



Joint Session of Panel on Tropical Cyclones & Typhoon Committee

UNCC, Bangkok • Thailand
09-11 February 2015

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**REPORT OF THE 3rd Joint Session of Panel on Tropical Cyclone | Typhoon Committee
(42nd Session of PTC and 47th Session of TC)
Bangkok, Thailand
09 – 13 February 2015**

PROCEEDINGS OF THE 3rd Joint Session of TC and PTC

I. ORGANIZATION OF THE JOINT SESSION (agenda item 1)

1. The Third Joint Session of the ESCAP/WMO Typhoon Committee (TC) and Panel on Tropical Cyclone (PTC) was held at the United Nations (UN) Building, Bangkok, Thailand, from 09 to 13 February 2015.
2. The Session was attended by 107 participants. They were represented from 12 of 14 Members of the Typhoon Committee, namely: Cambodia; China; Hong Kong, China; Japan; Lao PDR; Macao, China; Malaysia; Philippines; Republic of Korea; Thailand; the United States of America (USA); and the Socialist Republic of Viet Nam; and 5 of 8 Members of Panel on Tropical Cyclone, namely: Maldives, Oman, Pakistan, Sri Lanka, Thailand
3. The Session was attended by **04** observers from International Civil Aviation Organization (ICAO), Tohoku University, International Federation of Red Cross and Red Crescent Societies (IFRC) and Intergovernmental Oceanographic Commission (IOC)/UNESCO.
4. The Representatives of the Economic and Social Commission for Asia and the Pacific (ESCAP), World Meteorological Organization (WMO), the Secretariat of CS and PTC also attended the Session. The list of participants is given in **Appendix I**.
5. Also participating in a Video Conference were the head of RSMC New Delhi, Dr. M. Mohapatra and SSOP Project Manager, Mr. James Weyman.

1.1. Opening of the Session

6. The Session was declared open at 09:30 am on Monday, 09 February, 2015 in Bangkok, Thailand in the presence of the Members' representatives.
7. The Opening Ceremony included welcoming addresses from the following:
 - a. Mr. SHUN-ichi Murata, Deputy Executive Secretary of ESCAP.
 - b. Mr. Ali SHAREEF, Vice- Chair of the WMO/ESCAP Panel on Tropical Cyclones.
 - c. Mr. WANCHAI Sakudomchai, Chair of the ESCAP/WMO Typhoon Committee.
 - d. Dr. Taoyong PENG, Representative of World Meteorological Organization (WMO)
8. The above-mentioned statements are provided in **Appendices II.a, II.b, II.c, and II.d**, respectively.

1.2. Appointment of Co-Chairs of Drafting Committee

9. Mr. Don Joseph Ajith WEERAWARDENA, Director of Department of Meteorology of Sri Lanka was elected Co-Chair of the Drafting Committee of PTC and Mrs. Genevieve MILLER, Meteorologist-in-Charge from NOAA National Weather Service was elected the Co-Chair of Drafting Committee of TC.

1.3. Adoption of the Agenda

10. The Joint Session adopted the agenda as shown in **Appendix III.**

II. REVIEW OF TROPICAL CYCLONES IN 2014 AND RSMC ACTIVITIES (agenda item 2)

2.1 Summary of typhoon season in TC region

11. The Joint Session took note with appreciation the review of the 2014 typhoon season provided by the RSMC Tokyo as provided in **Appendix IV.**
12. The Joint Session noted that in the western North Pacific, 23 named tropical cyclones (TCs) formed in 2014, which is less than the 30-year average of 25.6 for the period, 1981-2010. 11 reached typhoon (TY) intensity, and six named TCs hit the continent.
13. The mean genesis point of the named TCs in 2014 was 13.0°N and 137.1°E, showing deviation to the southward from the 30-year average (16.2°N and 137.4°E).
14. Three named TCs formed from January to February. Lingling (1401) and Kajiki (1402) formed east of the Philippines in January, and damaged the Philippines.
15. Four named TCs formed from April to June. Hagibis (1407) formed over the South China Sea and damaged China.
16. Five named TCs formed in July. Neoguri (1408) formed west of the Mariana Islands and damaged Japan. Rammasun (1409) formed southwest of the Mariana Islands and caused severe damage to the Philippines and China, which also damaged Viet Nam. Matmo (1410) formed east of the Philippines and damaged China. Halong (1411) formed east of the Mariana Islands and damaged Japan. Nakri (1412) formed east of the Philippines and damaged Japan and the Republic of Korea.
17. One named TC formed in August. Genevieve (1413) entered the western North Pacific with TY intensity on 7 August..
18. Five named TCs formed in September. Kalmaegi (1415) formed east of the Philippines and damaged the Philippines, China and Viet Nam. Fung-wong (1416) formed east of the Philippines and caused damage to the Philippines and China. Phangfone (1418) formed north of the Chuuk Islands and damaged Japan.
19. Five named TCs formed from October to December. Vongfong (1419) formed northwest of Pohnpei Island and damaged Japan. Sinlaku (1421) formed over the South China Sea and damaged the Philippines and Viet Nam. Hagupit (1422) and Jangmi (1423) caused severe damage to the Philippines..

2.2 Summary of tropical cyclone season in PTC region

20. The meeting expressed its appreciation to the RSMC New Delhi while bringing into record the review of the 2014 cyclone season in the PTC region made by RSMC New Delhi as mentioned in **Appendix V – need DOC.**
21. The meeting noted that the North Indian Ocean an adjoining land surface Ocean witnessed the formation of three tropical cyclones during the year 2014 including one over the Bay of Bengal and two over the Arabian Sea against the long period average of 4 in Bay of Bengal and 1 over the Arabian Sea.
22. Cyclone 'Nanauk' formed in the Arabian Sea during June with genesis point (68.5°E – 15.5°N), only one very Severe Cyclone 'Hudhud' in the Bay of Bengal during 2nd week

of October (95.0°E – 11.5°N) while the Very Severe Cyclone 'Nilofar' formed in the Arabian Sea during the last week of October (61.5°E – 12.5°N).

