

**ESCAP/WMO Typhoon Committee**

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FORTY-FIFTH SESSION

HONG KONG, CHINA

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AGENDA ITEM 8

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## **REPORT OF WGM**

*(Submitted by WGM)*

### **Action Proposed**

The Committee is invited:

- (a) To take note of the Members activities and major progress and issues in meteorology component in 2012 as reported by Members at the 7<sup>th</sup> IWS in Nanjing ([http://www.typhooncommittee.org/IWS\\_Nanjing/members.html](http://www.typhooncommittee.org/IWS_Nanjing/members.html));
- (b) To review the WGM activities in 2012 and planned activities in 2013 and beyond
- (c) To endorse the WGM recommendations

APPENDIX: Report of WGM Parallel Meeting at the 7<sup>th</sup> IWS

## 1. Introduction

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.) 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.

## 2. WGM Membership

The current composition and focal point members list of WGM are:

Chair	Mr. Lei Xiaotu (China)
Vice Chair	Mr. Nathaniel Servando (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. Masashi Kunitsugu (Japan) Ms. Souvanny Phonevilay (Lao PDR) Mr. Chan Cheng Hou (Macao, China) Ms. Che Gayah Ismail (Malaysia) Mr. Renito B. Paciente (Philippines) Dr. Myoung-Hwan Ahn (Rep. of Korea) Mr. Lesley Choo (Singapore) Mr. Somsri Huntrakul (Thailand) Mr. Bill Ward (USA) Mr. Vo Van Hoa (Viet Nam)

### **3. WGM activities in 2012**

With the assistances of Tropical Cyclone Program (TCP) of WMO and Typhoon Committee Secretariat (TCS), and the strong support from all Members, WGM has successfully completed the AOPs in 2012 endorsed at the 44<sup>th</sup> Session. Experts from other working groups of TC as well as TCP/WMO, TCS, RSMC-Tokyo, JTWC have also provided assistances to accomplish the tasks of WGM over 2012. The WGM activities in 2012 are as reported in the Appendix – Report of the WGM Parallel Meeting at the 7<sup>th</sup> IWS.

### **4. Proposal of WGM AOPs and Future Planning**

During the 7<sup>th</sup> IWS, the participants of the WGM Parallel Meeting had the opportunities to discuss the AOP for 2013 and the potential projects that can involve and enhance the cooperation of three WGs.

- a. The Meeting concurred with the proposal of the Chair of WGM to restructure the table of the AOPs, namely the inclusion of 2 additional tables, which are the Perennial Operating Projects (POPs) and the Preliminary Projects (PPs). POPs are now 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.
- b. As the results of the discussion and based on the comment expressed by the participants, the Meeting concurred that the 2012 AOP items (2, 3, 4, 6, 7, 9, 10, 11 and 12) will be continued in 2013, while AOP items (5 and 8) will be moved to the POPs with the addition of a new POP item of Improvement of QPE/QPF and storm surge techniques for Members.
- c. In response to the request to support the SSOP, the Meeting concurred to establish a new AOP on this issue. Based on the follow up discussion after the meeting, it was concurred to establish the new AOP of “Contribution to SSOP” with the aim to support the implementation of SSOP project.
- d. Details of the proposed AOPs for 2013 and future planning is as reported in the Appendix - Report of the WGM Parallel Meeting at the 7<sup>th</sup> IWS.

### **5. Conclusions**

On the basis of the information provided by Members and the respective coordinator of the AOPs 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 2012.
- b. Members made significant progress during 2012 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 AOPs in 2012.

- d. Based on the outcome preliminary studies on the published papers on climate change, WGM will initiate third assessment report on the impact of climate change on tropical cyclone in TC region.
- e. Improvement of storm watch scheme will further contribute to the early warning of storm surge in TC region.
- f. There are needs form Members to continue the transfer of technology and knowledge of the Typhoon Information System among Members.
- g. The role of ensemble prediction products in tropical cyclone forecasts for effective warning is increasing through effective tools provided in the WMO NWP-TCEFP Web page.
- h. Based on the outcome of a survey carried out by WMO Typhoon Landfall Forecast Demonstration Project (WMO-TLFDP), more attention should be paid to the verification of probabilistic forecasts, and precipitation and high wind forecasts related to tropical cyclone.
- i. The web-based typhoon forum is helpful in terms of providing a communication platform for both forecasters and researchers.
- j. With the assistances provided by JMA, TMD starts to carry out the roadmap of the development of regional radar network.
- k. 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 latest progress in tropical cyclone research, forecasting technique and warning system as well as to enhance the visibility of Typhoon Committee.
- l. The in-depth QPE/QPF training organized with the Typhoon Committee Research Fellowship Scheme was much appreciated by the participants from the UFRM pilot cities. Follow-on technical assistance to participating Members on the adaptation of the QPE/QPF technique is necessary.
- m. Significant progress has been made on the construction of web-based portal system to aid typhoon seasonal prediction information.
- n. 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 portal web page hosted by National Hydro-Meteorological Service of Viet Nam.
- o. Reconnaissance flights undertaken in the vicinity of Hong Kong to gather meteorological observations around tropical cyclones for operational reference and research studies provided useful information on tropical cyclone location and the wind distribution in the vicinity of tropical cyclone, for monitoring their development and assessment of impact of associated weather system.

## **6. Recommendations**

On the basis of the outcomes of the WGM Parallel Meeting at 7<sup>th</sup> IWS in Nanjing and subsequent discussion, the WGM made the following recommendations:

- a. To carry out the preliminary studies on published papers and relevant documents on climate change with the aim to publish the third assessment report on impact of climate change on tropical cyclone in TC Region.
- b. To encourage Members to collaborate with the SSOP project.

