Third Joint Session
Panel on Tropical Cyclones | Typhoon Committee
(42nd Session of PTC and 47th Session of TC)
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FOR PARTICIPANTS ONLY
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WORKING GROUP ON METEOROLOGY ACTIVITIES ANNUAL REPORT 2014

(Submitted by WGM Chair)

ACTION PROPOSED:

The Committee is invited:

(a) To take note of the Members activities and major progress and issues in meteorology component in 2014 as reported by Members at the 9th IWS

(b) To review the WGM activities in 2014 and planned activities in 2015 and beyond

(c) To endorse the WGM recommendations.

APPENDIX I: Summary Report of WGM Parallel Meeting at the 9th IWS

2014 ANNUAL REPORT OF WGM

1. Introduction

1.1 According to the terms of reference, Working Group on Meteorology (WGM) is to promote cooperation among the Members of Typhoon Committee (TC) in the implementation of activities under the Meteorological Component of the Committee's Strategic Plan with the aim to support the socio-economic development process and enhance cooperation among the Members in all the three components. (Training and Research are incorporated as part of these three components.) Towards this end, the WGM is expected to advise and assist the Committee in:

(a) Identifying priority issues and areas of cooperation in the Meteorological Component;

(b) Promoting and facilitating the exchange of experiences and knowledge on latest developments and techniques related to the above issues and areas;

(c) Coordinating and implement priority activities and programmes of the Committee aiming at strengthening capacity of the Members in meteorology;

(d) Mobilizing resources to carry out priority activities of the Committee related to the meteorological Component;

(e) Reporting overall progress in the implementation of the meteorology component of the Strategic Plan;

(f) Recommending to the Committee priority areas, programmes and activities for cooperation in meteorological research by related experts of the Members.

1.2 With the help of ESCAP, Tropical Cyclone Program (TCP) of WMO and Typhoon Committee Secretariat (TCS), the absolute sincerity cooperation of all Members, and the effective work of focal points, WGM has successfully finished the following tasks in 2014:

(a) WGM has fulfilled all the plans (include 4 POPs, 11 AOPs and 3 PPs) which endorsed at the 46th Session;

(b) WGM has promoted the development of the new techniques on the generation prediction and seasonal prediction based on ensemble forecast and TIGGE data, and promoted the development of the high-resolution tropical cyclone model. All of them have achieved initial success.

(c) The expert team of the 3rd assessment report on the influence of climate change on tropical cyclones was established based on 2nd assessment report and its expert team. The 3rd assessment report will be published in 2017-2018 (before IPCC-AR6 published in 2019 or 2020).

(d) With the support of all Members and WGs, WGM has edited and published the journal *Tropical Cyclone Research and Review* (Vol.3, No.1-4) under the name of Typhoon Committee.

(e) WGM has provided help for WMO Landfall Typhoon Forecast Demonstration Project (LTFDP) and Northwest Pacific Tropical Cyclones Ensemble track Forecast Project (NWP-TCEFP) concerning related Members. Both projects have been applied into service

of TC Members from 2010, and have been extend to 2015.

(f) WGM has piloted the buoy array in South China Sea and continued to test the mobile sounding and surveillance flight for typhoon monitory. WGM also finished the preparation for piloting the un-manned aircraft and dope sound by rocket in 2015.

2. Membership

2.1 After the 46th TC Session, the composition and focal point members list of WGM are:

Chair	Mr. Lei Xiaotu (China)
Vice Chair	Dr. Vicente Malano (The Philippines) Ms. Che Gayah ISMAIL (Malaysia)
Members	Ms. Peou Phalla (Cambodia) Mr. Ryu Ki Ryol (DPR Korea) Mr. C.M. Cheng (Hong Kong, China) Mr. Tsukasa Fujita (Japan) Mr. Vanhdy Douangmala (Lao PDR) Mr. Leong Weng Kun, Ivan (Macao, China) Mr. Renito B. Paciente (Phillippines) Mr. Se-Won Kim (Rep. of Korea) Dr. Felicia Shaw (Singapore) Dr. Songkran Agsorn (Thailand) Mr. Bill Ward (USA) Mr. Vo Van Hoa (Viet Nam)

2.2 Experts from other working groups of TC, TCP/WMO, TCS, RSMC-Tokyo, JTWC, etc. have also provided assistances to accomplish the tasks of WGM over 2014, endorsed at the 46th session of TC, the two WMO demonstration projects, SSOP cooperative mechanism workshop in Bangkok of Thailand, attachment training on QPE/QPF in RSMC Tokyo and HKO, technical meeting among the radar experts of TMD and JMA in JMA Headquarters, as well as visiting editors to TCRR editorial office (Shanghai) and the fellowships.

2.3 WGM came to aware that the TCS meteorologist, Mr. Derek Leong will complete his term of services as seconded meteorologist on 12 February 2015 after the 47th TC Session, WGM would like to express its appreciation to Mr. Derek Leong for his outstanding contributions to the WGM as well as the efficient and effective coordination among other TC WGs through his dedicated efforts to carry out the function as TCS meteorologist for the past 8 years since TCS transferred from Manila to Macao.

3. The progress of WGM's plans in 2014

With the assistances of TCP/WMO and TCS and the strong support from all Members, WGM has successfully completed the action plans in 2014, which were endorsed at the 46th Session. The WGM activities and the progress of all action items in 2014 are reported in the Appendix I – Summary Report of the WGM Parallel Meeting at the 9th IWS. The complete table of the 2014 action plans (POPs, AOPs and PPs) and its implementation status are listed in Annex I of the Summary Report.

After the 46th TC Session in 2014, WGM has been carrying out many activities that involve the cooperation among Members as well as other TC WGs and international organizations, which includes:

- Coordinate with RSMC Tokyo to organize the year's Attachment Training, conducting the training of storm surge and QPE/QPF, held at RSMC Tokyo from 23 July to 1 August 2014, with funding support from TCTF and WMO. Three experts from Lao PDR, the Malaysia, and the Philippines attended the Attachment Training.
- Coordinate with STI of CMA, TCS and WMO/TCP to edit and publish the Typhoon Committee Journal *Tropical Cyclone Research and Review*, No.1-4 of Vol.3. Two visiting editors from the Philippines and Thailand was invited to visit the editorial office in STI to provide guidance of improving the editorial procedures, reviewing articles as well as inviting articles to be submitted to the Journal.
- Coordinate with National Typhoon Center (NTC) of KMA, STI and National Meteorology Center (NMC) of CMA to organize the 7th China-Korea joint workshop on the tropical cyclones, held in Jeju and Seoul of Republic of Korea on 25-29 May 2014.
- Coordinate with KMA to conduct a training course and research fellowship on TAPS, held at KMA from 12 May to 11 July 2014. Three experts from the Philippines (PAGASA), Vietnam (NCHMF) and China (STI/CMA) participated the training and the research fellowship.
- Coordinate with Lao PDR to invite two experts from NTC of KMA to carry out a mission to DMH in Lao PDR for the transfer of TAPS technology on Sept. 29 to Oct. 2, 2014.
- Coordinate with WMO Regional Training Center (RTC) of Nanjing to conduct a training workshop on SSOP, held at Nanjing of China on 9-11 June 2014. Thirty-three participants from the TC and PTC beneficiary countries attended the training workshop.
- Coordinate with STI/CMA to conduct a research fellowship on tropical cyclone genesis, held at STI from August to September 2014. One expert from Thailand and two experts from DPRK participated at the research fellowship.
- Coordinate with JMA and TMD to hold a technical meeting, on the quality management techniques of radar data and basic calibration technique for QPE, at JMA in November 2014. Two experts from TMD participated the technical meeting.
- Coordinate with HKO to conduct an attachment training and research fellowship on QPE/QPF and nowcasting, held at HKO from 6 Oct. to 5 Dec. 2014. One expert from PAGASA participated the attachment training and the research fellowship program.

- Coordinate with HKO to conduct an Ad-hoc meeting of Taskforce on timing of upgrade of TC to TS, held at HKO on 13 May 2014. Fiver experts from CMA (1), JMA (2), HKO (1) and TCS (1) attended the meeting.
- Coordinate with TRCG and HKO to organize the TC Roving Seminar on 3-5 November 2014 in Hong Kong, China.
- Coordinate with KMA and WMO to organize the IWTC-8 and IWTCLP-3, held at Jeju of ROK on 2-10 Dec. 2014.

