting for hand-on exercise beforehand;
(e) content of the event is still wide and it is better to focus on storm surge only.

V. Closing

1. The resource persons and participants expressed their gratitude to the NHMS of Viet Nam for hosting this seminar and for the warm hospitality.

2. Mr. Tran Hong Thai and Mr. Fong Chi Kong presented the attendance certificates to the participants.

3. The Roving Seminar was closed on 17 November 2016.

Attachment A

List of Participants of the Typhoon Committee Roving Seminar 2016 (Viet Nam, 15 - 17 November 2016)

Members	Name of Participants
Cambodia	Mr. Lim HAK
	Ms. Phalla PEOU
China	Ms. ZHENG Yunxia
	Dr. LIN Yi
Macao, China	Mr. HO Kuok Hou
Hong Kong, China	Mr. HUNG Fanyiu
Philippines	Mrs. Maria Cecilia A. MONTEVERDE
Singapore	Mr. YANG Junhua
Thailand	Mr. Pawat SIRIYOTHA
Republic of Korea	Mr. CHO Kwang Woo
Lao PDR	Mrs: Somsanouk VANHLAKHALACK
Viet Nam	Mr. Tran Hong THAI
	Mr. Nguyen Ba THUY
	Mr. Dinh Thai HUNG
	Ms. Dang Thanh MAI
	Mr. Vo Van HOA
	Mr. Hoang Phuc LAM
	Ms. Le Thi HUE
	Ms. Nguyen Thu LAN
	Mr. Pham Dinh VAN
	Mr. Dao Dinh KHOA
	Mr. Nguyen Van LY
	Mr. Nguyen Xuan TIEN
	Mr. Tang Van AN
	Ms. Ton Thi THAO
	Mr. Bui Thanh QUYNH
	Mr. Tran Trung THANH
	Mr. Nguyen Hong SINH
	Mr. Vu Van QUAN
	Ms. Nguyen Thi Nhuy TAM
	Ms. Le Thi Bich NGOC
	Ms. Hoang Thi Le NHUNG
	Mr. Trương Ba KIEN

	Mr. Pham Tien DAT Mr. Nguyen Manh LINH Ms. Luong Thi Thanh HUYEN Mr. Nguyen Manh DUNG Ms. Pham Khanh NGOC Mr. Sanaul HoQue MONDAL

Resource persons	Mr. Nadao KOHNO Mr. Masaki ITOH Mr. Arthur TAYLOR Mr. Dick Shum Dickson LAU
TCS	Mr. FONG Chi Kong

Attachment B

Typhoon Committee Roving Seminar 2016
Seminar Programme

Dates and Venue: 15 – 17 November 2016, Hoa Binh Hotel, Ha Noi, Viet Nam

Main Theme: Storm Surge

Topic A – Advances in Operational Storm Surge and Coastal Inundation Prediction
Mr Nadao Kohno and Mr Masaki Itoh of Japan Meteorological Agency, Japan

Topic B – SLOSH - Storm Surge Modeling and Applications for Decision Support
Mr Arthur Taylor of National Weather Services, U.S.A.

Topic C – Development of an Operational Storm Surge Prediction System for a Coastal City - Hong Kong Experience
Mr Dickson Lau, Hong Kong Observatory, Hong Kong, China

Seminar Schedule:

<table>
<tr><th colspan="2"></th><th>Day 1
(15 Nov, Tue)</th><th>Day 2
(16 Nov, Wed)</th><th>Day 3
(17 Nov, Thu)</th></tr>
<tr><td rowspan="3">AM</td><td>0900 – 1030</td><td>Registration &
Opening Ceremony
(0900 – 1000)</td><td>Lecture Topic A (2)
(0915-1030)</td><td>Invited Lecture by
Dr. Nguyen Ba Thuy
(0915 – 1030)</td></tr>
<tr><td>1030 – 1045</td><td colspan="3">Tea Break (1000 – 1030 on Day 1)</td></tr>
<tr><td>1045 – 1200</td><td>Experience Sharing by Member Representatives[(a)]
(1030 – 1200)</td><td>Lecture Topic B (2)</td><td>Wrap-up Discussion</td></tr>
<tr><td colspan="5">Lunch Break (1200 – 1330)</td></tr>
<tr><td rowspan="5">PM</td><td>1330 – 1500</td><td>Lecture Topic A (1)</td><td>Hand-on experience session (Part I)</td><td rowspan="5">Technical Visit
(National Center for Hydro-Meteorological Forecasting and Ba Vi weather station)</td></tr>
<tr><td>1500 – 1515</td><td colspan="2">Tea Break</td></tr>
<tr><td>1515 – 1645</td><td>Lecture Topic B (1)</td><td>Hand-on experience session (Part II)</td></tr>
<tr><td>1645 – 1700</td><td colspan="2">Tea Break</td></tr>
<tr><td>1700 – 1800</td><td>Lecture Topic C (1)</td><td>Lecture Topic C (2)</td></tr>
</table>