- c. To request RSMC Tokyo develop the storm surge model for expansion of the region, provide storm surge time series charts at more than one point if so requested by Members, and conduct training on storm surges during the annual TC attachment training,
- d. To request Members provide additional points and tidal data archive to RSMC Tokyo for verification and further improvement of the storm surge model.
- e. To request RSMC Tokyo to improve the WMO North Western Pacific Tropical Cyclone Ensemble Forecast (NWP-TCTEF) home page upon feedback from Members through WMO questionnaire and SWFDP-SeA.
- f. To request KMA further improve the typhoon information processing system (TAPS of KMA) project including to upgrade the user-compatible version of the TAPS and to provide training for the typhoon forecasters on the use of TAPS upon Member's request.
- g. To promote the web-based typhoon forum among Members and to request more forecasters and researchers from Members to register in the forum.
- h. To request TMD make a progress report on radar composite map project based on the outcome of the training course at JMA in November 2012. To request JMA the assistance to provide attachment training to TMD radar expert or to dispatch an expert mission to TMD upon the receipt of the progress report.
- i. To request STI/CMA carry out post-season verification and reliability analysis on the operational forecast of tropical cyclones and further improve the evaluation system for tropical cyclone forecast with special attention on probabilistic and genesis forecast.
- j. To request STI/CMA further improve the editorial procedures of the TC Journal *Tropical Cyclone Research and Review*.
- k. To further improve QPE/QPF techniques of Members and request RSMC Tokyo to conduct QPE/QPF training during annual TC attachment training.
- l. To collaborate with TC Fellowship Scheme to provide QPE/QPF training to Members participating in the UFRM pilot project.
- m. To request CMA further improve the numerical prediction System TRAMS model of the project of Improvement of South China Sea Typhoon Forecast as well as to provide more related products through its website.
- n. To request KMA further develop the techniques of typhoon seasonal prediction as well as to establish the semi-operational web-based provide to provide the products of typhoon seasonal prediction to Members.
- o. To request National Hydro-Meteorological Service of Viet Nam further improve the SWFDP-SeA portal web page; to provide more products in real time and to investigate interpretation of EPS products as well as its NWP guidance.
- p. To continue the study on the methodology to compare the best track datasets based on the recommendation of the best track consolidation meeting with the consideration on the progress of digitization of CI numbers in hardcopy.
- q. To continue the work of the Taskforce on TC Intensity Analysis for upgrading TD.
- r. To re-appoint Mr. Masashi Kunitsugu (Japan) as the TOM Rapporteur.
- s. To request WMO publish 2013 edition of TOM, upload it on the Tropical Cyclone Programme (TCP) Website and distribute the CD ROM version to Members by March 2013.
- t. To request WMO and ESCAP to promote the TC Journal *Tropical Cyclone Research and Review* as well as to encourage Members to submit articles to the Journal.

- u. To re-appoint Dr. Lei Xiaotu (China) as Chairperson of WGM, Dr. Nathaniel Servando (the Philippines) and Ms. Che Gayah Ismail (Malaysia) as Vice-Chairpersons of WGM.

**Report of the WGM Parallel Meeting  
7<sup>th</sup> Integrated Workshop  
Nanjing, China  
27-28 November, 2012**

1. The WGM Parallel Meeting of the Integrated Workshop was held on 27-28 November 2012, which was attended by 36 participants from 12 members (China; DPR Korea; Hong Kong, China; Japan; Lao PDR; Macao, China; Malaysia; Philippines; Republic of Korea; Singapore; Thailand and Viet Nam). Representatives from TCS and WMO also attended the Meeting.
2. The Meeting first reviewed the activities of the Members during 2012. 12 Members presented their Members' report during the Meeting. The Meeting took note of the presentation of the Members' Reports and appreciated the Members' efforts in improving the tropical cyclone forecast accuracy, knowledge and technique transfer, information sharing, training and research coordination and various support extended to the Committee. The Members' Reports and the respective summary of the Members' report, which outlines their activities and the major progress in the related KRAs are posted on the TC website ([http://www.typhooncommittee.org/IWS\\_Nanjing/members.html](http://www.typhooncommittee.org/IWS_Nanjing/members.html)).
3. The Meeting reviewed the progress and the results of the 2012 AOPs of WGM since the 44<sup>th</sup> TC Session and discussed the future plan. The complete table of WGM AOP 2012 Implementation status including the actions and the implementation status are shown in annex I.

**Working Group on Meteorology (WGM) – AOP 2012 Implementation Status**

Objective Number	Objective	Action	Success Indicators	Completed – Yes or No
1	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) Publish the "2 <sup>nd</sup> assessment report on the impact of climate change on tropical cyclone track and impact area in TC region"; (b) Follow-up of the recommendation of the best-track consolidation meeting	(a) Publish the 2 <sup>nd</sup> report in 45 <sup>th</sup> Session; (b) Consolidate the operational procedures of tropical cyclone analysis for inclusion in the TOM, exchange and compare the historical best-track datasets, including CI numbers if available, among the centers	(a) Yes (b) Yes
2	Storm surge watch scheme for UFRM	(a) To conduct training of storm surge model for UFRM during the annual TC attachment training by RSMC Tokyo (b) To provide storm surge time series charts at one point upon TC Member's request (c) To develop storm surge time series charts at more than one point if so requested by Members	(a) Conduct of training and subsequent evaluation (b) Provide storm surge time series charts at one point upon TC Member's request (c) Develop storm surge time series charts at more than one point if so requested by Members	(a) Yes (b) Yes (c) Yes
3	Transfer of the Typhoon Information Processing System technology	(a) To improve the English version of KMA's typhoon information processing system (TAPS) (b) To train the meteorologists and forecasters of TC Members on TAPS from May with the duration of 2 months	Submission of report on the technique and training of TAPS	(a) Yes (b) Yes
4	Enhanced use of ensemble forecast	(a) To get feedback from Members for improvement of the TCEFP website through WMO's questionnaire (b) To promote Members' understanding of EPS through SWFDP and its training workshop	Improvement of the web site will be implemented and will be reported in the Progress report	(a) Yes (b) No (postponed)