4. Conclusions and proposed action plans for 2015

On the basis of the information provided by Members and the respective coordinator of the action plans and based on the discussion during the Meeting, the following conclusions were reached:

a. Members made important progress in the implementation of the TC Strategic Plan during the year 2014.
b. Members made significant progress during 2014 in tropical cyclone monitoring and communication systems, data assimilation and numerical weather prediction systems, tropical cyclone forecast-aiding systems, and scientific understanding of tropical cyclone activities.
c. Successful completion of the WGM action plans in 2014.
d. The yearly RSMC Tokyo Attachment Training will be moved to TRCG from 2015. The in-depth QPE/QPF training organized with the Typhoon Committee Research Fellowship Scheme was much appreciated by the participants from the TC Members. Follow-on technical assistance to participating Members on the adaptation of the QPE/QPF technique is necessary. The TCTF budget allocation for each trainee should be increased to US$2500 up from the current amount of US$2000.
e. The web-based typhoon forum could be very useful in terms of providing a convenient platform for both forecasters and researchers with more registered users from the Members.
f. The publication of the Typhoon Committee Journal "*Tropical Cyclone Research and Review*" plays an important role in providing an effective way to exchange the knowledge and the latest progress in tropical cyclone research, forecasting technique and warning system as well as to enhance the visibility of Typhoon Committee.
g. There are needs from Members to continue the transfer of technology and knowledge of the Typhoon Information System (TAPS) among Members as well as the assistances to implement the system.
h. The Synergized Standard Operating Procedures (SSOP) Manual would be completed before the 47th TC Session. Members of TC and PTC were encouraged to use the Manual and feedback the related information during using to TCS.

i. JMA has made significant progress in the research on tropical cyclone genesis prediction skills. The results of the comparison of the Brier Scores of ECMWF, JMA, NCEP and UKMO for the period from 2010 to 2013 indicated that operational global medium-range ensembles have been found capable of providing guidance on tropical cyclone activity forecasts extending into the second week. Brier Skill Score (BSS) for the Western North Pacific, the Eastern and Central Pacific and the North Atlantic basins are higher than those for other basins, and ECMWF has the highest values in general. Meanwhile, BSS and reliability have been found to be sensitive to the choice of wind threshold values in the definition of model tropical cyclone.

j. Forecasts of tropical cyclone tracks from operational forecast agencies and deterministic NWP models in 2013 were assessed by STI/CMA. A remarkable progress has been made by TC Members over last 4 years in the subjective track forecast. Most Members' subjective track errors at 24 hours are less than 100 km in 2013. The accuracy of subjective intensity forecast has not made any progress over last 10 years. The intensity forecast errors from models are much larger compare to subjective methods at each lead-time levels. To make an accurate intensity forecast is still a challenge work for both subjective and objective methods.

k. The South China Sea Typhoon Model (TRAMS) have been updated the resolution to 9km from 36km in 2014, some model technique schemes have been improved, including the improved calculation of the nonlinear term in model dynamics and the marine boundary layer parameterization technique. The performance of the new version (9km) TRAMS has been improving in 2014. For example of typhoon "Kalmaegi (2014)" 48h track forecast, the forecast error of old (36km) and new version TRAMS are 120km and 98km respectively.

l. Significant progress has been made on typhoon seasonal prediction and the seasonal activity outlook began to provide through the website (http://typ.kma.go.kr/eng) in May of 2014 by KMA. The accuracy rate of tropical cyclone frequency improved by 26% through the correction method, using Linear Regression Method developed by KMA, during the period of 2004-2013.

m. Significant progress has been made on the improvement of severe weather forecasting and interaction with the user communities of the participating Members through the implementation of the SWFDP-SeA website (http://www.swfdp-sea.com.vn) hosted by National Hydro-Meteorological Services of Viet Nam.

n. With the technical assistances from JMA, TMD has successful applied the lowest level intensity techniques (EIL) to each radar site and created nationwide radar composite map.

o. The expert team for the 3rd Assessment Report on the impact of climate change on tropical cyclone in TC region was established in 2014 with the following six members: Ming Ying (STI/CMA), Thomas R. Knutson (GFDL/NOAA), Toshiyuki Nakaegawa (JMA), Tsz-Cheung Lee (HKO), Yun Wontae (KMA) and Wong Chan Seng (MGB of Macao) as the expert team coordinator. The 3rd Assessment Report is planned to be published in 2017

or 2018.

p. The graphical representation of storm surge model and its improvement (to make the products more user friendly) in 2014 as well as the addition of the stations from Members for storm surge time series forecasting services will further contribute to the early warning capabilities of storm surge in the TC Region.

q. The technique developing and preparing of field campaign, including the mobile sounding, unmanned aircraft, rocket sounding and the buoy array in South China Sea, as well as the reconnaissance flight conducted by HKO in 2014. Some following national level research project related to the EXOTICA on air-sea interaction under tropical cyclone condition and the high resolution model development are carried out by CMA.

r. Significant progress has been made on the high resolution (3km) tropical cyclone model based on the Global/Regional Assimilation and Prediction System (GRAPES) by STI/CMA, including vortex initialization scheme, hybrid system based on GSI and the implicit Rayleigh damping for the vertical velocity. Compared with HWRF on typhoon "Fitow (2013)" forecast, the high resolution GRAPES-TCM and its vortex initialization scheme seem to be more effective.

s. The digitization of CI numbers for the period of 2004-2013 was completed and the best-track datasets including CI numbers of CMA, HKO, JTWC, and RSMC Tokyo were exchanged in June 2014. The exchanged datasets were checked through, and cyclone by cyclone analysis will be continued in 2015 to identify reasons for CI number difference between four centers.

t. Early issuance of warning bulletins from JMA would greatly facilitate warning operation of Members. JMA would strive to issue TCs bulletins as early as possible, while keeping the current T+90 minutes deadline for issuance of bulletins. Members to pay attention that Dvorak analysis by JMA – CI of 2.0-2.5 could be a precursor of soon upgrade of TD to TS.

u. Exchange of more observational data (e.g. buoy, island station and oil rig data over the South China Sea), along with metadata, and the all available observational data used in operational analysis for tropical cyclone track and intensity, encouraged.

v. It is recognized that the SSOP project of ESCAP Trust Fund is a very good example to closely link two regional bodies (TC and PTC) together.

w. Based on the discussion on the action plans for 2015 and according to the new structure of the action plans, it was also concluded that:

    i. POP1, on attachment training, will be moved to TRCG from 2015. POP item 2-4 will be continued in 2015.

    ii. AOP1, on SSOP, which was completed in 2014 and closed. AOP item 2 – 4 and 6- 10 will be continued in 2015 except AOP5 which will be moved to POP as POP item 1 in 2015.

    iii. PP item 1-2 will be continued in 2015. PP3 of "Harmonization of timing of upgrade of TD to TS by various warning centers" which was completed in 2014 and closed.

iv. Establish the new project as AOP item 9 on “Development of TC Forecasting Competency", in order to develop an outline of tropical cyclone forecasting competency. The project of Available data used in operational tropical cyclone analysis will be undertaken as the new PP item 3 in 2015.

v. The total budget proposed by WGM, which was also concurred at the AWG meeting after the 9th IWS, for undertaking the actions plans (AOPs, POPs and PPs) in 2015 is **USD16000**. In addition, the budget of **USD11000** will be allocated for the support of WGM attendance at the next Integrated Workshop. Thus the total budget for WGM for year 2015 is **USD27000**. The financial support of USD5000 for AOP-EXOTICA will be allocated through the “Special funding request”.

5. Future Directions and Strategies

a. Intensify the field campaign on tropical cyclone in TC region, jointly carry out a special scientific experiment on the difficulty (hard to forecast) but important issues. For example the structure and intensity changes of tropical cyclone in the coast area and landfall in TC region.
b. Develop high resolution typhoon model and reinforce the forecast ability of intensity, wind (gale) and quantitative precipitation.
c. Reinforce the research of techniques for medium and long range forecasting of TC, evaluate and recommend the short term climate prediction techniques of TC.
d. Strengthen the cooperation with WGH and WGDRR towards evaluation of TC impact and risk management.
e. Enhance the collaboration with TRCG towards the exchange of latest developments and techniques related to tropical cyclone research and operational forecast, as well as the effectiveness of typhoon early warning system.
f. Improve the quality and influence of the TC journal Tropical Cyclone Research and Review.

6. Recommendations

a. To request RSMC Tokyo and the WMO Regional Training Center (RTC) Nanjing to continue the collaboration with TRCG to conduct the annual training (including attachment training) for operational forecaster from TC Members.
b. To move the project of RSMC Tokyo yearly attachment training to TRCG from 2015.
c. To promote the web-based typhoon forum among members and to encourage more forecasters and researchers from Members to register to the forum
d. To request STI/CMA to further improve the editorial procedures of the TC Journal *Topical*

Cyclone Research and Review.

e. To request WMO and ESCAP to promote the TC Journal *Topical Cyclone Research and Review,* and to encourage more contributions from the TC and PTC Members, WGs and the visitor of TCTF research fellowship.

f. To request KMA to further improve the typhoon information processing system (TAPS of KMA) project; and to collaborate with the Typhoon Committee Research Fellowship Scheme to provide training for the typhoon forecasters on the use of TAPS as well as to provide follow-on technical assistance on the implementation of TAPS as requested by Members.

g. To encourage TC and PTC Members, in particular the SSOP beneficiary Members to use the SSOP Manual and to feedback the related information during using to TCS.

h. To request RSMC Tokyo to prepare for provision of ensemble tropical cyclone track guidance of major NWP centers in the Western North Pacific through the website if necessary NWP data provided.

i. To request RSMC Tokyo to examine multi-center grand ensemble tropical cyclone generation prediction skill to identify potential of its operational use in the future.

j. To request STI/CMA to continue the post-season verification and reliability analyses on the operational forecast of tropical cyclones and report to Committee Session, to further improve the evaluation system for tropical cyclone forecast in conjunction with WMO-TLFDP and to continue providing the real time verification information on genesis, track and intensity forecast through WMO-TLFDP website.

k. To request CMA to further improve the operational process of the high resolution (9km) TRAMS model as well as to provide more prediction products through its website.