23. Frequency of TCs was below normal against the normal value of 4.7 in the North Indian Ocean, whereas the frequency of very severe cyclonic storms was near normal (02).
24. Only one cyclone named Hudhud crossed the coast and caused damage in the eastern coast of India including city of Visakhapatnam. The other two cyclones dissipated over the Arabian Sea.
25. The tracks of all the storms were recurving in nature. Tropical Cyclone Hudhud recurved northwards after landfall, Nilofar recurved northeastwards after attaining maximum intensity and only the remnant of the Cyclone Nanauk recurved northeastwards.
26. Velocity Flux(knots), accumulated cyclone energy (knots²) and Power Distribution Index (knots³) over north Indian Ocean during 2014 were 2970, 206850 and 16004250 against long period average of 2117, 130867 and 9673246 respectively based on the dataset of 1990-2013.
27. The total duration of cyclonic disturbances during 2014 was 30.4 days against the long period average of 29.4 days base on data of 1990-2013.
28. The Joint Session expressed its gratitude to the RSMC New Delhi for its continued valuable support to the PTC Member countries and hoped that existing cooperation and collaboration between the Members and the RSMC New Delhi will be further strengthened through these activities.

2.3 Summary of activities of RSMC New Delhi

29. The Joint Session was informed about the major activities of RSMC New Delhi during 2014 as per given detail **Appendix VI – need DOC:**

a. Observations:

- INSAT-3D products (enhanced infra red imagery and colour enhanced infra red imagery etc) were fully utilised. These products were made available in a separate web page in the IMD web site as cyclone image
- High Wind Speed Recorders were made operational and continuous recording of wind speed was made available in website.

b. Monitoring and Analysis:

Round the clock watch over the entire North Indian Ocean. In addition to 3-hourly monitoring and analysis hourly monitoring and analysis were carried out on the date of landfall.

c. Prediction technique:

- Running of global and regional numerical models for tropical cyclone track and intensity prediction.
- HWRF products at high resolution (3 km) were utilised in addition to the generally utilised model products.
- Storm surge and coastal inundation modelling efforts by INCOIS and IIT Delhi fully utilised for operational forecasting.

d. Forecasting:

- Issue of Tropical Weather Outlook once daily (at 0600 UTC) and an additional outlook at 1700 UTC in the event of a depression which is likely to intensify into a cyclonic storm. Issue of cyclone advisories to the Panel countries 8 times a day.
- Introduction of Probabilistic Cyclogenesis Forecast upto 3 days commenced from 1 June 2014) and its verification over Bay of Bengal & Arabian Sea separately. The same was included in Tropical Weather Outlook.
- Uncertainty of cyclone track forecast was reduced by 20-30% for 24-120 hr forecasts with effect from HUDHUD due to reduction in error in last five years.
- Introduction of hourly update on day of landfall started in 2014.
- The lead period of forecast was increased to 7 days (two days outlook and five days forecast(text and graphics)).
- The cyclone track forecast accuracy was increased by 7.6 km per year and landfall point forecast accuracy improved by 30 km per year in 24 hr forecast during 2003-14. The cyclone intensity forecast improved by about 20 kmph in past five years. Heavy rainfall and Storm surge warning accuracy and lead period improved substantially since 2009 with 72 hr lead period and coastal inundation forecast commenced in 2013.
- Introduction of experimental seasonal forecast of frequency of Cyclonic Disturbances over the Bay of Bengal during the Post-Monsoon Season of 2014.

e. Warning dissemination

The following modes of communication were utilized for dissemination of cyclone advisory.

- Telephone, Tele-fax
- Mobile Phones (SMS) through IMD severe weather network, Agromet Network of Ministry of Agriculture(Farmers portal, Kisan SMS service), INCOIS network & to registers users(fishermen & farmers along the coast)
- Warning message to the coastal population through Electronic Display Boards (EDB) of INCOIS, Hyderabad
- VHF/HFRT/Police Wireless
- Satellite based cyclone warning dissemination System
- Aeronautical Fixed Terminal Network
- Global telecommunication system (GTS): (International Telecom centres)
- Internet (e-mail) & ftp
- Radio/TV, News Paper network (AM, FM, Community Radio, Private TV)
- A dedicated website(www.rsmcnewdelhi.imd.gov.in for cyclone warning) was launched on 4th April, 2014. The Static page of this website contain mainly cyclone awareness, main publications of RSMC data and tools used for forecasting and archive for general public & scientific community and the dynamic page contain all bulletin, cyclone warning graphics issued & prepared by RSMC New Delhi. Beside bulletins& graphics it also contains NWP guidance and marine forecast/advisories. The internet Lease Line Bandwidth was upgraded from 60mpbs to 100 mpbs during the cyclonic storm 'HUDHUD' for failure free accessibility of IMD website.
- Regular updating of RSMC website with latest bulletins and graphics and made bulletins are disseminated through email also in addition to GTS.

f. Tropical Cyclone Operation Plan

- Implementation of the Regional Cyclone Operational Plan of WMO/ESCAP Panel.
- E-mail IDs and focal point addresses are updated every year before the start of the cyclone season. Telephonic communication is also used as and when required.
- RSMC New Delhi appreciates the cooperation extended by the member countries in this regard.