5	Web-based typhoon forum	(a) Expand the number of registered users and the team of moderators on related topics; (b) To upgrade the on-line forum by sharing more real-time observation, forecast and warning information by Members	Effective use of web-based typhoon forum as shown by website access statistics	(a) Yes (b) Yes
6	Development of regional radar network	(a) Specialized attachment training for TMD radar staff upon submission of the progress report of the operating status of the TMD radar system by TMD (b) To follow-up the recommendations and the suggested roadmap of the expert team and to develop the radar composite map which covers the area of the UFRM pilot city in Thailand as the first step	Submission of the progress report, including a detailed schedule for the establishment of the radar composite map	(a) Yes (b) Yes
7	Verification of tropical cyclone operational forecast	(a) Organize a training workshop on typhoon landfall forecast demonstration project (b) Modify the methods to verify the generation, track and intensity forecast accuracy of tropical cyclones in the Asian-Pacific Region (c) Assess the performance of objective model prediction and the official forecast of Members.	(a) Hold a training workshop and subsequent evaluation of the training  (b) Submit report of the assessment of the performance of objective model prediction and the official forecast of Members in 45 <sup>th</sup> Session	(a) Yes (b) Yes
8	Publication of <i>Tropical Cyclone Research and Review</i>	(a) Improvement of the editorial procedure (include visit the visiting editor) (b) Publish the journal quarterly	Progress report	(a) Yes (b) Yes
9	QPE/QPF for UFRM	(a) To conduct a forum and training for UFRM pilot cities (b) To provide QPE/QPF training to TC Members participating in the UFRM pilot projects upon a request. (c) To conduct training on QPE/QPF during the annual TC attachment training at RSMC Tokyo (d) Upon availability of budget, QPE/QPF Workshop to be held by MMD	Conduct of training and subsequent evaluation of the training	(a) No (b) Yes (c) Yes (d) No (due to budget constraint)
10	South China Sea typhoon forecast	(a) Further improvement of TRAMS model (b) Provide more products relate to typhoon assess through website (c) Establish the feedback column for all Members	Submission of the report on the assessment of model and website	(a) Yes (b) Yes (c) Yes
11	Development of web-based typhoon seasonal prediction system	(a) Development of web portal for typhoon seasonal prediction (b) Providing typhoon seasonal prediction results to members through web-based portal page together with the participating members' results	Submission of the report on assessment of seasonal prediction models	(a) Yes (b) Yes
12	Improvement of severe weather forecasting and interaction with user communities	Development of collaborative relationship with WMO severe weather forecast demonstration project	Progress report	Yes

### 3.1 AOP1 – Assessment Report on the impact of climate change on tropical cyclone in TC Region

- The expert team met in Shanghai on November 2011 to discuss and finalize the draft of the 2<sup>nd</sup> Assessment Report and with subsequent revisions and comments from Members during beginning of 2012, the report was completed. Two technical papers of the 2<sup>nd</sup> Assessment Report were submitted to the TC Journal “Tropical Cyclone Research and Review” and were published in May 2012.



- The 2<sup>nd</sup> Assessment Report will be officially launched at the 45<sup>th</sup> Session.
  - The Meeting agreed that a preliminary study of the 3<sup>rd</sup> Assessment should be carried out by the WGM before it is to be assigned as the AOP item.
  - The Meeting expressed sincere gratitude to the members of the expert team for their contribution to this work as well as the efficient coordination of the coordinator and the assistances provided by TCS.
  - As a follow-up of the recommendation of the best-track consolidation meeting in 2012, the Meeting was informed the progress of the follow up in 2012. In September, JMA informed the contact points of the related centers (CMA, HKO and JTWC) on the summarized questionnaire regarding the best-track datasets (parameter, duration and format, etc) and the way to include the information on the center's satellite analysis in the TOM. CMA, JMA, JTWC and HKO will include their operational procedures of tropical cyclone analysis into the TOM. It was confirmed by the related centers the availability of their historical best-track datasets in digital format. The Meeting was also informed that the historical CI numbers in hardcopy of some centers are in the process of digitizing in order to facilitate the exchange of datasets.
- 3.2 AOP2 – Storm surge watch scheme for UFRM
- The Meeting was informed that the storm surge prediction was conducted during the TC attachment training at RSMC Tokyo in July 2012, and the evaluation of the attachment training was sent to WMO/TCP.
  - The Meeting noted that RSMC Tokyo started to provide storm surge time series charts at one station on 5 June 2012 for three stations at Quarry Bay (Hong Kong), Macao and Hua Hin (Thailand). RSMC Tokyo circulated the letter (JMA12/F2/077) in May requesting Members' cooperation to provide additional stations' name and position for storm surge time series charts with their tidal and bathymetric data for verification. As a result, RSMC Tokyo received from Republic of Korea the tidal data and information on the points for the time series charts of 6 stations and requested to provide the time series charts for these 6 stations.
  - The Meeting was informed that the storm surge time series charts are available on the JMA Numerical Typhoon Prediction (NTP) Website. RSMC Tokyo had carried out evaluation the results of the storm surge model for the stations of the Members with the provided observation data. The results of the evaluation were reported in the JMA' Technical Review, No. 14 "JMA's Storm Surge Prediction for the WMO Storm Surge Watch Scheme (SSWS)".
  - The Meeting noted that the name of this AOP will be renamed as Storm Surge Watch Scheme with the activities on: To develop the storm surge model for expansion of the region and To provide storm surge time series charts at more than one point if so requested by Members.
- 3.3 AOP3 – Transfer of the Typhoon Information Processing System technology
- The Meeting was informed that improvement of TAPS was made to enable the multi-language interface for non-English speaking Members and new framework of using PHP was applied to TAPS for self-tuning. The technique was transferred to Viet Nam in February 2012 to Viet Nam and through the training course in June 2012. A laptop with the installed TAPS software will be delivered to Viet Nam at the end of the year.
  - The Meeting noted with appreciation the training course of 2 months on TAPS was hosted by KMA with the participation of three experts from Thailand, the Philippines and Lao PDR.
  - The Meeting noted that KMA will continue to provide the training on TAPS upon Members' request as well as to improve the English version of TAPS and to construct data server for operating TAPS.
- 3.4 AOP4 – Enhanced use of ensemble forecast
- The Meeting was informed that questionnaires addressed to the Members about the effectiveness of EPS for improvement of the TCEFP website will be summarized by the WMO WWRP/TCP and GIFS-TIGGE WG. Addition of requested elements such as surface wind and precipitation to the website will be implemented, should the product specification be considered and corresponding EPS data including the extended CXML be developed with the support of data providers. Continual improvement of the website including the addition of elements will be carried out based on the regular questionnaire survey by WMO. The planned training Workshop of SWFDP in Southeast Asia in this year has been postponed. The Meeting also noted that the possibility of adding a new element of tropical cyclone genesis prediction

using the TIGGE was discussed.

### 3.5 AOP5 – Web-based typhoon forum

- The Meeting was informed that the number of registered users and team on related topics has been expanded though in a slower pace than expected. Until October 2012, there are 64 users from 11 Members has registered. In 2012, totally, 55 topics and 141 posts were presented in the forum by October 2012. The Meeting was also informed that the on-line forum has been upgraded by sharing more real-time observations, forecast and warning information by Members, some real-time information and forecasts including the seasonal predictions of STI/CMA and NTC/KMA were exchanged via this forum.
- The Meeting noted that the forum could be served as the platform for real-time and interactive communication among the forecasters as well as experience sharing among the researchers. To enhance the functionality of this forum, it is recommended that more forecasters and experts from the Members should register at the forum.
- The meeting expressed its gratitude to the support provided by STI/CMA to host the forum.