l. To request KMA to further develop the technique of seasonal typhoon prediction and the web-based system to provide the product of seasonal typhoon prediction for TC Members.

m. To request National Hydro-Meteorological Service Vietnam to develop very-short range convective cloud forecasting system based on MTSAT satellite, to provide more special products for tropical cyclone forecast and NWP of Sear State products through the SWFDP-SeA website, and to establish a FTP server at NCHMF in order to NMCs can access to download or exchange raw data.

n. To request TMD to apply quality control technique using statistical method to each of the TMD radar, and to develop the source codes of radar data calibration for QPE by TMD with technical assistance of JMA. To request TMD and JMA to hold a technical meeting to follow up with the progress and to identify a way forward.

o. To request the 3rd assessment report expert team to accumulate findings from CMIP5 results and Event Attribution (EA) studies, to summarize and assess related research emerges, and to collect data of progress of work and make a draft outline.

p. To request RSMC Tokyo to add stations for storm surge time series forecast if so requested by Members, to enhance training contents on storm surge forecasts during the annual attachment training responding to requests from Members, to prepare for

multi-scenario storm surge forecasts, and to conduct verification of time series forecasts if hourly tidal data during past storm surge events are provided by Members.

q. To request CMA to hold the organization committee (OC) meeting for preparing the implementation of the field campaign and demonstration research, including establishing the Scientific Steering Committee and Research Groups and confirm the tasks of participating Members. To request the participating Members to test the field campaign by using aircraft dropsonde, rocket dropsonde as well as the reconnaissance flight.

r. To request STI/CMA to continue the research through the coordination with WMO-TLFDP, comparison of (semi-) operational model and to further improve the High Resolution Tropical Cyclone Model based on GRAPES (G-TCM) coordinating with EXOTICA.

s. To request RSMC Tokyo to conduct cyclone-by-cyclone comparison analysis to indentify reasons for CI number difference among RSMC Tokyo, CMA, HKO and JTWC.

t. To endorse the WGM new AOP of "Development of tropical cyclone forecasting competency" and Preliminary Project (PP) of "Available data used in operational tropical cyclone analysis", and to encourage the active participation of the Members.

u. To endorse the action plans (including the 4 POPs, 9 AOPs and 3 PPs) as listed in Annex II of the Appendix – Summary report of the WGM Parallel Meeting at the 9th IWS, which summarizes the above recommendations with additional action items.

v. To endorse the WGM budget proposal which is included in the budget proposal which to be submitted by AWG for TC's approval.

w. To request WMO to publish the 2015 edition of TOM on the Tropical Cyclone Programme (TCP) website by March 2015.

x. To re-appoint Mr. Tsukasa Fujita (Japan) as the TOM Rapporteur.

y. To re-appoint Mr. Lei Xiaotu (China) as Chair of WGM, and to re-appoint Dr. Vicente Malano (Philippines) and Ms. Che Gayah Ismail (Malaysia) as co vice-chairs of WGM for the term of next 2 years after the 47th Session.

z. To take measures to cover the vacant period of the seconded meteorologist at TCS after the 47th Session to ensure the smooth coordination and implementation of the WGM activities.

APPENDIX I

Summary Report of the WGM Parallel Meeting
9th Integrated Workshop
UNCC, Bangkok, Thailand
21 – 22 October 2014

1. The WGM Parallel Meeting of the 9th Integrated Workshop (IWS) was held on 21 -2 2October 2014 in Room H of UNCC, which was attended by 27 participants from 12 UNESCAP/WMO Typhoon Committee (TC) Members (China; DPR Korea; Hong Kong, China; Japan; Lao PDR; Macao, China; Malaysia; Philippines; Republic of Korea; Thailand, United States of America and Viet Nam). Representatives from TCS, PTC and WMO also attended the Meeting.

2. At the 7th IWS held in Nanjing, China, WGM Chair proposed to restructure the table of Annual Operating Plans (AOPs), namely the inclusion of 2 additional tables, which are the Perennial Operating Plans (POPs) and Preliminary Projects (PPs), and was adopted by WGM. POPs are referring to the WGM activities that will be carried out repeatedly in the following years while the PPs referring to the projects of which preliminary studies needed to be undertaken by WGM.

3. Organization of the Meeting

The Meeting firstly reviewed the progresses of POPs, AOPs and PPs in 2014 and the action plans for 2015 including the associated budget, then followed by the discussions on new project proposals and the issues on i) RSMC Tokyo attachment training; ii) PTC/TC Cooperation Mechanism and iii) Chairmanship of WGM. With the consideration for the efficient running of the Meeting, the action plans for each item for 2015 was also presented while presenting its progress in the year 2014.

4. Progress of WGM action plans (POPs, AOPs and PPs) in 2014 and the planning for action items in 2015

The Meeting reviewed the progress and the results of the POPs, AOPs and PPs since the 46th TC Session as well as the action plans in 2015 presented by the respective coordinators, which were reported as shown in bullet 4.1 to 4.20 (including new AOPs and PPs). The Implementation status of WGM Action plans in 2014 including the actions and the completion status; and the action plans in 2015 are listed in Annex I and Annex II respectively.

4.1 POP1 – Improvement of QPE/QPF and storm surge technique for TC Members

- RSMC-Tokyo has conducted the year's attachment training from 23 July to 1 August 2014, with funding support from TCTF and WMO. Three trainees from Lao PDR, the Malaysia, and the Philippines participated in the training, which includes the training on storm surge model and QPE/QPF. Evaluation reports by the participants were submitted to WMO/TCP.

- The Meeting noted the requests of the trainees that the training should be longer and have more participants to give them enough time for discussion and exchanges on views and experiences .It further noted the need of consideration of such requests to deepen trainee's understanding and improve their abilities.
- RSMC Tokyo emphasized the importance of capacity development of TC analysis and thus to rename this project as "Improvement of tropical cyclone analysis, QPE/QPF and storm surge technique of TC Members".
- In 2015, to continue the collaboration with TRCG to conduct the yearly RSMC Tokyo Attachment Training for operational forecaster from TC Members, including the training of tropical cyclone analysis, storm surge model and QPE/QPF in accordance with the TRCG attachment training plans.
- From 2015, this POP related to the yearly attachment training at RSMC Tokyo will be moved to TRCG.

4.2 POP2 – Web-based typhoon forum

- The web-based typhoon forum (http://www.typhoon.gov.cn/en/bbs) could act as a very convenient platform for forecasters and scientists to discuss typhoon-related topics online. The Meeting noted that the TC real-time information and forecast (WMO-TLFDP http://tlfdp.typhoon.gov.cn), History cases (http://10.228.2.54), Seasonal prediction (http://typ.kma.go.kr/eng) and Forecast Verification (WMO-TLFDP http://tlfdp.typhoon.gov.cn; Operational forecast products (http://172.21.3.142) are available in the Forum.
- Up to October 2014, there are 65 users coming from 11 Members in the forum.
- The Meeting agreed that it is advisable to explore the possibility to expand the information contained in the Forum as well as encouraging more scientists and forecasters to join the Forum.

4.3 POP3 - Tropical Cyclone Research and Review

- The Meeting was informed that 10 issues (hard copies and online version) of the Journal (Tropical Cyclone Research and Review, TCRR) have been published since its launch (in 2012), which comprises 75 articles submitted by authors from 13 countries and regions. The TCRR editorial office has made their effort in promoting the Journal, which includes posting publication news on Tropical-storms mailing list and distributing brochure and compact disc while attending international meeting. More than 40,000 downloads was recorded which reflected that the recognition of the Journal is enhancing.
- The Meeting expressed its appreciation to the editorial office of publishing the Journal as well as the effort of Shanghai Typhoon Institute (STI) of China Meteorological Administration (CMA) to maintain and update the TCRR website, and the post of hard copies of the Journal to TC Members, WMO and related research Institute.
- Two visiting editors from the Philippines and Thailand was invited to visit the editorial office in STI to provide guidance of improving the editorial procedures, reviewing articles as well as inviting articles to be submitted to the Journal.
- In 2015, it is planned to encourage more contributions from the TC Members and the PTC Members, and from WGH and WGDRR. To further improve the editorial procedures

and to apply the SCI.

4.4 POP4 – Transfer of the technology of the Typhoon Analysis and Prediction System (TAPS)

- The meeting took note that Korea Meteorological Administration (KMA) has offered and successfully hosted the training and research program to three experts from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Vietnam National Center for Hydro-Meteorological Forecasting (NCHMF), and STI of CMA for two months (12 May - 11 July 2014).
- The trainees first took the forecaster training course on optimizing typhoon forecast using TAPS and carried out research activities during 6 weeks on the following topics: 1) typhoon-mid latitude pressure system interaction, 2) study on the typhoon recurvature and moving speed, and 3) study on the relationship between the central pressure and maximum sustained winds for typhoon).
- The National Typhoon Center (NTC) of KMA was invited to carry out a mission to the Department of Meteorology and Hydrology (DMH) in Lao PDR for the transfer of TAPS technology on Sept. 29 to Oct. 2, 2014. It included three lectures and two practice classes for their staffs, showing that typhoon forecast process and the Typhoon Analysis and Prediction System (TAPS). During the visit period, experts of NTC/KMA helped their staff to install the TAPS on each machine and performed demonstration of typhoon forecasts using TAPS besides the introduction of TAPS as well as the TAPS data supporting system.
- It is planned to provide the further technical support on TAPS by sending a mission to Lao PDR and the implementation of TAPS in one other TC Member if so requested in 2015.