g. R&D activities

Following are the R & D activities of RSMC New Delhi

- Workshops and training programmes were conducted successfully with participation from member countries.
- Improved modelling efforts with HWRP and EPS based forecast products
- FDP on landfalling cyclones
- A project “TCWIND” on generation of wind profiles for TCs of NIO is in progress and would be executed during 2015-16.
- CWRC, Chennai would be upgraded to National Tropical Cyclone Research Centre in the near future.
- Preparation of comprehensive reports on each cyclonic storm.
- Continued research on storm surge, track and intensity prediction techniques.
- Development of daily genesis climatology based on data of 1891-2013 for calculation of genesis forecast skill score.
- Verification of forecast

h. Workshops and Conference

- National workshop on unique and enhanced cyclonic activities during 2013 (24-25 July 2014)
- Interactive Workshop in INCOIS to finalise SOP
- User Workshops
- Input on characteristics of cyclonic activity over north Indian Ocean was provided to organisers of IWTC-VIII and IWTCLP-III

i. Training on Tropical Cyclones by RSMC, New Delhi

- WMO Cyclone forecasters training was conducted for the forecasters from WMO/ESCAP Panel countries and ACWCs and CWCs (Feb, 2014)
- Precyclone lecture series was also conducted in April and September.
- Training workshop at Muscat, Oman (28 Sep-02 Oct 2014) was organised
- The refresher courses on Tropical Cyclone will be conducted for PTC member countries in April, 2015
- SWFDP-Bay of Bengal will be taken up by RSMC, New Delhi

2.4 Summary of activities of RSMC Tokyo Typhoon Center (Appendix VII)

30. The Joint Session was informed that RSMC Tokyo developed objective tropical cyclone satellite analysis using MTSAT called “Cloud grid information objective Dvorak analysis (CLOUD)” and introduced it into operation on 21 January 2014. Details on the methods and systems, including verification results, are found in the Technical Review in 2013 (<http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-public/techrev.htm>). The Joint Session was also informed that RSMC Tokyo developed two

methods for TC intensity estimation using microwave satellites for its operation: one is a method which estimates TC central pressure by using a regression equation which relates the maximum brightness temperature (TB) anomaly value from observations of Advanced Microwave Sounding Unit-A (AMSU-A) channel 6, 7 and 8 near TC center (within a radius of 200 km from the TC center) to TC central pressure. The other is an estimation method of maximum TC wind speeds with TC cluster analysis of parameterized Tropical Rainfall Measurement Mission (TRMM) Microwave Imager (TMI) brightness temperature distribution. The Joint Session was pleased to note that the TC intensity estimates with these methods are planned to be available through the Numerical Typhoon Prediction website (<https://tywnp-web.kishou.go.jp>).

31. The Joint Session was pleased that RSMC Tokyo has started to provide time-series charts of storm surge for additional 41 stations; USA(1), The Philippines (10) in June and October, Viet Nam (20), Hong Kong China (5), Republic of Korea (5) in September. It commenced the improved graphical representation to make the products more user friendly. The Joint Session expressed its gratitude to RSMC Tokyo for provision of storm surge forecasts to the TC Members, sharing information on storm surges through the annual TC attachment training, and assisting in PAGASA's storm surge forecasts during the event of Hagupit. It also noted with appreciation that RSMC Tokyo is preparing for the provision of multiple scenarios of storm surge forecasts to the Members in the near future.
32. The Joint Session was informed that, to explore ways to provide ensemble TC products in a more real-time basis responding to identified needs through the questionnaires in 2011 and 2012, RSMC Tokyo consulted with ECMWF, UKMO, and NWS about the possibility of their provision of ensemble NWP data on a real-time basis. RSMC Tokyo has found it difficult in short term to obtain the permission of ECMWF to provide their ensemble NWP data on a real-time basis for this purpose, and instead may use ECMWF ensemble track guidance available via GTS under the condition of use of the Numerical Typhoon Prediction website. It was also noted that RSMC Tokyo is being under negotiation with UKMO and NWS. The Joint Session also noted with appreciation the findings that operational global medium-range ensembles have been found capable of providing guidance on TC activity forecasts extending into the second week. The Brier Skill Score (BSSs) 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. The Joint Session was informed that RSMC Tokyo plans to examine a multi-center grand ensemble (MCGE) for TC generation prediction in 2015 and report outcomes to the 48th TC session.
33. The Joint Session reaffirmed that the RSMC Tokyo participates in a sub-regional project in Southeast Asia (SWFDP-Sea) as the Regional Center for Tropical Cyclone / Typhoon Forecasting Support to provide typhoon related products, including NWP-TCEFP products at the NWP-TCEFP Home page. It noted that RSMC Tokyo dispatched two experts as lecturers to Regional Training Workshop on Severe Weather Forecasting (GDPFS) and Warning Services (PWS) held in Metro Manila, Philippines from 2 to 7 in 2014. In addition, one storm surge expert of the Center gave a webinar (a lecture using a tele-communication tool) to the said workshop.
34. The Joint Session was informed that RSMC Tokyo started tropical cyclone satellite re-analysis in 2012 for the period from 1981 to confirm and improve the quality of the Current Intensity (CI) number in the satellite TC analysis. Re-analysis over the period from 1987 to 1999 is being implemented to be completed by the end of 2015.
35. The Joint Session was informed that the next-generation geostationary meteorological satellite of JMA, Himawari-8 was successfully launched on 7 October 2014 and will be operational in mid-2015. Himawari-8, with 16 bands, will obtain full-disk imageries every 10 minutes and rapid scanning at 2.5 minute intervals over several regions, one

of which will be targeted observation of tropical cyclones. The Joint Session noted with appreciation that Himawari-8 imagery will be distributed through a variety of methods, including HimawariCast Service for Members with limited Internet access.