### 3.6 AOP6- Development of regional radar network

- The Meeting noted with appreciation that the attachment training on radar composite technique for 2 TMD experts was successfully held by JMA on 19 to 22 November at the JMA Headquarters. In addition, the Meeting expressed its gratitude to JMA for the offer of the source codes on creation of radar echo intensity at the lowest level (EIL) to TMD for this project.
- This project was planned to work on the establishment of radar composite map in Thailand as the first step of regional radar network. Following on the recommendations of the 44<sup>th</sup> Session and upon the receipt of the progress report provided by TMD, in which TMD reported 3 radar sites covering the area of the UFRM pilot city (Hat Yai): Phuket, Krabi and Sathing Pra which make volume scan at 3 or 4 elevation angles every 15 minute and their respective data are available in UF format on a real time basis at TMD Headquarters are selected for this phase. The lectures of the training includes the topics on: Creation of ELS, basis on development of scan sequence strategy, algorithm for removal of isolated echoes, removal of noises with lower intensities than a threshold and algorithm for application of clutter maps for removal of ground clutters. As reported, the training was very successful and the knowledge and technique lectured were very much appreciated by TMD experts.
- The Meeting noted that TMD will continue to work on the development of source codes for conversion from UF format to GRIB2 format as well as ones for creation of EILS with the technical assistances from JMA. Upon the receipt of the progress report submitted by TMD, either specialized attachment training for TMD radar staff will be organized or an expert mission dispatched to TMD.

### 3.7 AOP7 – Verification of tropical cyclone operational forecast

- The Meeting was informed that the training workshop on typhoon landfall forecast demonstration project was successfully held in Shanghai, China during 12-14 June, 2012. More than 70 participants attended the meeting, including 16 lectures from 7 institutions worldwide.
- Real-time forecast products have been collected. The forecast products and its official website (<http://tlfdp.typhoon.gov.cn>) have been disseminated to the Members. The verification system for tropical cyclone track and intensity forecast was improved, especially ensemble prediction and landfall forecast. Post-season verification and reliability analyses have been carried out on the track, intensity and precipitation forecast of tropical cyclones in 2010 and 2011.
- A survey on current operational status of TC forecast verification in the western North Pacific region was carried out and an evaluation system for TC forecast is proposed to act as a guideline for future work of the project.
- The Meeting was informed that post-season verification and reliability analyses on the operational tropical cyclones as well as further improvement of evaluation system for tropical cyclone forecast with special attention on genesis forecast will be carried out in 2013. Fellowship for training on verification of tropical cyclone operational forecast will be offered with the support from TCTF and STI/CMA.

- 3.8 AOP8 – Publication of Tropical Cyclone Research and Review
- The Meeting was informed that the editorial office as well as the journal website (<http://tcrr.typhoon.gov.cn>) has been established, and its online manuscript submission and review system (<http://mc03.manuscriptcentral.com/tcrr>) has been installed in 2012.
  - As at the end of October, 3 issues (No.1-3) consist of 36 articles have been published. Not only WGs and TC Members, but also famous scientists worldwide have submitted their research paper to this journal. Each issue has been sent to each TC Members, WMO, universities and institutions and is also available on-line in the journal website.
  - The Meeting noted with appreciation that the journal is attracting more and more attention. As at the end of Oct., the number of abstract page view is up to 7906, and averagely, each article's abstract is viewed 208 times. The full texts were downloaded 4785 times, and averagely, each article was downloaded 125 times. And totally about 60 countries, including most of all TC Members, to download the journal's paper via the journal's website.
  - An invited expert from KMA acted as visiting editor visited the editorial office in Shanghai right after the 7<sup>th</sup> IWS for one week.
  - The meeting was informed that the journal will continuously be published quarterly in 2013 and improvement of the editorial procedures will be carried out. It is planned to invite an expert to be the visiting editor during 2013.
- 3.9 AOP9 – QPE/QPF for UFRM
- The Meeting was informed that QPE/QPF training for UFRM pilot cities was conducted during the TC attachment training at RSMC Tokyo in July 2012, and the evaluation of the attachment training was sent to WMO/TCP.
  - The Meeting was also informed that HKO offered one research Fellowship to MMD on the topic of 'Enhancement of rainfall nowcast in tropical cyclone situation' cum training on QPE/QPF. In collaboration with the TC Research Fellowship Scheme and HKO, TCTF provided the funding support for QPE/QPF training to one PAGASA research fellow to participate concurrently. The duration of the attachment is 2 months from 22 October to 21 December with the focus on in-depth training on QPE/QPF. In addition, a technology transfer exercise to adapt SWIRLS, HKO nowcasting system, for use in Malaysia and the Philippines was conducted. The results of the research work of the trainees will be published in the TCRR journal.
  - Due to the lack of funding, the QPE/QPF workshop proposed by MMD could not take place.
  - The Meeting was further informed that QPE/QPF attachment training will be organized upon request from the Members participating in the UFRM pilot projects and follow-up technical assistance to MMD and PAGASA on the adaption of HKO's SWIRLS will be provided.
- 3.10 AOP10 – South China Sea typhoon forecast
- The Meeting was informed that the TRAMS were put into trial operation from early this year. Due to the shortcomings existed in the former version of TRAMS, the physics processes, including the momentum exchange between the sea and land under conditions of varying wind speeds, cumulus parameterization scheme and related technical schemes, were upgraded in an attempt to improve the quality of model forecast.
  - More products were added on website from early this year, including: 1) a product of model simulated TBB imagery, which is generated using the RTTOV fast radiative transfer model; 2) the comparison diagram between typhoon forecast track and the real one during 2012.
  - Further improvement of the TRAMS model will be carried out in 2013.
- 3.11 AOP11 – Development of web-based typhoon seasonal prediction system
- The Meeting noted that the construction of web-based portal system to aid typhoon seasonal prediction information is underway. This system will be linked to National Typhoon Center of KMA homepage (<http://typ.kma.go.kr/eng>).
  - The portal pages are consisted of prediction products and the model information, including 3 types of typhoon seasonal prediction models – NTC\_KNU (multiple linear regression), NTC\_SNU (hybrid of statistical-dynamical), NTC\_COAPS (global spectral model) prediction results for summer (JJA) and fall (ASO) season are provided.
  - Each models prediction procedure and output interpretation help is also provided. The reference board will be used for exchanging member country's seasonal prediction results for comparison.
  - The Meeting was informed that KMA will further develop the techniques of typhoon seasonal

forecast prediction as well as to establish the semi-operational web-based portal to provide the products of typhoon seasonal prediction for Members.

