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SUMMARY OF MEMBERS' REPORTS 2018

(submitted by AWG Chair)

Summary and Purpose of Document:

This document presents an overall view of the progress and issues in meteorology, hydrology and DRR aspects among TC Members with respect to tropical cyclones and related hazards in 2018

Action Proposed

The Committee is invited to:

(a) take note of the major progress and issues in meteorology, hydrology and DRR activities in support of the 21 Priorities detailed in the Typhoon Committee Strategic Plan 2017-2021; and

(b) Review the Summary of Members' Reports 2018 in APPENDIX B with the aim of adopting a "Executive Summary" for distribution to Members' governments and other collaborating or potential sponsoring agencies for information and reference.

APPENDICES:

1) Appendix A – DRAFT TEXT FOR INCLUSION IN THE SESSION REPORT
2) Appendix B – SUMMARY OF MEMBERS' REPORTS 2018

APPENDIX A:
DRAFT TEXT FOR INCLUSION IN THE SESSION REPORT

6.2 SUMMARY OF MEMBERS' REPORTS

1. *The Committee took note of the Summary of Members' Reports 2018 highlighting the key tropical cyclone impacts on Members in 2018 and the major activities undertaken by Members under the TC Priorities and components during the year.*

2. *The Committee expressed its sincere appreciation to AWG Chair for preparing the Summary of Members' Reports and the observations made with respect to the progress of Members' activities in support of the 21 Priorities identified in the TC Strategic Plan 2017-2021.*

Recommendations of AWG

3. *AWG recommended the Committee to consider the key tropical cyclone impacts on Members in 2018 and review the initiatives and activities to be pursued in support of the 21 TC Priorities to mitigate future impacts.*

4. *Any other text to be included in the Session Report.*

APPENDIX B:
SUMMARY OF MEMBERS' REPORTS 2018

Raymond Tanabe (AWG Chair)

The summary is based on Members' Reports as submitted by Members of the Typhoon Committee for the 13th IWS in Chiang Mai on 5-9 November 2018. The full reports may be found in the member reports section of the 13th IWS website.

http://www.typhooncommittee.org/13IWS/Members13IWS.html

1. Objectives

The objectives of this Summary are to extract the key aspects of tropical cyclone impact and related topical issues of regional interest in Members' countries or territories, and to consolidate the information and observations for:

(a) the attention of Members' governments to encourage allocating the necessary resources for the purposes of operational effectiveness and readiness, disaster mitigation and risk reduction, or leveraging available resources and support for technology transfer and capacity-building through regional cooperation initiatives; and

(b) reference by sponsoring agencies with a view to coordinating and synergizing effort in the planning of relevant projects and programmes for such purposes, as well as channeling resources and aids into identified areas of gaps or needs.

2. Key Observations in 2018

2.1 Overview (courtesy RSMC Tokyo)

In the western North Pacific and the South China Sea, 29 named tropical cyclones formed in 2018, which was above 30-year average, and 13 out of them reached typhoon intensity, whose ratio was the smaller than the 30-year average.

Eighteen named TCs formed in summer (June to August), which ties with 1994 as the largest number of formation in summer since 1951. Among them, nine named TCs formed in August, which is the third largest number of formation in August after ten in 1960 and 1966. During the month, sea surface temperatures were above normal in the tropical Pacific east of 150˚E. Enhanced cyclonic vorticity existed over the sea east of the Philippines where strong southwesterly winds due to the above-normal monsoon activity and easterly winds in the southern side of the Pacific High converged. Adding to these, upper cold lows cut off from the meandering subtropical jet stream in the central to eastern North Pacific repeatedly moved southward and westward. These factors are thought to have contributed to the large number of TC formation.