4.5 AOP1 – Contribution to SSOP

- The Meeting took note that the Synergized Standard Operating Procedures (SSOP) Manual would only be available at the end of year 2014, members were encouraged to review and comment on the Manual when it is available.
- The Meeting was informed about the training workshop on SSOP for Coastal Multi-hazards Early Warning System (EWS). It was held under Activity 2.1 of the SSOP Work Plan, “Conduct training of users and issuers in the interpretation and preparation of EWS SOPs and products for decision-making, media, and communications” which is one item under Activity 2 of the Work Plan, “Enhance the performance and effectiveness of SOPs for coastal multi-hazard Early Warning System in the Member Countries of Typhoon Committee (TC) and Panel on Tropical Cyclones (PTC) through capacity building. The workshop was conducted at the WMO Regional Training Center (RTC) in Nanjing, China on 9-11 June 2014 with 33 participants from the TC and PTC beneficiary countries. For details of the conclusions and recommendations resulted from this Workshop, please consult the Summary Report on SSOP Training at http://www.typhooncommittee.org/SSOP/SSOP_training.html.
- As the SSOP Manual is expected to be completed by the end of this year after the review and comments from Members, it is considered this AOP is completed and thus

recommended to close this AOP.

4.6 AOP2 – Enhanced use of Ensemble Forecast

- Operational global medium-range ensemble forecasts of tropical cyclones (TCs) activity were systematically evaluated to further examine the skill of such forecasting and determine its potential for future operational use. The global ensembles used are ECMWF, JMA, NCEP and UKMO for the period from 2010 to 2013. It was found that operational global medium-range ensembles have been found capable of providing guidance on TCs activity forecasts extending into the second week. Brier Skill Score (BSS) for the Western North Pacific, the Eastern and Central Pacific and the North Atlantic basins are higher than those for other basins, and ECMWF has the highest values in general. Meanwhile, BSS and reliability have been found to be sensitive to the choice of wind threshold values in the definition of model TCs.
- To explore ways to provide ensemble TCs forecast products, responding to identified needs through the past questionnaires by WWRP/TCP and GIFS-TIGGE WG, RSMC Tokyo requested ECMWF, UKMO, and NWS to provide their ensemble NWP data on a real-time basis. It is difficult in short term to obtain ECMWF's ensemble NWP data, through ECMWF ensemble track guidance available via GTS may be used with the condition of use of the Numerical Typhoon Prediction website. RSMC Tokyo is being under negotiation with UKMO and NWS.
- RSMC Tokyo plans to examine a multi-center grand ensemble (MCGE) for TCs generation prediction in 2015.
- RSMC Tokyo will prepare for provision of ensemble TCs track guidance of ECMWF, UKMO, NCEP, and JMA through the Numerical Prediction Website if necessary NWP data of ECMWF, UKMO, and NWS are provided.

4.7 AOP3 – Verification of tropical cyclone operational forecast

- Forecasts of tropical cyclone tracks from operational forecast agencies and deterministic NWP models in 2013 were evaluated and the results were reported to the 46th Session of Typhoon Committee. Part of the work is going to be submitted to TCRR.
- Forecasts of tropical cyclone intensity from global EPS systems in 2013 were evaluated.
- Track forecast performance – A remarkable progress has been made by TC Members over last 4 years in the subjective track forecast. Most Members' subjective track errors at 24 hours are less than 100 km in 2013.
- Intensity forecast performance – the accuracy of subjective intensity forecast has not made any progress over last 10 years. The intensity forecast errors from models are much larger compare to subjective methods at each lead-time levels. To make an accurate intensity forecast is still a challenge work for both subjective and objective methods.
- Evaluation of landfall tropical cyclone rainfall forecasts from operational NWP models was carried out as a case study on Fitow (2013) as a joint effort with CAWCR. The results were reported to the working group meeting of WMO/WWRP/WGTMR.
- Participated in the 6th International Verification Methods Workshop in March 2014 with an invited presentation.

- Providing real time verification on track and intensity forecasts through WMO-TLFDP website.
- STI/CMA hosted a two-month visit of Mr. Boothum Tanglumlead from Thailand, as jointly funded by the Typhoon Committee and STI/CMA. Mr. Boothum evaluated the tropical cyclone genesis products in real time based on CMA-T639 and NCEP-GFS gridded output.
- STI/CMA funded and hosted a one-month visit of Mr. SONG Yong Chol and Mr. PAK Sang Il from DPRK. They implemented the tropical cyclone genesis products in real time based on ECMWF-IFS gridded output in Typhoon Forecast Evaluation and Assessment System (TFEAS).
- Plan for 2015
    a. To continue the post-season verification and reliability analyses on the operational forecast of tropical cyclones and report to Committee session.
    b. To continue providing real time verification information on track and intensity forecast through WMO-TLFDP website.
    c. To provide the tropical cyclone genesis forecasts through WMO-TFLDP website and carry out post-season verification on genesis forecasts.
    d. To further improve the evaluation system for tropical cyclone forecast, with special attention on genesis and ensemble forecast in conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme).

4.8 AOP4 – Improvement of South China Sea typhoon forecast

- TRAMS covers the range of 0.8-50.5^{o}N, 81.6-160.8^{o}E. The horizontal grid interval is 0.36^{o}, and the model is divided into 55 layers in the vertical. The model provides 120-h typhoon track and intensity forecasts since January 2014.
- Some model technique schemes have been improved and updated in TRAMS, including the improved calculation of the nonlinear term in model dynamics, the marine boundary layer parameterization technique, and coupling process between dynamics and physics, etc. The above techniques were developed to improve the overall performance of TRAMS.
- The higher resolution version: TRAMS-9km, which is movable nested in TRAMS, is developed based on the typhoon location. The number of nested domain of TRAMS-9km could automatic follow the number of the typhoon, as well as the domain center for parameters setup and statistic data generating following each typhoon center location.
- Forecasting experiment result shows that the typhoon track forecasting in 60-h by higher resolution version is better than TRAMS-36km. Take Typhoon “Kalmaegi” for example, the 24-h typhoon track forecast error of TRAMS-36km and TRAMS-9km are 68km and 64km, respectively, and the 48-h forecast error are 120km and 98km respectively, which show the improvement of the typhoon track forecasting by the high resolution model of TRAMS.
- Plan for 2015
    a. Transform the research work of model technique during 2014 into operation model.
    b. Observation test of the South China Sea will be carried out to study the physics process in tropical typhoon.

c. The operation process of high-resolution typhoon model (TRAMS-9km) will be further improved and more prediction products of typhoon will be provided.

4.9 AOP5 – Development of typhoon seasonal prediction system

- KMA investigated the performance of the typhoon seasonal predictability in Northwestern Pacific using the dynamical climate model and developed the correction method using Linear Regression Method between the observed TCs frequency and model variability in the Northwestern Pacific. The accuracy rate of TCs frequency improved by 26% through the correction during the period of 2004-2013.
- KMA began to provide the seasonal typhoon activity outlook on May 2014 through the website operated by NTC/KMA (http://gtaps.kma.go.kr/TSP/index.php). The information about the number of typhoon genesis and track pattern is produced based on the results of three types of models: multi-regression model, global dynamical model, and hybrid model of statistical and dynamical method.
- The users can find a variety of information about the tropical seasonal prediction in the website including prediction products, model information, model verification and climate monitoring for summer (June to August) and fall (August to October) season.
- The web-based typhoon seasonal prediction portal system (http://typ.kma.go.kr/eng) was opened to registered users of TC Members in May of 2014.
- As the typhoon seasonal prediction system will be continued to run routinely, it was suggested this item to move to POP1.
- Plan for 2015
  a. To further develop the technique of seasonal typhoon prediction
  b. To further develop the web-based system to provide the product of seasonal typhoon prediction for TC Members.

4.10 AOP6- Improvement of severe weather forecasting and interaction with user communities

- Regional Forecasting Support Center (RFSC) has finished creating motion vector from successive satellite data with variational method.
- The Semi-Lagrangian advection scheme will be applied with these variational motion fields to forecast brightness temperature, which will be used to estimate precipitation up to 3 hours.
- All results will be posted to SWFDP-SeA portal in 2015.
- The tropical cyclone track and intensity forecasting charts based on global models (GSM, GME, GFS, GEM, NAVGEM) are ready to posted to SWFDP-SeA website. These products are updated every 6 hours.
- Due to RFSC's plan of upgrade SWFDP-Sea website framework, the coordination with the WMO-TLFDP and Web-based Typhoon Forum project the verification product as well as the "Forecast Forum" function will be added in 2015-2016.
- The global model forecasts (Japanese model: GSM, NCEP model: GFS) will be shared via SWFDP-SeA website in netCDF format at the end of 2014. We will keep these raw data 3 nearest days.
- The SWFDP-SeA webpage (http://www.swfdp-sea.com.vn) is operational now and there

are a lot of products in available on the portal (username: swfdp-sea and password: RA2 - in case sensitive).