- 3.12 AOP12 – Improvement of severe weather forecasting and interaction with user communities
- In order to develop collaborative relationship with WMO severe weather forecast demonstration project, NHMS of Vietnam had developed a portal website for Severe Weather Forecasting Demonstrative Project (SWFDP) for South-East Asia. This is a key function of Regional Forecasting Support Centre (RFSC) in the SWFDP-SeA that is located at NaHMS of Vietnam (<http://www.swfdp-sea.com.vn:8080/index>), the username is swfdp-sea, and the password is RA2.
  - At present, the webpage can routinely provide products as: 1) deterministic products from global models such as GME (DWD), GFS (NCEP), NOGAPS (US Navy), GEM (CMC) and GSM (JMA); 2) probabilistic products from global EPS such as NAEFS (NCEP), SREPS (NHMS of Vietnam: run 4 regional models including HRM, BoLAM, WRFARW, WRFNMM with initial and time-dependent conditions from 5 global models is above mentioned); 3) MTSAT's satellite image, satellite-based rainfall (GSMaP) and storm track (based on MTSAT data).
  - The Meeting was informed that more products in real time will be provided through the portal webpage and coordination real time 24/7 communications among the participating centers in the region of this project will be implemented.

4. The Meeting reviewed the report submitted by the leader of the Taskforce on TC Intensity Analysis for Upgrading TD. In response to the recommendations of the 44<sup>th</sup> Session, the Taskforce led by Hong Kong, China was established in April 2012 with the Taskforce members from China, Japan, Philippines, Republic of Korea and Viet Nam. The objective of the taskforce is to eliminate or reduce the discrepancies in the timing of upgrading of TD to TS by various warning centers through a scientific and objective approach. The Meeting noted the progress of the taskforce activities carried out in 2012. The Meeting expressed its gratitude to the Taskforce members for their contribution. The Meeting concurred to establish a preliminary project (PP) on Harmonization of Timing of Upgrade of TD to TS which refers to the work of the Taskforce to be carried out in 2013.

5. The Meeting noted that, WGM has been working closely with WGH and WGDRR during year 2012, namely participating on the drafting of the UFRM guidelines and cooperated in the activities on QPE/QPF training as well as participating the expert mission organized by WGDRR to the Philippines for the disaster assessment caused by TS Washi.

6. During the Meeting, the participants had the opportunities to discuss the AOP for 2013 and the potential projects that can involve and enhance the cooperation of three WGs.

- The Meeting concurred with the proposal of the Chair of WGM to restructure the table of the AOPs, namely the inclusion of 2 additional tables, which are the Perennial Operating Projects (POPs) and the Preliminary Projects (PPs). POPs are now 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
- As the results of the discussion and based on the comment expressed by the participants, the Meeting concurred that the 2012 AOP items (2, 3, 4, 6, 7, 9, 10, 11 and 12) will be continued in 2013, while AOP items (5 and 8) will be moved to the POPs with the addition of a new POP item of Improvement of QPE/QPF and storm surge techniques for Members.
- In response to the request to support the SSOP, the Meeting concurred to establish a new AOP on this issue. Based on the follow up discussion after the meeting, it was concurred to establish the new AOP of "Contribution to SSOP" with the aim to support the implementation SSOP project.
- Due to the restructuring of the AOPs, the 2013 AOP item number will not be in correspondence with the 2012 AOP item numbers.
- The summary of the proposed AOPs is shown in following tables while the complete WGM AOPs including the actions and the success indicators are listed in annex II. The Meeting recommended that the proposed WGM AOPs (including the POPs and PPs) to be endorsed at the 45<sup>th</sup> Session.

**Working Group on Meteorology (WGM) – Annual operating projects (AOPs) 2013**

Objective Number	Objective	Action	Funding Required
1	Contribution to SSOP	(a) To collect current status of Members' SOP for MEW for coastal region (b) To convey the above outcomes to SSOP project for the implementation of SSOP	TBD
2	Enhanced use of ensemble forecast	(a) To get feedback from Members for improvement of the TCEFP through WMO's questionnaire and SWFDP in Southeast Asia (b) To investigate tropical cyclogenesis prediction in the western North Pacific on medium-range timescales using the TIGGE data and on intraseasonal timescales using the JMA 1-month EPS conjunction with WMO-TCEFP	/
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 forecast conjunction with WMO-TLFD (to be included in the TC Fellowship Scheme) (c) To offer fellowship for training on (b)	US\$5,000
4	Improvement of South China Sea typhoon forecast	(a) Further improvement of TRAMS model (b) Provide more products relate to typhoon assess through website	/
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	/
6	Improvement of severe weather forecasting and interaction with user communities	(a) Semi-operation of SWFDP-SeA portal webpage (b) Provide more products in real time such as Daily Severe Weather Forecasting Guidance, thunderstorm index forecasting map, AMV, ASCAT, tropical cyclone track and intensity forecast, nowcasting for rainfall and storm, and Medium Weather Guidance (c) Investigate interpretation of EPS products as well as its NWP guidance (d) Coordinate real-time 24/7 communications among the participating centres in the region of the project (to maintain a list of 24/7 contact information; telephone, fax, e-mail)	/
7	Development of regional radar network	(a) Development of source codes for conversion from UF format to GRIB2 format, as well as ones for production of EILS with the technical support from JMA (b) Specialized attachment training for TMD radar staff or an expert mission to TMD to complete the action (a) on receipt of the progress report by TMD. (c) To make the preparation studies on developing the composite map for the coverage Thailand as well as utilizing QPE techniques by TMD.	US\$5000
8	QPE/QPF for UFRM	(a) To collaborate with TC Fellowship scheme to provide QPE/QPF training to TC Members participating in the UFRM pilot projects upon a request (b) To provide follow-on technical assistance to MMD and PAGASA on the adaptation of HKO's SWIRLS (c) Upon availability of budget, QPE/QPF workshop to be hosted by MMD	US\$5,000
9	Storm surge watch scheme	(a) To develop the storm surge model for expansion of the region (b) To provide storm surge time series charts at more than one point if so requested by Members	/
10	Transfer of the Technology of the Typhoon Analysis and Prediction System (TAPS)	(a) To construct data server for operating the TAPS (b) To upgrade the user-compatible version of the TAPS (c) To train the typhoon forecasters on the use of the TAPS upon Member's request	US\$3,000