(a) One of the participants from each Member will be invited to represent his/her weather services to deliver a 10 to 15 minutes presentation regarding strategy to handle storm surge of his/her Service.

Attachment C

TRCG ACTIVITIES EVALUATION FORM
Roving Seminar 2016
(Ha Noi, Viet Nam, 15 – 17 Nov 2016)

29 responses (out of 24 participants + 5 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	8	0	16	5
2. Pre-event arrangement and liaison	0	0	8	4	16	1
3. Venue facilities	0	0	10	2	14	3
4. Informative announcements and instructions	0	0	8	3	15	2
5. Travel arrangements	0	0	7	1	17	4
6. Funding arrangements	0	0	9	2	15	3
7. Accommodation	1	0	10	1	13	4
8. Refreshments	0	0	7	2	17	3
9. Social events and visitors' information	0	0	6	1	18	4
10. Helpfulness and friendliness of organizers	0	0	5	0	19	5

Specific points for improvement, if any:

More details on how to use the new mode for operational prediction
there should be more discussion about PC setting for hand-on exercise beforehand
More time given to hands-on exercises
Training in SLOSH model should be given a priority

Part B: Technical Contents (from participants only)

A – Lectures by Nadao Kohno B – Lectures by Arthur Taylor C – Lectures by Dickson Lau	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)			

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 (from participants only)

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

- JMA SS (Theory to operation), skill about forecasting SS, data input to JMA SS
- SLOSH (Basic Framework, Knowledge)
- SS phenomenon and the risk for conducting risk assessment and impact studies
- New idea for making a decision
- whether the SS is bigger when TC movers faster or slower
- More practicing with the models, new methodology to run SS in Thailand
- Use the coupled model of surge wave and tide, EPS in SS model

2. 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	4
(b) in 2 – 5 years	13
(c) in 5 years or more	4
(d) no foreseeable opportunity	2

Group photo of the participants of the Roving Seminar with the Deputy Director General of National Hydro-Meteorological Service of Viet Nam, Mr. Tran Hong Thai (4th to the right, 1st row), Meteorologist of Typhoon Committee Secretariat, Mr. Fong Chi Kong (5th to the right, 1st row) and the lecturers.

Annex III

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	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 (Philippine), Mr. Jose Frivaldo, JR. (Philippine), 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
Development of objective guidance on tropical cyclone genesis forecast using global models	Mr. Wen FENG (China)	Hong Kong Observatory	16 Nov 2015 – 15 Jan 2016
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
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	Mr. Boonthum Tanglumlead (Thailand) Mr. Narongpon Thongsang (Thailand) Mr. Benison Jay N. Estareja, (Philippine)	Korea Meteorological Administration	1 – 14 May 2016
Tropical cyclone genesis forecast technique	Mr. Pak Sang Il (DPR Korea) Mr. Kim Kum Song (DPR Korea)	Shanghai Typhoon Institute	Oct – Nov 2016

Visiting editor for Tropical Cyclone Research and Review (TCRR)	Mr. Kamol Promasakha ng Sakolnakhon (TMD) Dr. Chen Yi-Leng (USA)	Shanghai Typhoon Institute	Oct 2016
Tropical Cyclone Size Climatology	Mr. Wei HONG (China)	Hong Kong Observatory	mid-Dec 2016 – 31 Jan 2017

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, accepted for publication.