- Plan for 2015
    a. Develop very-short range convective cloud forecasting system based on MTSAT satellite.
    b. Provide ECMWF products for short and medium range forecast.
    c. Provide more EPS for all given stations of Participants (specially for Philippines and Myanmar).
    d. Put more remote sensing products as ASCAT, AMV, etc on SWFDP-SeA webpage.
    e. Upgrade the webpage to support for IE & Chrome browsers.
    f. Provide special products for TCs forecast.
    g. Develop Real-time NWP verification for deterministic and ensemble products.
    h. Complete forecaster's forum and the archiving system.
    i. Hosting the SWFDP-SeA website at IDC using load balancing technology to increase accessibilities.
    j. Establishing a FTP server at NCHMF: NMCs can access to download or exchange raw data (NWP product and observation).

4.11 AOP7 – Development of regional radar network

- Thailand Meteorological Department (TMD) has successful applied the lowest level intensity techniques (EIL) to each TMD radar site and created nationwide radar composite map with technical assistance of JMA.
- Because of the Clutter Map for LMP radar site has not been applied, some noise corresponding to elevation angle composite table appeared.
- TMD has set up the new volume scan profile for each radar site which elevation angle is not suitable for EIL.
- The number of sector or number of angle for each azimuth for TMD radar site is not fixed, therefore, accuracy is changed site by site.
- In the future, TMD should consider the volume scan profile to keep at least 4 tilt in lowest elevation angle which correspondence to topography and appropriable for EIL.
- The combination of 2 dataset has encountered problem about memory not enough.
- Quality control (QC) with rainfall data and radar data need to be done before QPE process
- A technical meeting for TMD radar staff is to be held at JMA in late November 2014. Two experts from TMD will participate at the technical meeting to discuss the progress and to follow up on the training of quality management technique of radar data. TMD radar staff also will acquire basic calibration technique for the QPE in the technical meeting. TMD expressed its appreciation to JMA's technical assistances in the Meeting.
- Plan for 2015
    a. Application of JMA's quality management technique using statistical method to each of the TMD radar
    b. Development of source codes of radar data calibration for QPE by TMD with technical assistance of JMA.
    c. Submission of a progress report by TMD. Upon the receipt of the report, a

technical meeting will be held in JMA or TMD to follow up with the progress and to identify a way forward.

4.12 AOP8- Assessment report on the impact of climate change on tropical cyclone in TC region

- The expert team for the 3rd Assessment Report was established in 2014 with the following members:
    a. Ming Ying (Shanghai Typhoon Institute/ CMA)
    b. Thomas R. Knutson (Geophysical Fluid Dynamics Laboratory/NOAA)
    c. Toshiyuki Nakaegawa (Japan Meteorological Administration)
    d. Tsz-Cheung Lee (Hong Kong Observatory)
    e. Yun Wontae (Korea Meteorological Administration)
    f. Wong Chan Seng (Macao Meteorological and Geophysical Bureau) as the expert team coordinator
- With the consideration that the 1st and 2nd Assessment Report on the impact of climate change in Typhoon Committee Region has already presented the findings with the respective focus on "tropical cyclone frequency, intensity and Landfalling", and "tropical cyclone frequency, intensity, precipitation, high winds, genesis, tracks, duration and impacts", the expert team thus proposed the 3rd Assessment Report will be focus on the "tropical frequency, intensity, precipitation rates, shifts in activity, track pattern, landfalling, sea level rise, storm surge and impacts". The 3rd Assessment Report is planned to be published in 2017 or 2018.
- Plan for 2015 and beyond
    a. 2015 – Accumulate findings from CMIP5 results and Event Attribution (EA) studies; Summarize and assess related research emerges; Collect data of progress of work; Make a draft outline.
    b. 2016 – Literature review and discussion; Write the first draft of th3rd Assessment Report; To hold the experts symposium; Complete the first draft in October or December and solicit opinions at the IWS.
    c. 2017 – To solicit the comments from Members in January or March; Revise and plan to publish it in 2017 or 2018 (before IPCC AR6 in 2019 or 2020).

4.13 AOP9 – Storm surge watch scheme

- In 2014 RSMC Tokyo added 41 stations; USA(1), The Philippines(9) from June, Viet Nam(20), Hong Kong China(5), Republic of Korea(5) in September. It also added one more station in the Philippines in October. The graphical representation has also been improved to make the products more user friendly since September 2014. All products can be found on the JMA Numerical Typhoon Prediction website (https://tynwp-web.kishou.go.jp).
- There were requests from NWS for time-series storm surge forecasts at Kwajalein, Marshall Islands and in Wake Island located outside of the current forecasting region. It is difficult to expand the forecasting region eastward due to limitation of the current computation resource. This request will be taken care of when the computer system is upgraded in two or three years.
- Storm surge time series charts and tide level at more stations, will be developed and

provided on the website by RSMC Tokyo, if so requested by Members.

- Members are encouraged to calculate astronomical tides at stations and complete hourly tidal data during past storm surge events at the station, and to verify storm surge forecasts, or provide complete hourly tidal observation data at stations to RSMC Tokyo for verification the storm surge forecasts.
- Plan for 2015 and beyond
    a) to provide storm surge time series forecasts if so requested by Members
    b) to prepare for provision of multiple scenarios of storm surge forecasts to TC Members.
    c) to conduct verification of time series forecasts if tidal data during past storm surge events are provided by Members.

4.14 AOP10 - Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICA)

- The Organizing Committee (OC) Meeting which was expected to be held in June 2014 was not been able to be realized due to the time conflict of the OC Members with their own commitments. Nevertheless, the Meeting noted the field campaign conducted by CMA, which includes the technique of mobile sounding, unmanned aircraft and rocket sounding, as well as the reconnaissance flight conducted by HKO in 2014.
- The Meeting was informed on the following research project related to the EXOTICA on Rocket Sounding, Unmanned aircraft, Satellite Buoy array in South China Sea and the research programme-973 (Landfall) and the High Resolution Model (WGM-PP) will be carried out by CMA in 2014 and beyond.
- Plan for 2015
    a. To hold the OC meeting in 2015 for preparing the implementation (field campaign in 2015) of the experiment, including establishing the Scientific Steering Committee and the Research Groups (Field Campaign, Basic Research and Typhoon Modelling) and confirm the tasks of participating TC Members on the field Campaign in 2015.
    b. To test the field campaign by using aircraft (unmanned) drop-sounds, mobile GPS rise-sound and rocket drop-sound as well as the aircraft (manned) drop-sound.
    c. Demonstration research on tropical cyclone intensity change by using target typhoon data from the field campaign (to be included in the TC Fellowship Scheme) with the focus on target typhoon data assimilation and mechanism of target typhoon intensity change.

4.15 AOP11 – Training attachment to HKO on QPE/QPF

- HKO offered a research fellowship to Mr. Evan James K. Carlos of PAGASA under with TC Research Fellowship Scheme (TCRF) 2014. A two-month attachment from 6 October to 5 December 2014 has been arranged with the research topic titled “Nationwide Nowcast of Tropical Cyclone Rainfall”. Research and technique development would be conducted on applying multiple radars / radar mosaics for development of nationwide QPE and QPF using SWIRLS nowcasting system.
- A two-weeks training was provided to Mr. Carlos on radar QPE/QPF techniques,

algorithms of severe weather nowcast, and familiarization and adaptation of SWIRLS nowcasting system.

- Through this research attachment and training, the technology transfer exercise to adapt SWIRLS for uses in PAGASA would continue in support of further studies and planning for potential operational applications of SWIRLS.
- Since several rounds of QPE/QPF trainings under the support of HKO and TCTF have already been carried out and HKO is considering to deploy the fellowship offer to other topics in the forthcoming years, it was proposed to close this AOP.

4.16 PP1 – High Resolution Tropical Cyclone Model (HTCM)

- The GRAPES (Global/Regional Assimilation and Prediction System) was developed during 2003-2008 by CMA, which includes variational data assimilation (3DVAR), full compressible non-hydrostatical dynamic core with semi-implicit and semi-Lagrangian discretization scheme, modularized model physics package. STI implemented a BDA scheme into the GRAPES, known as GRAPES-TCM (GRAPES-Tropical Cyclone Model) and put into operational forecast since 2007.
- The Meeting was informed that i) the HWRF vortex initialization scheme was successfully implemented in the GRAPES-TCM; ii) for typhoon “Fitow(2013)”, the vortex initialization improved forecasts for both track and intensity; iii) the forecast accuracy of updated GRAPES-TCM is comparable to that of HWRF for typhoon Fitow; iv) compared with HWRF, the vortex initialization scheme seems to be more effective.
- The Meeting was informed about a 3-year project of “Development and Implementation in High-resolution Modelling of Tropical Cyclone” supported by “China Special Fund for Meteorological Research in the Public Interest” from Ministry of Finance of China with the objective to develop a new regional modeling for tropical cyclone forecast to achieve 10% reduction of track error with respect to the operational GRPAES-TCM’s track error in 2011(116km/24hr) and 5 % increase of intensity accuracy.
- It is planned to continue the research through the coordination with WMO-TLFDP, comparison of (semi-) operational model and GRAPES-TCM and the coordination with EXOTICA with respect to the practicability and pilot study on the high resolution (less than 3 km) typhoon model development.