2.2 Summary of Member contributions supporting the 21 Priorities of the Typhoon Committee Strategic Plan 2017-2021.

	Priorities	
1	Enhance activities to develop impact-based forecast and risk-based warning.	31
2	Strengthen cross-cutting activities among working groups in the Committee.	9
3	Enhance collaborative activities with other regional/international frameworks/organizations, including TC and PTC cooperation mechanism.	24
4	Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.	29
5	Develop and enhance typhoon analysis and forecast technique from short- to long-term.	21
6	Enhance and provide typhoon forecast guidance based on NWP including ensembles and weather radar related products, such as QPE/QPF.	20
7	Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.	14
8	Strengthen the cooperation with WGH and WGDRR to develop impact-based forecast and risk-based warning.	5
9	Enhance, in cooperation with TRCG, training activities in accordance with Typhoon Committee forecast competency, knowledge sharing, and exchange of latest development and new techniques.	10
10	Enhance RSMC capacity to provide regional guidance including storm surge, responding to Member's needs.	8
11	Improve typhoon-related flood (including river flood, urban flood, mountainous flood, flash flood and storm surge, etc the same below) monitoring data collection, quality control, transmission, and processing.	14
12	Enhance capacity in typhoon-related flood risk management (including dam operation), integrated water resources management and flood-water utilization.	16
13	Enhance capacity in impact-based and community-based operational flood forecasting and early warning, including methodology research, hydrological modeling, and operation system development.	19
14	Enhance capacity in flood risk (hazard, inundation) information, mapping, and its application.	27
15	Enhance capacity in assessment and dealing with the impacts of climate change, urbanization, and other human activities on typhoon-related flood disastervulnerability and water resources availability.	11
16	Enhance capacity in advanced technology (including satellite data, GIS, RS, QPE/QPF, ensemble, parallel computing) utilization in typhoon-related flood forecasting and early warning, and hydrological modeling.	19
17	Provide reliable statistics of mortality and direct disaster economic loss caused by typhoon-related disasters for monitoring the targets of the Typhoon Committee.	5
18	Enhance Members' disaster reduction techniques and management strategies.	26
19	Evaluate socio-economic benefits of disaster risk reduction for typhoon-related disasters.	14
20	Promote international cooperation of DRR implementation project.	27
21	Share experience/know-how of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.	18

2.3 Summary of Members' Reports

2.3.1 Cambodia.

During the period from October 2017 to September 2018, there were no direct landfalling tropical cyclones in Cambodia. Interactions between the outer circulation of nearby tropical cyclones with the southwest monsoon or the ITCZ produced a significant amount of thunderstorm activity and heavy rainfall. One example was Tropical Storm Ewiniar in June 2018 which made landfall in southern China and produced heavy rain and significant flooding in Cambodia.

The increased thunderstorm activity led to a record number of fatalities due to lightning strikes. A report issued by the National Committee for Disaster Management indicated over 100 deaths and dozens of injuries due to lightning strikes over the first nine months of 2018, well above the 70-80 lightning related deaths in all of 2017.

In July 2018, several days of heavy rain associated with the periphery of Tropical Storm Son-Tinh, which made landfall in Vietnam on 18 July 2018, produced significant flooding in the provinces of Kampong Speu, Battambang, Koh Kong and Phreah Sihanouk. As many as 1,786 houses and 1,100 hectares of paddy fields were damaged.

2.3.2 China

During the period of 1 January – 18 October 2018, the western North Pacific and the South China Sea witnessed the genesis of 25 tropical cyclones. Ten tropical cyclones made landfall in China's coastal areas, including Tropical Storm Ewiniar, Super Typhoon Maria, Tropical Storm Son-Tinh, Severe Tropical Storm Ampil, Typhoon Jongdari, Severe Tropical Storm Yagi, Severe Tropical Storm Bebinca, Severe Tropical Storm Rumbia, Super Typhoon Mangkhut, and Tropical Storm Barijat.

China noted several characteristics of tropical cyclone impacts in the region for 2018. A slight increase in genesis let to more landfalling events. Of significance were landfalls further north in China, and unusually more landfalls in Shanghai, where three tropical cyclones made landfall in 2018, marking the largest number of landfalls since 1949. Next, there were more tropical cyclones to move northward after landfall. This post-landfall motion produced significant rainfall impacts over East, North, and Northeast China. Finally, a weak average landing strength was noted in 2018. Of the 10 landfalling tropical cyclones, only Maria and Mangkhut reached severe typhoon strength at landfall. The remaining 8 were storms or severe tropical storms.