36. The Joint Session noted with appreciation the extra supports provided by RSMC Tokyo, when Hagupit was approaching the Philippines, to PAGASA through the provision of technical assistance in storm surge forecasts, implementation of 10-minute rapid scan observations, and designation of a focal point (24 hours accessible from PAGASA both email and cell phone).
37. The Joint Session was informed that RSMC Tokyo dispatched five experts to the Post-Typhoon Haiyan expert mission to the Philippines which was carried out by WMO, UN ESCAP, and the Typhoon Committee from 7 to 12 April 2014. The mission reviewed the response of PAGASA to Haiyan, identified gaps and challenges, in particular, in TC analysis/forecasts and storm surge forecasts, and proposed follow-up actions/projects. The Joint Session also noted that WMO subsequently organized the expert mission to Viet Nam, from 14 to 16 April 2014, in which four experts of the Centre participated. It was informed that the mission team fully analyzed the national and international emergency response to Haiyan in Viet Nam. It agreed that the recommended activities, particularly on the international response, proposed by the mission team should be followed up to further enhance the regional cooperation, in an appropriate manner, for increase in tropical cyclone disaster resilience.
38. The Joint Session was informed that RSMC Tokyo is continuing experimental provision of TC advisory in CAP format at the JMA website (http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm) since 12 November 2012. The experimental CAP messages are served in an Atom feed (sometimes called as RSS), enabling recipient centers to retrieve updates by polling (periodically accessing) the feed at <http://www.data.jma.go.jp/fcd/yoho/cap-rsmctk/atom.xml>.
39. The Joint Session was pleased that in accordance with TMD's progress in the application of the JMA's radar composite techniques to its nationwide radar network, as well as preliminary study on QPE technique of its own, RSMC Tokyo organized a technical meeting from 25 to 28 November 2014 with particular focus on provision of training on JMA's quality control techniques of radar data and essential techniques for QPE which can be applicable to TMD. It noted with appreciation that application of the JMA's quality control radar techniques and QPE source codes provided by JMA to the Thailand radar network, and a follow-up technical meeting is also to be conducted with technical assistance of RSMC Tokyo.
40. The Joint Session was informed that based on the techniques utilizing the cloud grid information for the analysis of existing CB areas, RSMC Tokyo, as ICAO Tropical Cyclone Advisory Center (TCAC) Tokyo, plans to provide graphical tropical cyclone advisories (TCAs) according to MODEL TCG in the Appendix 1 of ICAO Annex 3 in 2015.
41. The Joint Session was pleased that RSMC Tokyo conducted the 14th Typhoon Committee Attachment Training at RSMC Tokyo from 23 July to 1 August 2014 inviting three forecasters from Lao PDR, Malaysia, and the Philippines.

III. REVIEW OF 2014 ACTIVITIES AND MEMBER'S REPORTS (agenda item 3)

3.1 Summary of TC Member reports

42. The Joint Session took note of the major progress and issues in meteorology, hydrology and DRR aspects under the Key Result Areas (KRAs) of TC in 2014 as reported by Members and summarized by AWG Chair, and endorsed the Executive Summary in **APPENDIX VIII** as the basis for a message to be sent by TCS to Members'

governments and other collaborating or potential sponsoring agencies for reference and future planning.

3.2 Summary of PTC Member reports Appendix IX – need DOC

43. There were three cyclonic storms in the north Indian Ocean during 2014, a very severe cyclonic storm “HUDHUD” formed in the Bay of Bengal and two cyclonic storms ‘NANAUK’ and ‘NILOFAR’ in the Arabian Sea. Among the three cyclones, only cyclone ‘Hudhud’ made landfall and caused damage in eastern coastal areas of India. While the other Panel countries were not directly affected by these cyclones.
44. The NMHSs of PTC Member Countries as well as their respective DMO’s took number of initiatives having considering them as their national responsibilities to provide services in the fields of meteorology, hydrology, Strengthening of Early Warning Systems & promotion of DRR activities during the inter-sessional period.
45. Following improvements, upgrades and capacity building activities were undertaken in Panel Member countries in the fields of Meteorology, Hydrology and DRR etc:
 - a. Strengthening of Early Warning System through up-grading and installing new equipment like Radar, AWS, satellite image receiving stations, NWP, data communication systems and forecasters work stations.
 - b. Enhanced Cooperation / assistance of international and regional organizations such as JICA, ICIMOD, UNESCO, Norwegian Met Institute, World Bank, RIMES towards improving the services and products of NMHSs.
 - c. Capacity building of Met, hydro and DRR personnel.
 - d. Promotion of research activities

3.3 Secretariat report of PTC Key activities and publications Appendix X – need DOC

46. The Joint Session expressed its deep appreciation to the PTC Secretariat for its valuable services extended towards implementation of programmes and activities of the WMO/ESCAP Panel on Tropical Cyclones as well as to promote cooperation among the Panel Members. The intersessional activities of the PTC Secretariat are enumerated below.
 - a. Pursuant upon organization of 41st Session of the WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and the Arabian Sea (PTC-41) (Dhaka, Bangladesh, 2-6 March, 2014), PTC Secretariat collected input/feedback from the Panel Member countries and other participating international organizations under the auspicious of WMO and ESCAP and prepared / compiled the PTC-41 final report. The same was circulated to all Panel members, WMO, UN-ESCAP, Typhoon Committee and other concerned international organizations.
 - b. In connection to the updating of Tropical Cyclone Operational Plan (TCP-21) for 2014 version, PTC Secretariat collected feedback from PTC Member countries to assist Rapporteur of the Operation Plan in the early issuance of TCP-21 2014 version.
 - c. As per recommendation of PTC at its 41th Session (Dhaka, Bangladesh from 2-6 March, 2014) WMO made arrangements of holding an International Training Workshop on Dvorak Technique and Tropical Cyclone Forecasting in Muscat, Oman from 28th September to 2 October 2014. The Government of Sultanate of Oman co-sponsor and host the workshop in Muscat, Oman. PTC Secretariat extended invitation to the PTC Member countries for inviting suitable nominations. The workshop was attended by thirteen (13) participants from seven PTC Member’s countries besides the representatives of Oman. The financial support in lieu of travel and per diem to the participants was provided by WMO through PTC Trust Fund.