4.17 PP2 - Harmonization of tropical cyclone intensity analysis

- Digitization of CI numbers for the period of 2004-2013 was completed and the best-track datasets including CI numbers of CMA, HKO, JTWC, and RSMC Tokyo were exchanged in June 2014 as scheduled.
- The exchanged datasets were checked through, and it was confirmed that overall, maximum CI numbers of JTWC tend to be larger than those of RSMC Tokyo for the said period. RSMC Tokyo introduced T0922(NIDA), T1013(MEGI), and T1330(HAIYAN) as examples to demonstrate that minor difference in satellite data interpretation and application of Dvorak techniques sometimes resulted in large CI number difference. The meeting noted that cyclone by cyclone analysis will be continued in 2015 to identify reasons for CI number difference between four centers.

4.18 PP3 – Harmonization of timing of upgrade of TD to TS by various centers

- The Meeting was informed that an Ad-hoc meeting of Taskforce was organized in Hong Kong on 13 May 2014 with the aim of examining the discrepancy cases and discussed possible improvement measures to reduce the discrepancies in future. Representatives from CMA (1), HKO (1), JMA(2) and TCS (1) attended the meeting.
- The meeting was also informed the outcomes of the Ad-hoc meeting with the following conclusions and recommendations:
  a. Early issuance of warning bulletins from JMA would greatly facilitate warning operation of Members. JMA would strive to issue TCs bulletins as early as possible, while keeping the current T+90 minutes deadline for issuance of bulletins.
  b. Members to pay attention that Dvorak analysis by JMA – CI of 2.0-2.5 could be a precursor of soon upgrade of TD to TS.
  c. For the discrepancy cases studied (2007-2011), CMA put more emphasis on observations and warning policy, while JMA concerned about consistency between observations and satellite analysis (esp. Dvorak).
  d. Exchange of more observational data (e.g. island station and oil rig data over the South China Sea), along with metadata, and the all available observational data used in operational analysis for tropical cyclone track and intensity, encouraged.
  e. Methods to make correction to wind obs. from elevated off shore platforms by other countries reviewed. Application by Members should be considered
  f. JMA encouraged to explore reviewing upgrade decision at 3-hourly intervals, given that more observational data could be made available in future.
  g. Members' capabilities in TCs intensity analysis need to be enhanced (e.g. Dvorak technique, use and interpretation of obs. from oil rigs, microwave imageries & wind scatterometers, etc.)
  h. Considering that all planned tasks of Taskforce satisfactorily completed, it was recommended the Taskforce to be disbanded and item closed.

4.19 New AOP – Development of tropical cyclone forecasting competency

- Background: At the 66th WMO Executive Council, it was reiterated the need to develop the tropical cyclone forecaster competencies to ensure the quality of tropical cyclone forecasting services and to meet the users' requirements, and noted with satisfaction the tangible progresses in developing TC forecasting competencies in RA IV and RA V. The Council stressed the need for, and urged the Secretariat to support development of TC forecasting competencies in other tropical cyclone basins by regional tropical cyclone committees under the initiative of the RSMCs while ensuring that these are well coordinated with other relevant and developing competencies, such as Marine Weather Forecasting and others. As supplementary information for reference, the tropical cyclone forecasting competency being developed by the Hurricane Committee is available at http://www.wmo.int/pages/prog/www/tcp/HC-36_docplan.html.
- In response to this, RSMC Tokyo thus proposed this new AOP with the action to develop an outline of TCs forecasting competency, which will be jointly coordinate by RSMC Honolulu and RSMC Tokyo. A progress report on the development of TCs forecasting competency will be submitted as the success indicator of this AOP.

4.20 New PP – Available data used in operational tropical cyclone analysis

- Considering the recent advances in the observation and communication techniques and thus the availability of new observation data, it was proposed to establish this new PP to explore the possibility and try to develop the suitable analysis techniques to improve the operational tropical cyclone intensity analysis capability by using the all available data (e.g. meteorological tower/platform, some buoy and island station and oil rig, et. al.) based on the currently operational analysis process.

5. Proposal of RSMC Tokyo Attachment Training

- The Meeting noted that the number of forecasters attending the training would be increased from 2 to 3 every year with the target trainees from Cambodia, Lao PDR, Malaysia, Philippines, Thailand and Viet Nam in 2014 and 1015 as agreed in the TRCG meeting held in Macao, China in 2013.
- The Meeting reviewed the RSMC Tokyo Attachment proposal as proposed by TRCG Chair which is in accordance with the decision at the 46th Session that: *TRCG was requested to develop a budgetary feasible plan in consultation with WMO on RSMC Tokyo attachment training for 2016-2017., to be made available for all Members, with high priority on capacity development of less developed Members, for submission to the 47th Session.*
- The Meeting generally agreed that the number of trainees each year to be increased to 3 and with priority on Members that necessitates the capacity development support, and also agreed that the TCTF budget allocation for each trainee should be increased to US$2500 up from the current amount of US$2000.
- Considering the concerns on the issue on the priority attributed to Members to attend the Training as expressed by the representative of WMO, the Meeting advised that the proposal of RSMC Attachment Training be revised with further consultation with WMO and RSMC Tokyo.

6. PTC/TC Cooperation Mechanism

- The Meeting was informed on the outcome of the Working Meeting on Cooperative Mechanism for Coastal Multi-hazard Early Warning Information Sharing and Technical Transferring between the Panel on Tropical Cyclones (PTC) and the Typhoon Committee (TC), which was established in the Activity 2.2 of the Work Plan of the project "Synergized Standard Operating Procedures for Coastal Multi-hazards Early Warning System (SSOP)", was held in Bangkok, Thailand on 9-10 October 2014.
- The Working Meeting was attended by 22 participants which were mainly Chairpersons of the Working Groups on meteorology, hydrology and disaster risk reduction (DRR) of PTC and TC or their representatives; Heads of the Regional Specialized Meteorological Centers (RSMC) of Honolulu, New Delhi and Tokyo, or their representatives; Program Specialist in Early Warning Systems of Asian Disaster Preparedness Center (ADPC); the Acting Administrator of PAGASA, and representatives of the Secretariats of ESCAP, WMO, PTC and TC.
- The Meeting recognized the mutual benefit for PTC and TC, which will be brought about by enhancing the cooperation between the two regional bodies. The Meeting generally

agreed with the recommendations of the Working Meeting of the way forward to enhance the cooperation. Nevertheless, concerns were expressed in regard the funding support of the cooperation activities and the detailed planning of how to implement this cooperation mechanism.

- The Summary Report of the Working Meeting including the detailed conclusions and recommendations is available on the SSOP webpage of the TC website (http://www.typhooncommittee.org/SSOP/indexSSOP.html).

7. Chairmanship of WGM

As the term of the current Chair and Vice-Chairs will come to the end at the 47th Session, the Meeting agreed to recommend to the 47th Session to reappoint Dr. Lei Xiaotu (China) as Chair of WGM and to reappoint Dr. Vicente Malano (Philippines) and Ms. Che Gayah Ismail (Malaysia) as Co Vice-chairs of WGM for the term of next 2 years after the 47th Session.

8. Conclusions and the proposed action plans for 2015

On the basis of the information provided by Members and the respective coordinators of the action plans and based on the discussions during the Meeting, the following conclusions were reached:

a. With the help of Tropical Cyclone Programme (TCP) of WMO and Typhoon Committee Secretariat (TCS), and the absolute sincere cooperation of all Members and the effective efforts of the WGM focal points, WGM has successfully completed the tasks in 2014.

b. Members have made important progress in the implementation of the TC Strategic Plan during the year 2014.

c. Members made significant progress during 2014 in tropical cyclone monitoring and communication systems, data assimilation and numerical weather prediction systems, tropical cyclone forecast-aiding systems, and scientific understanding of tropical cyclone activities.

d. Based on the discussion on the action plans for 2015 and beyond as outlined above and subsequent discussion after the 9th IWS, it was concluded to adopt the action plans as follows:

   i. The POP1, on RSMC Tokyo attachment training, will be moved to TRCG from 2015.
   ii. The POP item 2-4 will be continued in 2015.
   iii. The AOP1, on SSOP, which was completed in 2014 and closed.
   iv. The AOP item 2 – 4 and 6- 10 will be continued in 2015 except AOP5 which will be moved to POP as POP item 1 in 2015.
   v. The PP item 1 and 2 will be continued in 2015.
   vi. The Current PP3 – “Harmonization of timing of upgrade of TD to TS by various warning centers” which was completed in 2014 and closed.
   vii. Establish the new AOP item 9 of “Development of tropical cyclone forecasting competency” in 2015.
   viii. Establish the new PP item 3 of “Available data used in operational tropical cyclone analysis” in 2015.

e. The total budget proposed by WGM, which was also concurred at the AWG meeting after

the 9th IWS, for undertaking the actions plans (AOPs, POPs and PPs) in 2015 is **US$16000**. In addition, the budget of US$11000 was allocated for the support of WGM attendance at the next Integrated Workshop. Thus the total budget for WGM for year 2015 is **US$27000**. The financial support of US$5000 for AOP-EXOTICA will be allocated through the "Special funding request".

f. The complete WGM 2015 action plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget is listed in Annex II.