Annex V

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	Kazumasa AONASHI	aonashi@mri-jma.go.jp	Meteorological Research Institute
	Satellite data assimilation	Kozo OKAMOTO	kokamoto@mri-jma.go.jp	Meteorological Research Institute
	Data assimilation	Toshiyuki ISHIBASHI	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	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	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	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	msawada@mri-jma.go.jp	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	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	Ryo OYAMA	royama@mri-jma.go.jp	Meteorological Research Institute
	Doppler radar data analysis	Udai SHIMADA	ushimada@mri-jma.go.jp	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

(C) Forecasting (cont'd)

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
USA (western North Pacific)	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

Annex VI

TRCG Work Plans (2016 – 2018)

Year	Quarter	Typhoon Committee Activity	Training and Research Activities (*activities organized by parties other than TRCG)	Themes (if any) / Remarks
2016	**Q1**	TC-48		
	Q2		Research Fellowship	
	Q3		RSMC Tokyo attachment	
			Research Fellowship	
	Q4	11th Integrated Workshop	Research Fellowship	
			CMA Training Program	
			Roving Seminar	Held in Viet Nam with themes on "storm surge"
2017	**Q1**	TC-49		
	Q2		Research Fellowship	
	Q3		RSMC Tokyo attachment	
			Research Fellowship	
	Q4	12th Integrated Workshop	Research Fellowship	
			CMA Training Program	
			TRCG Meeting	To be held during the 12th Integrated Workshop in Republic of Korea
2018*	**Q1**	TC-50 TECO	Technical Conference (TECO) in conjunction with the TC50	Proposed to be held in Viet Nam with the main theme on "Embracing new technologies and knowledge to meet the challenges in the 21st century"
	Q2		Research Fellowship	
	Q3		RSMC Tokyo attachment	TBC
			Research Fellowship	
	Q4	13th Integrated Workshop	Research Fellowship	
			CMA Training Program	TBC
			Roving Seminar	Theme and venue to be decided during TRCG Meeting in Q4 of 2017

*Provisional plan for reference

Annex VII

Typhoon Committee Technical Conference (TC50 TECO) on
"Embracing new technologies and knowledge to
meet the challenges in the 21st century"
In conjunction with the 50th Session of the Typhoon Committee

Ha Noi, Viet Nam 2018

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 2-day TECO, expert 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 with participants on issues related to the three topics under the main theme on “Embracing new technologies and knowledge to meet the challenges in the 21st century”. 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** [about 3 invited speakers]

- 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 DRR effort

through stakeholder engagement.

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

[about 3-4 invited speakers]

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

(iii) **Facing the challenges arising from the changing climate**

[about 3-4 invited speakers]

- To prepare for the future climate, this session will review the plausible impacts of climate change on various aspects of tropical cyclone activity and related DRR challenges in the region.

Annex VIII

	Training and Research Coordination Group (TRCG) Annual Operating Plan 2016										
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	Roving Seminar [with theme on Storm Surge]	WGH	Provision of administrative and logistic support.	4th	-	Feedback from evaluation forms to be completed by a target audience of about 30 people.	USD 16,000	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 other forecasters from PTC to RSMC Tokyo	Nil	Provision of administrative and logistic support.	3rd	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 7,500	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.	3rd – 4th	CMA	Assessment as given in CMA report.	Participation will be supported by CMA	CMA	Yes

Annex IX

Training and Research Coordination Group (TRCG) Annual Operating Plan 2017[1]

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	TRCG planning meeting in conjunction with the 12th IWS	WGM, WGH and WGDRR	Provision of administrative and logistic support.	4th	-	Formulating the 4-year plan of TRCG	USD 12,500	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.	2nd - 4th	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.	3rd	RSMC Tokyo, WMO	Assessment as given in RSMC Tokyo report.	USD 7,500[2]	TCTF
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.	3rd – 4th	CMA	Assessment as given in CMA report.	Participation will be supported by CMA	CMA

5	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.	1st Quarter of 2018	-	Feedback from evaluation forms to be completed by a target audience of about 50 people.	USD 60,000[3]	TCTF

Remarks :

1. Including estimated budget for the proposed TC50 TECO to be held in conjunction with TC50 in early 2018
2. Additional financial supports from WMO Secretariat (PWS) for 2 day extension of the training (i.e., DSA for three trainees staying 2 days in Tokyo) will be provided from 2016 on a regular basis
3. The estimate includes the cost for organizing a 2-day TC50 TECO and the Special Thematic Forum on Day 1 of TC50 Session.