- d. With the support of the Panel, Secretary of PTC represented PTC at 70th Session of ESCAP (Bangkok, Thailand from 4-8 August, 2014). The opportunity was also used to share PTC programmes and activities, and to highlight the cooperation of PTC with the other regional body of WMO/ESCAP Typhoon Committee (TC) in the development of manual on integrated multi hazard early warning systems for both PTC and TC regions. At this important platform of ESCAP, the Secretary of PTC made the following statement:

“On behalf of the WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and the Arabian Sea, I would like to highlight the need for the regional cooperation particularly in the field of Early Warning. The PTC is making determined efforts in this regard and has expanded close collaboration with the ESCAP/WMO Typhoon Committee on Multi-hazard Synergized Standard Operating Procedures (SSOP) with support from ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness and is planning to hold a joint session of Panel on Tropical Cyclones and Typhoon Committee in February, 2015 in Bangkok, Thailand for obtaining goals of early warning in this region.”

- e. Panel on Tropical Cyclones has been closely collaborating with the Typhoon Committee in the implementation of joint project “Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System (SSOP) which is funded by ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and South East Asia. The beneficiary countries include Bangladesh, Cambodia, China, India, Lao PDR, Malaysia, Maldives, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam.
- f. In connection to the organization of 3rd Joint Session of PTC and TC in Bangkok, PTC Secretariat has been extending its utmost cooperation to the Typhoon Committee to make the event successful and fruitful.
- g. Concerning to the participation of Panel Members’ representatives in the joint session of PTC and TC, PTC Secretariat extended invitations to the Panel Members for seeking their nominations. The invitations were also extended to other international organizations like IOC-UNESCO, ICAO, CMA, Tohoku University, for sharing of knowledge.
- h. PTC Secretariat collected input/feedback from PTC Member countries and prepare/arrange summary based on their report(s) in relation to meteorology, hydrology, DRR, training/research components for presenting it at the joint session of the WMO/ESCAP Panel on Tropical Cyclones and ESCAP/WMO Typhoon Committee.
- i. During 2014, PTC Secretariat published two PTC newsletter “Panel News” Issue No. 37 and 38 and distributed them to the Panel Members, WMO, ESCAP, Typhoon Committee and other international organizations. The e-version of these publications were also uploaded on PTC website <http://www.ptc-wmoescap.org/newsLetters.htm>

3.4 Secretariat report of TC Key activities and publications

47. The Joint Session took note of the activities report given in **Appendix XI** prepared by the Secretary of the Committee and appreciated the efforts of the TCS for executing the decisions of the TC and supporting its activities.
48. The Joint Session expressed its appreciation to Macao, China for hosting TCS since 2007 and seconding meteorologist and DRR expert in the past years.

IV. REVIEW OF OPERATIONAL MANUAL AND PLANS (agenda item 4)

4.1 Review of Typhoon Committee Operational Manual (TOM)

49. The Joint Session noted that the Typhoon Committee Operational Manual (TOM) rapporteur requests WMO to publish and upload the 2015 edition of TOM on the Tropical Cyclone Programme (TCP) Website as submitted by the Rapporteur, with the amendments given in **Appendix XII**.
50. The Joint Session expressed its appreciation to the rapporteur for update of TOM.

1.2 Review of Tropical Cyclone Operational Plan (TOP)

51. The Joint Session noted the Tropical Cyclone Operational Plan (TOP) implementation plans in 2014 and implementation for 2015 as submitted by the Rapporteur, with the amendments given in **Appendix XIII – need DOC**.
52. The Joint Session expressed its appreciation to the rapporteur for reviewing and updating the TOP of the PTC. The Joint Session noted the **following points, as suggested by the rapporteur of the TOP for inclusion in 2015 version**:
 - a. A separate web page for INSAT-3D satellite products has been created and the products are available in the public domain for access.
 - b. A GIS based quick visualization and analysis tool for satellite data on a real time basis, namely, Real time Analysis of Products & Information Dissemination (RAPID) has been launched.
 - c. From 2015, experimental seasonal prediction for frequency of cyclonic disturbances (CDs, i.e. Depression and above) during October-December would be prepared in the month of September and circulated to all member countries for in-house use.
 - d. Experimental extended range prediction on cyclogenesis based on NWP models to be commenced from 2015.
 - e. Under the modernization of Radar Network programme, 9 Doppler Weather Radars (DWR) have been installed. 6 Doppler Weather Radar products (PPI(Z), PPI(V), MAX(Z), VVP2, SR1, PAC) are uploaded in the IMD website at 10 minute intervals when a cyclone comes within a coastal Radar range and could be used by member countries.
 - f. From the year 2015 onwards, the Very Severe Cyclonic Storm (VSCS) category (64-119 kts) of low pressure systems would be bifurcated into Very Severe Cyclonic Storm (VSCS) (64-89 kts) and Extremely Severe Cyclonic Storm (ESCS) (90-119 kts) and all cyclone bulletins would be issued based on the new nomenclature.
 - g. Quadrant wind radii analysis information would be included in the best track parameters from 2015 onwards.
 - h. HWRF model will be run on greater resolution 27x9x3 km and products will be available in IMD website and RSMC, New Delhi, website.
 - i. Coastal inundation model forecasts guidance based on ADCIRC model run at INCOIS, Hyderabad, India will be provided to member countries through INCOIS website and link through RSMC, New Delhi website.
 - j. Special Tropical Weather Outlook and Tropical Cyclone Advisory Bulletins will be disseminated through Google Alerts also in addition to existing means of communication.
 - k. Synergised Standard Operating Procedure (SSOP) for Marine Weather and Ocean state forecasts will be implemented by IMD-INCOIS for north Indian Ocean region.