9. Recommendations

a. The Committee to take note of the outcomes of the WGM Parallel Meeting at the 9th IWS and to endorse the proposed WGM 2015 action plans and the associated budget (subject to some follow-up revisions) at the 47th Session.

b. The Committee to endorse the reappointment of the current Chair and Vice-Chairs for the term of the next 2 years after the 47th Session.

10. Closing

The Chair of WGM expressed his thankfulness to all the participants for their interactions and input during the Meeting as well as the assistances of Mr. Renito Paciente, Mr. Ambun Dindang and Mr. Derek Leong to chair the part of the Meeting. He also thanked all the coordinators for their significant efforts to implement the action plans in 2014 as well as the collaboration all the WGM focal points. In addition, thanks also expressed to the Members for their support of the WGM actions and the offer of the Fellowship to the TC Members.

With no other business, the Meeting closed at 12:30 on 22 October 2014.

Annex I

Status of Perennial Operating Plans (POPs) in 2014

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
KRA 1 KRA 2 KRA 4 /SG4(a)	1	Improvement of QPE/QPF and storm surge techniques for TC Members	(a) To collaborate with TRCG to conduct the yearly RSMC Tokyo Attachment Training for operational forecaster from TC Members including the training of storm surge model and QPE/QPF.	TRCG	1st -4th	JMA, WMO	Submission of the evaluation report	/	/	Tsukasa Fujita (JMA)	Yes
KRA 6 / SG 6b and SG 6c	2	Web-based typhoon forum	(a) To run routinely (b) Upgrade the forum and opening for scientists and operational forecasters upon request	WGs	1st -4th	CMA Members	Submission of the progress report	/	/	Zen Zhihua (CMA)	Yes
KRA 1 - 6	3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2014 (b) Improvement of the editorial procedure (includes inviting 2-3 visiting editors)	AWG, WGs	1st -4th	CMA, TCS Members	Submission of the progress report	US$5,000	TCTF	Ms. Wang Donglian g& Zhou Xiao (CMA)	Yes
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	4	Transfer of the Technology of the Typhoon Analysis and Prediction System (TAPS)	(a) To train the typhoon forecasters on the use of the TAPS upon Member's request (b) To provide follow-on technical assistance to Members on the implementation of TAPS	TRCG	1st–4th	KMA Members	Submission of the progress report	US$3,000	TCTF	KiRyong Kang (KMA)	Yes

Status of Annual Operating Plans (AOPs) in 2014 (WGM)

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
KRA 1 KRA 2 KRA 4	1	Contribution to the development of SSOP Manual and SSOP Training	(a) To review and comment on the SSOP Manual and related Documents (b) To review and provide input into planned SSOP Training	WGH WGDRR TRCG	1st -4th	TCS, Members, ESCAP WMO PTC ADRC ADPC ABU	(a) Seven beneficiary Members provide comments on SSOP Manual and related Documents (All Members are encouraged to provide comments) (b) Seven beneficiary members provide comments on planned SSOP training (All Members are encouraged to provide comments)	/	SSOP Budget	Project Manager, Steering Committee, Task Team, RenitoPaciente (PAGASA)	(a) Yes, Members will provide comments when the Manual is available. (b) Yes
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	2	Enhanced use of ensemble forecast	(a) To explore ways to improve the ensemble forecast products on the website, responding to identified needs through the past questionnaires by WWRP/TCP and GIFS-TIGGE WG. (a) To further examine TC generation prediction skills to identify potential for its operational use in the future.	/	1st -4th	JMA	(a) Report possible ways to improve the ensemble forecast products. (b) Identify potential for TC generation prediction skills using TIGGE data	/	/	Tsukasa Fujita (JMA)	(a) Partly completed and be postponed (b) Yes

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
KRA1 KRA2 KRA6 / SG 6b and 6c	3	Verification of tropical cyclone operational forecast	(a) To carry out post-season verification and reliability analyses on the operational forecast of tropical cyclones in Committee session (b) To further improve the evaluation system for tropical cyclone forecast, with special attention on genesis and ensemble forecast conjunction with WMO-TLFDP (to be included in the TC Fellowship Scheme) (c) To offer fellowship for training on (b)	AWG, TRCG	1st -4th	CMA, KMA, HKO, RSMC Tokyo, Members	(a) Submission of the post-season verification report (b) Progress report on the improvement of evaluation system for tropical cyclone forecast	US$3,000	TCTF	Ms. Yu Hui (CMA)	Yes
KRA1 KRA2 KRA6	4	Improvement of South China Sea typhoon forecast	(a) Further improvement of TRAMS model and products (b) Provide TRAMS-9km products relate to typhoon assess through website	/	1st -4th	CMA, Viet Nam, PAGASA, MMD	Submission of the report on the assessment of model and website	/	/	Chen Zitong (CMA)	Yes
KRA1 KRA2 KRA6	5	Development of typhoon seasonal prediction system	(a) To further develop the techniques of typhoon seasonal prediction (b) To establish the semi-operational web-based portal to provide the products of typhoon seasonal prediction for TC Members	/	1st -4th	KMA Members	Submission of the report on assessment of seasonal prediction models	/	/	KiRyong Kang (KMA)	Yes

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
KRA1 KRA2 KRA6	6	Improvement of severe weather forecasting and interaction with user communities	(a) Provide the motion of observed precipitation areas up to 3 hours ahead (1 hour cycle) using Semi-Lagrangian advection scheme in combination with satellite data (b) Provide tropical cyclone track and intensity and severe weather forecasting charts based on NWP model (c) Coordinate with WMO-TLFDP and "Web-based Typhoon Forum" project to provide the verification product and add the "Forecast Forum" tool in SWFDP-SeA website. (d) Set up FTP server to share raw data between Vietnam and others.	WGH, WGDRR, TRCG	2nd-4th	Viet Nam, Cambodia, Lao, Thailand, China, RSMC Tokyo	Progress report	/	/	Vo Van HOA NHMS of Viet Nam	(a) Partly and be postponed (b) Yes (c) Postponed (d) Yes
KRA1 KRA2	7	Development of regional radar network	(a) Application of the radar composite techniques provided by JMA to the nationwide radar network in Thailand by TMD with technical assistance of JMA (b) Preliminary works on application of QPE techniques by TMD with technical assistance of JMA (c) Submission of a	TRCG	1st – 4th	TMD, JMA	(a) & (b) Submission of the progress report by TMD	US$4,000	TCTF	Patchara Petvirojchai (TMD) Tsukasa Fujita (JMA) Derek Leong (TCS)	Yes

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
			progress report by TMD. On receipt of the report, holding a technical meeting at JMA or TMD to follow up with the progress and to identify a way forward								
KRA 1 KRA 2 KRA 4	8	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) Establish the expert team and start the AOP on the 3rd assessment report in 2014. (b) Carry out a preliminary review on the latest research development on the impacts of climate change on tropical cyclones to identify key areas that need to be pushed forward in the research activities of TC Members and addressed in the 3rd Assessment (e.g. TC induced extreme rainfall, storm surge risk, data homogeneity, etc). (c) Proposed the outline and schedule of the 3rd Assessment Report based on the preliminary review.	WGH WGDRR TRCG	1st – 4th	HKO/China, CMA, USA, JMA, KMA, Macao/China (coordinator) Members	Submission of the progress report	/	/	Wong Chan Seng (Macao/China)	Yes

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
KRA 1 KRA 2 KRA 4 /SG4(a)	9	Storm surge watch scheme	(a) To provide storm surge time series forecasts at several stations of Guam, the Philippines, and Viet Nam. Further addition will be considered if so requested by Members. (b) To conduct verification of time series forecasts at the stations to be added.	WGH TRCG	1st- 4th	JMA	(a) Develop storm surge time series charts at more than one point if so requested by Members (b) Report of verification results of time series forecasts at stations where feasible	/	/	Tsukasa Fujita (JMA)	(a) Yes (b) ongoing which is upon the providence of data from Members
KRA1 KRA2 KRA6	10	Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICA)	(a) To hold a small meeting for preparing the implementation (field campaign in 2014) of the experiment (b) To test the field campaign by using aircraft (un/manned) drop-sounds, mobile GPS rise-sound and rocket drop-sound. (c) Demonstration research on tropical cyclone intensity change by using target typhoon data from the field campaign (to be included in the TC Fellowship Scheme).	AWG	1st – 4th	CMA, HKO Members	(a) To report the outcomes of the meeting to the Organizing Committee (b) Carry out the field campaigns and gather the special observation data of 1-2 target typhoon (c) Submission of the progress report	US$5,000	To be funded through "Special Funding Request" and not included in the WGM budget	LEI Xiaotu (CMA) WK Wong (HKO)	(a) Postponed to May 2015 (b) Party yes (c) Partly yes

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Status of Completion
KRA1 KRA2 KRA4 /SG4 a	11	Training attachment to HKO on QPE/QPF	(a) To collaborate with TC Fellowship scheme to provide QPE/QPF training to one TC Member	TRCG, WGH	2nd – 4th	HKO	Submission of the progress report			WK Wong (HKO)	Yes

Status of Preliminary Projects (PPs) in 2014 (WGM)

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remarks
KRA1 KRA2 KRA6	1	High resolution tropical cyclone model (HTCM)	(a) Coordinate with WMO-TLFDP, comparison of (semi-) operational typhoon model (HWRF and GRAPES-TCM) (b) Practicability and pilot study on the high resolution (≤ 3km) typhoon model development.	/	1st – 4th	CMA, Members WMO	Submission of the progress report	/	/	Chan Baode (STI/CMA)	Yes