### Perennial Operating Projects (POPs)

Objective Number	Objective	Action	Funding Required
1	Improvement of QPE/QPF and storm surge techniques for TC Members	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.	/
2	Web-based typhoon forum	(a) To run routinely (b) Opening for scientists and operational forecasters upon Member's request (nominated by Members)	/
3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2013 (b) Improvement of the editorial procedure (includes inviting the visiting editor) (c) Application of online ISSN	US\$3,000

### Preliminary Projects (PPs)

Objective Number	Objective	Action	Funding Required
1	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) To carry out the preliminary studies, on the impact of climate change on tropical cyclone, especially on the unusual behavior of tropical cyclone in the TC region (b) To prepare the AOP for drafting the 3rd assessment report upon the results of the preliminary studies (it'll be issued before IPCC AR6 in 2016)	/
2	Harmonization of Tropical cyclone intensity analysis	Based on the recommendation of the best track consolidation meeting, continue to study the methodology to compare the best track datasets with the consideration on the progress of digitization of CI numbers in hard copy	/
3	Harmonization of timing of upgrade of TD to TS by various warning centers	To continue with the work of the Taskforce on TC Intensity Analysis for Upgrading TD	/

#### 6. Conclusions of the Meeting

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

- Members made important progress in the implementation of the TC Strategic Plan during the year 2012.
- Members made significant progress during 2012 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.
- Successful completion of the WGM AOPs in 2012.
- Based on the outcome preliminary studies on the published papers on climate change, WGM will initiate third assessment report on the impact of climate change on tropical cyclone in TC region.
- Improvement of storm watch scheme will further contribute to the early warning of storm surge in TC region.
- There are needs from Members to continue the transfer of technology and knowledge of the Typhoon Information System among Members.
- The role of ensemble prediction products in tropical cyclone forecasts for effective warning is increasing through effective tools provided in the WMO NWP-TCEFP Web page.
- Based on the outcome of a survey carried out by WMO Typhoon Landfall Forecast Demonstration Project (WMO-TLFDP), more attention should be paid to the verification of probabilistic forecasts, and precipitation and high wind forecasts related to tropical cyclone.
- The web-based typhoon forum is helpful in terms of providing a communication platform for both forecasters and researchers.
- With the assistances provided by JMA, TMD starts to carry out the roadmap of the development of regional radar network.

- 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 latest progress in tropical cyclone research, forecasting technique and warning system as well as to enhance the visibility of Typhoon Community.
  - The in-depth QPE/QPF training organized with the Typhoon Committee Research Fellowship Scheme was much appreciated by the participants from the UFRM pilot cities. Follow-on technical assistance to participating Members on the adaptation of the QPE/QPF technique is necessary.
  - Significant progress has been made on the construction of web-based portal system to aid typhoon seasonal prediction information.
  - 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 portal web page hosted by National Hydro-Meteorological Service of Viet Nam.
  - Reconnaissance flights undertaken in the vicinity of Hong Kong to gather meteorological observations around tropical cyclones for operational reference and research studies provided useful information on tropical cyclone location and the wind distribution in the vicinity of tropical cyclone, for monitoring their development and assessment of impact of associated weather system.
7. Recommendations
- To recommend the submission of the WGM AOP 2012 implementation status (as shown in annex I) to the 45<sup>th</sup> Session for review.
  - To recommended the submission of the proposed WGM AOP 2013 (as shown in annex II) to the 45<sup>th</sup> Session for endorsement.

**Annex I - Working Group on Meteorology (WGM) – AOP 2012 Implementation Status**

SP's KRA and SG	Objective Number	Objective	Action	Other WG's	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator	Completed – Yes or No
KRA 1 KRA 2 KRA 4	1	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) Publish the "2 <sup>nd</sup> assessment report on the impact of climate change on tropical cyclone track and impact area in TC region" (b) Follow-up of the recommendation of the best-track consolidation meeting	WGDRR	(a) 3 <sup>rd</sup> (b) 4 <sup>th</sup>	HKO/China, CMA, USA, JMA, KMA, Macao/China (coordinator) and Members	(a) Publish the 2 <sup>nd</sup> report in 45 <sup>th</sup> Session; (b) Consolidate the operational procedures of tropical cyclone analysis for inclusion in the TOM, exchange and compare the historical best-track datasets, including CI numbers if available, among the centers	US \$2,500 (for publication of the 2 <sup>nd</sup> report)	TCTF	(a) Tam Iu Man/Leong Weng Kun (Macau, China) (b) Masashi Kunitsugu (JMA)	(a) Yes (b) Yes
KRA 1 KRA 2 KRA 4 /SG4(a)	2	Storm surge watch scheme for UFRM	(a) To conduct training of storm surge model for UFRM during the annual TC attachment training by RSMC Tokyo (b) To provide storm surge time series charts at one point upon TC Member's request (c) To develop storm surge time series charts at more than one point if so requested by Members	WGH WGDRR TRCG	(a) 3 <sup>rd</sup> (b-c) 4 <sup>th</sup>	JMA	(a) Conduct of training and subsequent evaluation (b) Provide storm surge time series charts at one point upon TC Member's request (c) Develop storm surge time series charts at more than one point if so requested by Members	/	/	Masashi Kunitsugu (JMA)	(a) Yes (b) Yes (c) Yes
KRA 1 KRA 2 KRA 6 / SG 6b and 6c	3	Transfer of the Typhoon Information Processing System technology	(a) To improve the English version of KMA's typhoon information processing system (TAPS) (b) To train the meteorologists and forecasters of TC Members on TAPS from May with the duration of 2 months	TRCG	2 <sup>nd</sup> - 4 <sup>th</sup>	KMA, Viet Nam, Members	Submission of report on the technique and training of TAPS	US \$2000	TCTF	Mr. Ki-Ho Chang (KMA)	(a) Yes (b) Yes
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	4	Enhanced use of ensemble forecast	(a) To get feedback from Members for improvement of the TCEFP website through WMO's questionnaire (b) To promote Members' understanding of EPS through SWFDP and its training workshop	WGDRR TRCG	2 <sup>nd</sup> - 4 <sup>th</sup>	JMA, CMA, HKO/China, Viet Nam, KMA and WMO	Improvement of the web site will be implemented and will be reported in the Progress report	/	/	Masashi Kunitsugu (JMA)	(a) Yes (b) No (postponed)