V. COORDINATION OF ACTIVITIES WITH WMO (agenda item 5)

5.1. Coordination of WMO/TCP

53. The Joint Session was informed by the WMO Secretariat that, at its 16th Congress (Cg-XVI) of WMO gave priority on the following:
 - a. Global Framework for Climate Services (GFCS).

- b. Capacity Building.
- c. WMO Integrated Global Observing System (WIGOS) & WMO Information System (WIS).
- d. Disaster Risk Reduction.
- e. Aeronautical meteorology.

54. The Joint Session was also informed that Cg-XVI gave following guidance to the Tropical Cyclone Programme (TCP):

- a. To assist Members in their efforts to implement Tropical Cyclone Programme activities for the safeguard of life and property from tropical cyclones and related hazards to the maximum extent possible within the available budgetary resources.
- b. To continue to support the capacity building programmes for developing countries, especially for Least Developed Countries and Small Island Developing States.
- c. To maintain and further enhance the collaboration between the Tropical Cyclone Programme and relevant WMO Programmes and technical commissions, particularly in relation to the development of tropical cyclone forecasting competencies.
- d. To continue close cooperation with other international as well as relevant national organizations at the global and regional levels to promote a multidisciplinary and multi-hazard approach towards the attainment of the humanitarian goals of the Programme.

55. TCP activities during the inter-sessional period were highlighted as follows.

a. Training and Capacity Development

RA IV Workshop on Hurricane Forecasting and Warnings and Public Weather Service in Miami, Florida, USA, from 10 to 21 March 2014; WMO/JMA Workshop on Effective Warning of Tropical Cyclones, Tokyo, Japan, 10 – 14 March 2014; WMO/Oman International Workshop on Dvorak Technique and Tropical Cyclone Forecasting, Muscat, Oman, 28 September – 2 October 2014; WMO TCP/MMO Workshop on Storm Surge and Wave Forecasting, Miami, Florida, USA, 20-23 January 2015.

RSMC attachment training for tropical cyclones in New Delhi, India from 4 to 15 March 2014, and in Tokyo, Japan from 21 July to 1 August 2014.

Development of the tropical cyclone forecaster competencies for ensuring the quality of tropical cyclone forecasting services, and meeting the users' requirements. RA V Tropical Cyclone Committees, and RA IV Hurricane Committee reported progress on developing the competency standards during their annual/biennial sessions, respectively.

b. Support to Operational Forecasting

TCP updated regularly the WMO Tropical Cyclone Forecaster Website (TCFW) <http://severe.worldweather.wmo.int/TCFW> with committed support from Hong Kong Observatory of Hong Kong, China. TCFW will provide research outcomes and training materials, and thus serve as a comprehensive source of information for the forecasters.

The web version of the updated WMO Global Guide to Tropical Cyclone Forecasting with Mr. Chip Guard of the United States as Chief Editor is ready to be accessible. WMO will send a circular letter to announce the availability of the Guide to the Members prone to tropical cyclones in late February and early

March 2015. Thanks to the Bureau of Meteorology in Australia for their hosting and maintaining the website. Devoted to the Guide.

c. Coordination of Forecasting Services

The WMO Executive Council (EC) at its sixty-fifth session welcomed the recommendation of the 7th Technical Coordinating Meeting (TCM) (Indonesia, November 2012) to explore the feasibility of developing a globally-unified classification of tropical cyclones including a category system. The EC 66 noted the ongoing careful study and investigation by the ad hoc team established by TCM. A concept paper of the investigation would be presented to the next TCM planned in Miami, Florida, USA, 2-6 November 2015.

Amendment 75 to ICAO Annex 3/WMO Technical Regulations [C.3.1] concerning provision by TCACs of the graphical format of tropical cyclone advisories to the aviation community.

d. Storm Surge Watch Scheme

The WMO/ESCAP Panel on Tropical Cyclones, and ESCAP/WMO Typhoon Committee have implemented the Storm Surge Watch Scheme, RA IV Hurricane Committee decided during its annual session (Cancun, Mexico, 7 – 11 April 2014) decided to implement the scheme and provide the storm surge advisories starting from the hurricane season 2015.

56. The Joint Session was informed that the scope of activities of the regional TC committees had been expanded through involvement with the WMO's cross-cutting projects such as the Severe Weather Forecasting Demonstration Project (SWFDP), Coastal Inundation Forecasting Demonstration Project (CIFDP) and Disaster Risk Reduction projects for Early Warning Systems in Regions I, II, IV and V. The Committees' annual/biennial sessions serve as venues for information sharing for the projects and their technical plans have incorporated collaborative actions with those projects. Wider cross-cutting project coverage is further needed to reach all the Member countries of the regional TC committees. In addition, a synergistic relationship with other UN agencies and international/regional entities has also been developed.
57. The Joint Session was presented by WMO Secretariat about the outcomes and recommendations from the IWTC-VIII and IWTCLP-III which were jointly organized WWRP and TCP, and held in Jeju, Korea, 2-10 December 2014. The IWTC-VIII and IWTCLP-III are quadrennial fora for tropical cyclone community (both researcher and forecasters) to discuss together with virtually all aspects related to tropical cyclones with particular focus on motion, evolution, intensity, precipitation patterns, structure, and societal impacts, and unique behaviors during landfalling.