KRA 1 KRA 2 KRA 4 /SG4(a)	2	Harmonization of Tropical cyclone intensity analysis	(a) Exchange best-track datasets including digitized CI numbers for the period 2004-2013 by the end of June 2014. (b) Conduct cyclone by cyclone comparison analysis of CI numbers with preliminary report of findings, if digitization completed	/	1st – 4th	JMA, CMA, HKO	Submission of the progress report	/	/	Tsukasa Fujita (JMA)	Yes
KRA 1 KRA 2 KRA 4 /SG4(a)	3	Harmonization of timing of upgrade of TD to TS by various warning centers	(a) Devise measures to remove/reduce the discrepancies in future based on the findings from the investigation on the discrepancy cases identified on the data (2007-2011) (b) Discuss the pros and cons of the proposed measures and reach a consensus on the way forward; (c) Make recommendations to WGM at 9th IWS	/	1st – 4th	Taskforce on TC Intensity Analysis for Upgrading TD	Submission of the progress report	/	/	ST Chan (HKO)	Yes

Annex II

WGM - Perennial Operating Plans (POPs) in 2015

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remark
KRA1 KRA2 KRA6	1	Development of typhoon seasonal prediction system	(a) To further develop the techniques of typhoon seasonal prediction (b) To establish the web-based system to provide the products of typhoon seasonal prediction for TC Members	/	1st -4th	KMA Members	Submission of the progress report	/	/	KiRyong Kang (KMA)	Moved from 2014 AOP5
KRA 6 / SG 6b and SG 6c	2	Web-based typhoon forum	(a) To run routinely (b) Upgrade the Forum and opening for scientists and operational forecasters upon request.	WGs	1st -4th	CMA Members PTC	Submission of the progress report	/	/	Zen Zhihua (CMA)	Continued
KRA 1 - 6	3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2015 (b) Improvement of the editorial procedure and enhance the Journal's recognition (includes inviting 2-3 visiting editor)	AWG, WGs	1st -4th	CMA, TCS Members PTC	Submission of the Progress report	US$5,000	TCTF	Ms. Wang Dongliang & Zhou Xiao (CMA)	Continued
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	4	Transfer of the Technology of the Typhoon Analysis and Prediction System (TAPS)	(a) To train the typhoon forecasters on the use of the TAPS upon Member's request (b) To provide follow-on technical assistance to Members on the implementation of TAPS	TRCG	1st–4th	KMA Members	Submission of the progress report	US$4,000	TCTF	KiRyong Kang (KMA)	Continued

WGM - Annual Operating Plans (AOPs) in 2015

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remark
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	1	Enhanced use of ensemble forecast	(b) To prepare for provision of ensemble TC track guidance of ECMWF, UKMO, NCEP, and JMA through the Numerical Typhoon Prediction Website if necessary NWP data are provided. (c) To examine a multi-center grand ensemble (MCGE) for TC generation prediction.	/	1st -4th	JMA	(a) Submission of the progress report. (b) Summarize verification results of TC generation prediction skills using TIGGE data and potential for its operational use	/	/	Tsukasa Fujita (JMA)	Continued
KRA1 KRA2 KRA6 / SG 6b and 6c	2	Verification of tropical cyclone operational forecast	(a) To carry out post-season verification and reliability analyses on the operational forecast of tropical cyclones in Committee session (b) To provide the real time verification information on track and intensity forecast through WMO-TLFDP website (c) To further improve the evaluation system for tropical cyclone forecast, with special attention on genesis and ensemble forecast conjunction with WMO-TLFDP (d) To offer fellowship for	AWG, TRCG	1st -4th	CMA, Members PTC	(a) & (b) Submission of the post-season verification report (c) & (d) Progress report on the improvement of evaluation system for tropical cyclone forecast and Fellowship	US$3,000	TCTF	Ms. Yu Hui (CMA)	Continued

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remark
			training on (b)								
KRA1 KRA2 KRA6	3	Improvement of South China Sea typhoon forecast	(a) Further improvement of TRAMS-9km model (b) Provide TRAMS-9km products related to typhoon assess through website	/	1st -4th	CMA, Viet Nam, PAGASA, MMD	Submission of the report on the assessment of model and website	/	/	Chen Zitong (CMA)	Continued
KRA1 KRA2 KRA6	4	Improvement of severe weather forecasting and interaction with user communities	(a) Further develop the web portal with the providence of more products for Member (b) Hosting the SWFDP-SeA website at IDC (c) Establish a FTP Server at NCHMF.	WGH, WGDRR, TRCG	2nd-4th	Viet Nam, Cambodia Lao PDR Thailand WMO	Progress report	/	/	Vo Van HOA NHMS of Viet Nam	Continued Details of additional products to be available is referred in the Summary Report

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remark
KRA1 KRA2	5	Development of regional radar network	(a) Application of JMA's quality management technique using statistical method to each of the TMD radar (b) Development of source codes of radar data calibration for QPE by TMD with technical assistance of JMA (c) Submission of a progress report by TMD. On receipt of the report, holding a technical meeting at JMA or TMD to follow up with the progress and to identify a way forward	TRCG	1st – 4th	TMD, JMA	(a) & (b) Submission of the progress report by TMD	US$4,000	TCTF	Patchara Petvirojchai (TMD) Tsukasa Fujita (JMA) Derek Leong (TCS)	Continued
KRA1 KRA2 KRA4 / SG4a	6	Assessment report on the impact of climate change on tropical cyclone in TC region	(c) Accumulate findings from CMIP5 results and Event Attribution (EA) studies (d) Summarize and assess related research results emerged (e) Collect data of progress of work (f) Make a draft of outline	WGH WGDRR TRCG	1st – 4th	HKO CMA, USA JMA, KMA, Macao Members	Submission of the progress report	/	/	Wong Chan Seng (Macao/China)	Continued

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remark
KRA 1 KRA 2 KRA 4 /SG4(a)	7	Storm surge watch scheme	(a) To provide storm surge time series forecasts at more than one point if so requested by Members. (b) To prepare for provision of multiple scenarios of storm surge forecasts to TC Members. (c) To conduct verification of time series forecasts if tidal data during past storm surge events are provided by Members.	WGH TRCG	1st- 4th	JMA	(a) Develop storm surge time series charts at more than one point if so requested by Members. (b)Report progress of multiple scenarios of storm surge forecasts (c) Report the verification results, if any.	/	/	Tsukasa Fujita (JMA)	Continued
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	8	Contribution for the Experiment on Typhoon Intensity Change in Coastal Area (EXOTICA)	(a) To hold the OC meeting for preparing the implementation (field campaign in 2015) of the experiment (b) To test the field campaign by using aircraft (un/manned) drop-sounds, mobile GPS rise-sound and rocket drop-sound. (c) Demonstration research on tropical cyclone intensity change by using target typhoon data from the field campaign (to be included in the TC Fellowship Scheme).	AWG	1st – 4th	CMA, HKO Members	(a) To report the outcomes of the meeting to the Organizing Committee (b) Carry out the field campaigns and gather the special observation data of 1-2 target typhoon (c) Submission of the progress report	US$5,000	To be funded through "Special Funding Request" and not included in the WGM budget	LEI Xiaotu (CMA) WK Wong (HKO)	Continued

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Remark
KRA 1 KRA 2 KRA 4	9	Development of tropical cyclone forecasting competency	To develop an outline of tropical cyclone forecasting competency	TRCG	1st -4th	RSMC Tokyo and Honolulu, TC Members that are interested in this project	Submission of the outline and progress report	/	/	Tsukasa Fujita (RMSC Tokyo) Raymond Tanabe (RSMC Honolulu)	New

WGM Preliminary Projects (PPs) in 2015

SP's KRA and SG	Objective Number	Objective	Action	Other WG's involved	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Completed -Yes or No
KRA 1 KRA 2 KRA 4	1	High resolution tropical cyclone model based on GRAPES (G-TCM)	(a) Coordinate with WMO-TLFDP, comparison of (semi-) operational typhoon model (HWRF and GRAPES-TCM) (b) Coordinate with EXOTICA, Practicability and pilot study on the high resolution (≤ 3km) typhoon model development.	/	1st – 4th	CMA, Members WMO	Submission of the progress report	/	/	Chan Baode (STI/CMA)	Continued

KRA 1 KRA 2 KRA 4 /SG4(a)	2	Harmonization of Tropical cyclone intensity analysis	(a) Continue cyclone by cyclone comparison analysis of CI numbers. (b) Identify reasons for CI number differences between CMA, HKO, JTWC, and RSMC Tokyo.	/	1st – 4th	JMA, CMA, HKO	Submission of the progress report	/	/	Tsukasa Fujita (JMA)	Continued
KRA 1 KRA 2 KRA 4 /SG4(a)	3	Available data used in operational tropical cyclone analysis	(a) To investigate the available data in TC region (b) To assess the quality of the available data and try to develop the techniques to use them in operational tropical cyclone (intensity and track) analysis.	TRCG	1st -4th	CMA Members that are interested in this project	Submission of the progress report	/	/	Qian Chuanhai (CMA)	New