KRA 6 / SG 6b and SG 6c	5	Web-based typhoon forum	(a) Expand the number of registered users and the team of moderators on related topics (b) To upgrade the on-line forum by sharing more real-time observation, forecast and warning information by Members	AWG, WGH WGDRR	1 <sup>st</sup> - 4 <sup>th</sup>	CMA RSMC Tokyo, JTWC, Members	Effective use of web-based typhoon forum as shown by website access statistics	/	/	Li qingqing (CMA)	(a) Yes (b) Yes
KRA1 KRA2 KRA6 /SG6b and 6c	6	Development of regional radar network	(a) Specialized attachment training for TMD radar staff upon submission of the progress report of the operating status of the TMD radar system by TMD (b) To follow-up the recommendations and the suggested roadmap of the expert team and to develop the radar composite map which covers the area of the UFRM pilot city in Thailand as the first step	TRCG	4 <sup>th</sup>	TMD, JMA	Submission of the progress report, including a detailed schedule for the establishment of the radar composite map	US \$3000	TCTF	Masashi Kunitsugu (JMA) Derek Leong (TCS) PatcharaPetvir ojchai (TMD)	(a) Yes (b) Yes
KRA1 KRA2 KRA6 / SG 6b and 6c	7	Verification of tropical cyclone operational forecast	(a) Organize a training workshop on typhoon landfall forecast demonstration project (b) Modify the methods to verify the generation, track and intensity forecast accuracy of tropical cyclones in the Asian-Pacific Region (c) Assess the performance of objective model prediction and the official forecast of Members.	TRCG	(a-b) 2 <sup>nd</sup> (c) 4 <sup>th</sup>	CMA, RSMC Tokyo, JTWC, Members, WMO	(a) Hold a training workshop and subsequent evaluation of the training  (b) Submit report of the assessment of the performance of objective model prediction and the official forecast of Members in 45 <sup>th</sup> Session	US\$3,000	TCTF	Yu Hui (CMA)	(a) Yes (b) Yes
	8	Publication of <b>Tropical Cyclone Research and Review</b>	(a) Improvement of the editorial procedure (include visit the visiting editor) (b) Publish the journal quarterly	AWG, WGH, WGDRR, TRCG	1 <sup>st</sup> - 4 <sup>th</sup>	CMA, TCS Members	Progress report	US\$3,000	TCTF	Zhou Xiao (CMA)	(a) Yes (b) Yes

KRA1 KRA2 KRA4 / SG4a	9	QPE/QPF for UFRM	(a) To conduct a forum and training for UFRM pilot cities (b) To provide QPE/QPF training to TC Members participating in the UFRM pilot projects upon a request (c) To conduct training on QPE/QPF during the annual TC attachment training at RSMC Tokyo (d) Upon availability of budget, QPE/QPF Workshop to be held by MMD	WGH WGDRR TRCG	(a) 4 <sup>th</sup> (b) 1 <sup>st</sup> - 4 <sup>th</sup> (c) 3 <sup>rd</sup>	RSMC Tokyo HKO, CMA	Conduct of training and subsequent evaluation of the training	US\$5,000	TCTF	Masashi Kunitsugu (JMA)	(a) No (b) Yes (c) Yes (d) No (due to budget constraint)
KRA1 KRA2 KRA6	10	South China Sea typhoon forecast	(a) Further improvement of TRAMS model (b) Provide more products relate to typhoon assess through website (c) Establish the feedback column for all Members			CMA, Viet Nam, PAGASA, MMD	Submission of the report on the assessment of model and website	/	/	Zhang Zhongcheng (CMA)	(a) Yes (b) Yes (c) Yes
KRA1 KRA2 KRA6	11	Development of web-based typhoon seasonal prediction system	(a) Development of web portal for typhoon seasonal prediction (b) Providing typhoon seasonal prediction results to members through web-based portal page together with the participating members' results			KMA, CMA Members	Submission of the report on assessment of seasonal prediction models	/	/	Sangwook Park (KMA)	(a) Yes (b) Yes
KRA1 KRA2 KRA6	12	Improvement of severe weather forecasting and interaction with user communities	Development of collaborative relationship with WMO severe weather forecast demonstration project	WGH, WGDRR, TRCG	2-4	Viet Nam, Cambodia, Lao, Thailand, WMO	Progress report	/	/	NHMS of Viet Nam	Yes

**Annex II - Working Group on Meteorology (WGM) – Annual operating projects (AOPs) 2013**

SP's KRA and SG	Objective Number	Objective	Action	Other WG's	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator
KRA 1 KRA 2 KRA 4	1	Contribution to SSOP	(a) To collect current status of Members' SOP for multi-hazard early warning (MEW) for coastal region (b) To convey the above outcomes to SSOP project for the implementation of SSOP	WGH WGDRR TRCG	1 <sup>st</sup> -4 <sup>th</sup>	TCS, Members, ESCAP WMO PTC ADRC	(a) Report of the collection of current status of Members' SOP for MEW for coastal region	TBD	SSOP Budget	Renito Paciente (PAGASA)
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	2	Enhanced use of ensemble forecast	(a) To get feedback from Members for improvement of the TCEFP through WMO's questionnaire and SWFDP in Southeast Asia (b) To investigate tropical cyclogenesis prediction in the western North Pacific on medium-range timescales using the TIGGE data and on intraseasonal timescales using the JMA 1-month EPS conjunction with WMO-TCEFP	/	1 <sup>st</sup> -4 <sup>th</sup>	JMA	(a) Improvement of the web site responding to the feedback considering the provided data and feedback from SWFDP, if available (b) Investigate the TC genesis prediction over the western North Pacific during the 2009 and 2010 seasons using the TIGGE and JMA EPS data, and report the results	/	/	Masashi Kunitsugu (JMA)
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 forecast conjunction with WMO-TLFDPP (to be included in the TC Fellowship Scheme) (c) To offer fellowship for training on (b)	AWG, TRCG	1 <sup>st</sup> -4 <sup>th</sup>	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\$5,000	TCTF	Ms. Yu Hui (STI/CMA)