5.2 Coordination of WMO activities common to PTC and TC

58. The Joint Session was informed of some WMO's activities to assist the Members of PTC and TC since 2012.
59. The Joint Session noted that the WMO Technical Cooperation Programme (TCO) activities are being implemented with funding from the WMO Voluntary Cooperation Programme (VCP), Trust Fund (TF) arrangements and a modest Regular Budget contribution, mainly for fellowship and training purposes to ensure successful implementation of WMO programmes, as well as the WMO Programme for the Least Developed Countries (LDCs). Technical cooperation activities are also being implemented through bilateral and multilateral arrangements and through funding provided by financial institutions such as the World Bank and regional development banks and other partners.

60. The Joint Session noted that the Voluntary Cooperation Programme (VCP) projects were implemented for :
- Maldives: a Fact finding mission to the Maldives Meteorological Department; and for
 - Myanmar: a WMO expert mission to the Department of Meteorology and Hydrology for the relocation of GTS/MSS equipment and MTSAT Data Monitoring System
61. The Joint Session noted that within the Korea Trust Fund for Strengthening Climate Services with the financial contribution of the Korea Meteorological Administration (KMA), a project to provide the Department of Meteorology and Hydrology (DMH) of Lao PDR with a set of the satellite data receiving system and its related applications system for the Communication, Ocean and Meteorological Satellite (COMS) is being implemented. The system is expected to be delivered to DMH shortly.
62. The Joint Session further noted that within the Japan Trust Fund for Global Frameworks with the financial contribution of the Japan Meteorological Agency (JMA), a project has been initiated to provide the reception and processing systems for real-time data from JMA Himawari-series of satellites through the HimawariCast Service to seven (7) countries including five (5) PTC and TC members, namely, Bangladesh, Cambodia, Myanmar, Thailand and Viet Nam.
63. The Joint Session noted that in relation to Technical Cooperation among Developing Countries (TCDC) (or South-South Cooperation), the China Meteorological Administration (CMA) has organized a series of China Study Tours with the high-level representatives of NMHSs in developing countries including some members of PTC and TC.
64. The Joint Session was informed that after some synoptic weather stations in the National Capital Region of the Philippines were affected by monsoon floods in 2011, some high-priority equipment/instruments were provided to the Philippines within the WMO Emergency Assistance Fund within the WMO "Emergency Assistance Fund" (officially entitled "WMO Disaster Assistance Fund for Meteorological and Hydrological Services").
65. The Joint Session noted that after Typhoon Haiyan (also called Yolanda in the Philippines) hit the Philippines and affected Viet Nam in November 2013, WMO, ESCAP and the Typhoon Committee organized a Post-Typhoon Haiyan (Yolanda) expert mission to the Philippines in April 2014 and another expert mission to Viet Nam was conducted right after the mission to the Philippines. Outcomes of these missions were presented to the session during the Technical Presentations.
66. The Joint Session further noted that a Regional Workshop on Implementation of Weather- and Climate-related Services in the Least Developed Countries (LDCs) in Asia was held in September 2013 in Bhutan with the participation of Cambodia, Lao PDR and Myanmar within the WMO Programme for LDCs.
67. Nanette Lomarda, representative of WWRP/WMO presented the key outcomes of the 8th International Workshop on Tropical Cyclones (IWTC-8)(Jeju, 2-6 December 2014) and 3rd International Workshop on Tropical Cyclone Landfall Processes (IWTCLP-3)(Jeju, 8-10 December 2014). The IWTC is one of WMO's major quadrennial workshops which brings together tropical cyclone researchers and warning specialist to examine current knowledge, forecasting and research trends on tropical cyclones from an integrated global perspective.
68. The IWTCLP on the other hand looks into landfalling tropical cyclone and their impacts and is held a year before the IWTC. This is the first time that the IWTCLP was held in conjunction with the IWTC.

69. The workshops were attended by 237 participants from 32 Members of WMO. The presentation mainly focused on the recommendations resulting from discussions held at the two workshops. (List of recommendations provided in Annex ? of this report). The Recommendation Committee chaired by Mr C.M. Shun, Director of the Hong Kong Observatory compiled 27 recommendations, 7 of which were directed to WMO, 5 to operations & research, 6 to operations and 9 to the research community.
70. The two workshops were successfully held in Jeju, Republic of Korea, thanks to extensive preparations by the organizers, the participants and the local host, the National Typhoon Center of KMA. However, the real success may not be known for years until the recommendations have had their effect on advancing global efforts for improved understanding of tropical cyclones. The joint session, in noting this, urged the TC and PTC to take these suggested actions forward within their own areas of influence.
71. The Joint Session noted the presentation made by ICAO and recognize the importance of:
 - a. Full implementation of the provisions related to the content, format and dissemination of tropical cyclone advisory information, in particular tropical cyclone advisory information in graphical format, as contained in ICAO Annex 3, and the overlying provisions concerning quality management of meteorological service, which also apply to tropical cyclone advisory information;
 - b. Participation, as resources allow and particularly during respective tropical cyclone season(s), of the TCACs in routine coordination sessions with the WAFCs, hosted by WAFC Washington four times per day using a web-based chat room facility; and
 - c. The recent developments concerning the migration to the digital exchange of OPMET information to support international air navigation, and medium term intentions to include other meteorological information such as tropical cyclone advisory information in such developments.