KRA1 KRA2 KRA6	4	Improvement of South China Sea typhoon forecast	(a) Further improvement of TRAMS model (b) Provide more products relate to typhoon assess through website	/	1 <sup>st</sup> -4 <sup>th</sup>	CMA, Viet Nam, PAGASA, MMD	Submission of the report on the assessment of model and website	/	/	Chen Zitong (CMA)
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	/	1 <sup>st</sup> -4 <sup>th</sup>	KMA Members	Submission of the report on assessment of seasonal prediction models	/	/	Sangwook Park (KMA)
KRA1 KRA2 KRA6	6	Improvement of severe weather forecasting and interaction with user communities	(a) Semi-operation of SWFDP-Sea portal webpage (b) Provide more products in real time such as Daily Severe Weather Forecasting Guidance, thunderstorm index forecasting map, AMV, ASCAT, tropical cyclone track and intensity forecast, nowcasting for rainfall and storm, and Medium Weather Guidance (c) Investigate interpretation of EPS products as well as its NWP guidance (d) coordinate real-time 24/7 communications among the participating centres in the region of the project (to maintain a list of 24/7 contact information; telephone, fax, e-mail)	WGH, WGDRR, TRCG	2 <sup>nd</sup> -4 <sup>th</sup>	Viet Nam, Cambodia, Lao, Thailand, WMO	Progress report	/	/	Vo Van HOA NHMS of Viet Nam
KRA1 KRA2 KRA6 /SG6b and 6c	7	Development of regional radar network	(a) Development of source codes for conversion from UF format to GRIB2 format, as well as ones for production of EILS with the technical support from JMA (b) Specialized attachment training for TMD radar staff or an expert mission to TMD to complete the action (a) upon	TRCG	(a) 4 <sup>th</sup> (b) 4 <sup>th</sup> (c) 4 <sup>th</sup>	TMD, JMA	Submission of the progress report, including a detailed schedule for the establishment of the radar composite map	US \$5000	TCTF	PatcharaPetvir ojchai (TMD) Masashi Kunitsugu (JMA) Derek Leong (TCS)

			<p>receipt of the progress report from TMD</p> <p>(c) To make the preparation studies on developing the composite map for the coverage of Thailand as well as utilizing QPE techniques by TMD</p>							
KRA1 KRA2 KRA4 / SG4a	8	QPE/QPF for UFRM	<p>(a) To collaborate with TC Fellowship scheme to provide QPE/QPF training to TC Members participating in the UFRM pilot projects upon a request</p> <p>(b) To provide follow-on technical assistance to MMD and PAGASA on the adaptation of HKO's SWIRLS</p> <p>(c) Upon availability of budget, QPE/QPF workshop to be hosted by MMD</p>	WGH WGDRR TRCG	(a) 2 <sup>nd</sup> -4 <sup>th</sup> (b) 1 <sup>st</sup> -2 <sup>nd</sup>	RSMC Tokyo HKO, CMA	(a) & (b) Conduct of training and subsequent evaluation of the training	US\$5,000	TCTF	Masashi Kunitsugu (JMA) ST Chan (HKO)
KRA 1 KRA 2 KRA 4 /SG4(a )	9	Storm surge watch scheme	<p>(a) To develop the storm surge model for expansion of the region</p> <p>(b) To provide storm surge time series charts at more than one point if so requested by Members</p>	WGH TRCG	1 <sup>st</sup> -4 <sup>th</sup>	JMA	Submission of the progress report	/	/	Masashi Kunitsugu (JMA)
KRA 1 KRA 2 KRA 6 /SG 6b and 6c	10	Transfer of the Technology of the Typhoon Analysis and Prediction System (TAPS)	<p>(a) To construct data server for operating the TAPS</p> <p>(b) To upgrade the user-compatible version of the TAPS</p> <p>(c) To train the typhoon forecasters on the use of the TAPS upon Member's request</p>	TRCG	(a) 2 <sup>nd</sup> -3 <sup>rd</sup> (b) 2 <sup>nd</sup> -4 <sup>th</sup> (c) 2 <sup>nd</sup> -4 <sup>th</sup>	KMA Members	Submission of the progress report	US \$3,000	TCTF	Jiyoung Kim (KMA)

**Working Group on Meteorology (WGM) – Perennial Operating Projects (POPs)**

SP's KRA and SG	Objective Number	Objective	Action	Other WG's	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator
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	1 <sup>st</sup> -4 <sup>th</sup>	JMA, WMO	Submission of the evaluation report	/	/	Masashi Kunitsugu (JMA)
KRA 6 / SG 6b and SG 6c	2	Web-based typhoon forum	(a) To run routinely (b) Opening for scientists and operational forecasters upon Member's request (nominated by Members)	WGs	1 <sup>st</sup> -4 <sup>th</sup>	CMA Members	Submission of the progress report	/	/	Li qingqing (CMA)
KRA 1 - 6	3	Tropical Cyclone Research and Review	(a) To publish the journal quarterly in 2013 (b) Improvement of the editorial procedure (includes inviting the visiting editor) (c) Application of online ISSN	AWG, WGs	1 <sup>st</sup> -4 <sup>th</sup>	CMA, TCS Members	Progress report	US\$3,000	TCTF	Ms. Wang Dongliang & Zhou Xiao (CMA)

**Working Group on Meteorology (WGM) –Preliminary Projects (PPs)**

SP's KRA and SG	Objective Number	Objective	Action	Other WG's	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Coordinator
KRA 1 KRA 2 KRA 4	1	Assessment report on the impact of climate change on tropical cyclone in TC region	(a) To carry out the preliminary studies, on the impact of climate change on tropical cyclone, especially on the unusual behavior of tropical cyclone in the TC region (b) To prepare the AOP for drafting the 3rd assessment report upon the results of the preliminary studies (it'll be issued before IPCC AR6 in 2016)	WGH WGDRR TRCG	1 <sup>st</sup> – 4 <sup>th</sup>	HKO/China, CMA, USA, JMA, KMA, Macao/China (coordinator) Members	Submission of the progress report	/	/	Tam Lu Man (Macao/China)
KRA 1 KRA 2 KRA 4 /SG4(a)	2	Harmonization of Tropical cyclone intensity analysis	Based on the recommendation of the best track consolidation meeting, continue to study the methodology to compare the best track datasets with the consideration on the progress of digitization of CI numbers in hard copy	/	1 <sup>st</sup> – 4 <sup>th</sup>	JMA, CMA, HKO	Submission of the progress report	/	/	Masashi Kunitsugu (JMA)
KRA 1 KRA 2 KRA 4 /SG4(a)	3	Harmonization of timing of upgrade of TD to TS by various warning centers	To continue with the work of the Taskforce on TC Intensity Analysis for Upgrading TD	/	1 <sup>st</sup> – 4 <sup>th</sup>	Taskforce on TC Intensity Analysis for Upgrading TD	Submission of the progress report	/	/	ST Chan (HKO)