VI. CROSS-CUTTING PROJECTS AND PTC/TC COOPERATIVE MECHANISM (agenda item 6)

6.1 SSOP

72. The Joint Session took note of the progress of the project and analysed the current draft of the Manual and suggest changes (version 3 December 2014- posted on <http://www.typhooncommittee.org/SSOP/indexSSOP.html>) **Appendix XIV**.
73. On the basis of the experience gained during the implementation of the SSOP project, and considering that the final phase is already in progress, TCS would like to request the 3rd PTC/TC Joint Session to to:
 - a. Encourage Members of PTC and TC, SSOP Focal Points, SSOP Task Force and Steering Committee to actively collaborate in the revision of the Manual on Synergized Standard Operating Procedures for Coastal Multi-Hazards Early Warning System.
 - b. To request the Members, after the Manual is complete, to consider ways to make the best use of it.
 - c. Encourage the Members to disclose the Manual by various agencies, organizations and other entities related to early warning systems

6.2 EXOTICA

74. The Joint Session took note of the major progress and issues in implementing the project in 2014 as reported in **Appendix XV**.

75. The Joint Session encourage TC and PTC Members to participate the field campaign and the share the observational data related to the target typhoon.
76. The project proponents issued an invitation to Members of TC and PTC to join the project and should they be interested to inform the TCS and PTC secretariat of their interest either in an e-mail or formal letter before May 2015.

6.3 WMO-TLFDP

77. The Joint Session noted progress and suggestions of WMO Typhoon Landfall Forecast Demonstration Project (WMO-TLFDP) as reported in **Appendix XVI**.
78. The Joint Session supported the proposal of TLFDP to look for ways to collaborate with “The Experiment on Typhoon Intensity Change in Coastal Area (EXOTICA)” and extend WMO-TLFDP until 2018.

6.4 COOPERATIVE MECHANISM

79. The Joint Session noted the report of the Working Meeting on PTC/TC Cooperative Mechanism for Coastal Multi-hazard Early Warning Information Sharing and Technical Transferring between PTC and TC (**Appendix XVII**) and decided to pursue the following joint activities:
 - a. To develop a mechanism for holding Joint PTC/TC Sessions more frequently and regularly.
 - b. To develop a proposal for SSOP Phase II, based on the successful completion SSOP project, and submit to ESCAP for funding consideration.
 - c. To request ESCAP and WMO to provide funding and expertise support for extension of TC on-going project of real-time Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) to PTC Members, starting from organizing a joint workshop on implementation of OSUFFIM for selected pilot cities in TC and PTC Members in 2015
 - d. To facilitate PTC and TC Members to participate in each other's annual sessions and workshops/seminars, and to encourage PTC Members to seek funding through ESCAP or WMO to attend training courses and workshops offered by TC Members.
 - e. To coordinate and undertake joint expert mission in assessing the damage caused by tropical cyclones and related disasters with the support from ESCAP.
 - f. To invite two to three tropical cyclone forecasters from PTC Members to the RSMC Tokyo attachment training every year with the support of ESCAP, and to request ESCAP to make financial and logistic arrangements for the PTC participants in cooperation with RSMC Tokyo.
 - g. To invite one or two tropical cyclone forecasters or researchers from PTC Members to the TRCG Research Fellowship Scheme of KMA every year if possible with the support of WMO/ESCAP or other donors. To request WMO/ESCAP to make financial and logistic arrangements for the PTC participants in cooperation with KMA.
 - h. To invite TC members to join the initiatives of RSMC New Delhi on Forecast Demonstration Project on landfalling cyclones over Bay of Bengal, Severe Weather Forecast Demonstration Project and coastal inundation modelling with the involvement of PTC member Countries.

- i. To invite TC members to participate in the annual bi-weekly training and short term weekly/ bi-weekly training programmes on specific themes such as Satellite Meteorology, Radar Meteorology, and NWP currently conducted by RSMC New Delhi/IMD for the benefit of PTC countries. While RSMC New Delhi provides only training support, it requests extra-budgetary resources to support air fare and DSA for the participants from PTC and TC member Countries.
- j. To strengthen data sharing between TC and PTC Members including satellites data, noting that by the end of 2016 EUMETSAT will terminate the operations of Meteosat-7.

VII. DISCUSSION FORUM FOR WORKING GROUPS (agenda item 7)

80. Prior to the plenary session for the Joint Session, parallel sessions of the three Working Groups on Meteorology, Hydrology and Disaster Risk Reduction between TC and PTC were convened on the afternoon of 10 February 2015 in three separate meeting areas to discuss the cross-cutting projects and cooperative mechanisms.
81. The major outcomes of the parallel sessions of the three Working Groups were reported to the plenary session by the rapporteur appointed for each forum for presenting discussion summary at the plenary.

VIII. PTC-42nd and TC-47th Session (agenda item 8)

8.1 Parallel Session of PTC

82. The Parallel Session of PTC was held from 11-13 February 2015 and is reported separately. **(Appendix XVIII) - need DOC**

8.2 Parallel Session of TC

83. The Parallel Session of TC was held from 11-13 February 2015 and is reported separately. **(Appendix XIX)**

IX. TECHNICAL PRESENTATIONS (agenda item 9)

84. The scientific lectures were presented as shown in **Appendix XX**. The Joint Session expressed its appreciation to all the lecturers and requested the TCS to post it all the lecture papers/PowerPoint presentations on the TC website.

X. ADOPTION OF THE REPORT (agenda item 10)

85. The Joint Session adopted the report of the session at 16:02 pm, 13 February 2015.

XI. CLOSURE OF THE SESSION (agenda item 11)

86. The delegates from the Members of the Typhoon Committee and the Panel on Tropical Cyclones, representatives of WMO, TCS, PTCS and observers expressed their thanks and appreciation to the ESCAP for the successful hosting of the 3rd Joint Session of the Typhoon Committee and Panel on Tropical Cyclones.
87. The Joint Session was closed by the Chairperson at 16:15pm, 13 February 2015.