Heavy rainfall from tropical cyclones significantly impacted 22 provinces in China. Of the 10 landfalling tropical cyclones, Ewiniar, Rumbia, and Mangkhut produced the most significant impacts. The overall areas affected by flooding were larger than normal and rainfall intensities were greater. Typhoon-induced rainfalls led to reports of over 200 rivers exceeding warning levels with some breaking records

China continues to support important initiatives in the Typhoon Committee region. For 2018, China hosted the first WGM meeting at the Shanghai Typhoon Institute, the Project Meeting of the World Weather Research Programme (WWRP), coordinated video calls with CMA, HKO, SMG, and Vietnam to discuss impacts from Mangkhut, and published *Tropical Cyclone Research and Review* (TCRR) journal, including a special edition commemorating the 50th Anniversary of the Typhoon Committee. From January to September 2018, there were over 38000 TCRR downloads in full text, marking a 58% increase over 2017.

China reported on 13 initiatives supporting Typhoon Committee Priorities in 2018. Of note were advances in typhoon forecasting techniques, typhoon numerical modeling and data simulation, the publication of the *Climatological Atlas for Northwestern Pacific Tropical Cyclones,* and enhancement of typhoon disaster risk reduction management capacity by emergency management authorities. Of further interest is the high resolution of the imagery being captured by the FY-3D satellite launched in late 2017. Conventional and enhanced FY-3D microwave imagery and analyses provided critical observations of Mangkhut and Maria to support monitoring, analysis, and forecasting.

2.3.3 Democratic People's Republic of Korea (DPRK).

DPRK was affected by two tropical cyclones in 2018. Rumbia provided indirect impacts after its extratropical transition. Rumbia was upgraded to a Tropical Storm 15 August 2018 northwest of Okinawa before making landfall in China. Rumbia continued on a northwest track after landfall before underdoing extratropical transistion on 18 August 2018. After recurving moving into the western Korean Sea, Rumbia produced heavy rainfall across DPRK. The highest totals were in the North PyongAn Province with an average amount of 102mm.

Tropical Storm Soulik made landfall in DPRK in August 2018 and produced rainfall averaging 86mm nationwide. The highest totals were in the KongWon Province, where average rainfall was more than 400mm. The highest winds observed with TS SOULIK was 10-17 m/s along the eastern coast.

Overall, heavy rainfall and flooding produced the most severe impacts in DPRK, including historical flooding in the middle to lower sections of the Ryesong River from Soulik. Notable were maximum 1-hour precipitation amounts of 127mm in KumChon County and 142mm in YonBak Lake, which were the maximum precipitation values in observation history. SHMA issued warnings 3 days in advance of the heavy rain and flooding. Provincial and municipal governments were well prepared and took measures to minimize damage.

DPRK noted with thanks the numerical weather prediction suite of products from ECMWF, CMA, JMA, and NCEP for their role in assisting their forecasters in making accurate and timely warnings for typhoon related impacts in 2018. STI also provided assistance with research. DPRK reported increased use and success with the TOPS 2.0 system to analyze typhoon forecast products from Members which assisted development of the DPRK typhoon forecasts. These typhoon forecasts were then distributed to the relevant agencies and the public using television, radio, computer network, cell phones, and other means.

2.3.4 Hong Kong, China.

Five tropical cyclones affected Hong Kong, China from 1 January to 30 October 2018; Tropical Storm Ewiniar in June, Tropical Strom Son-Tinh in July, Severe Tropical Storm Bebinca in August, and Tropical Storm Barijat and Super Typhoon Mangkhut in quick succession over a 5- day period in mid-September.

Typhoon Mangkhut was by far the most destructive, necessitating the issuance of the highest tropical cyclone warning signal, the No.10 Hurricane Signal, for 10 hours in Hong Kong on 16 September 2018. This is the second longest duration of No. 10 Hurricane Signal in Hong Kong since 1946. Mangkhut battered Hong on 16 September 2018 with destructive tropical storm and hurricane force winds. Maximum 60-minute mean winds of 161 and 157 km/h were recorded Waglan Island and Cheung Chau, respectively. Both are the second highest records for these two stations. A maximum gust of 256 km/h was recorded at Tate's Cairn, ranking after Wanda (1962) and Ruby (1964) as the third highest for that station. Mangkhut also produced storm surge in excess of 2 meters, with the highest observed level of 4.69 meters at Tai Po Kau. Substantial impacts to Hong Kong included more than 60,000 fallen trees and at least 500 reports or smashed windows and glass walls. Hundreds of boats of various sizes were lost, sunk, or seriously damaged. Amazingly, while 458 people were injured, there were no fatalities.

One of the highlights of Hong Kong's regional cooperation is the signing of an MOU between HKO and WMO. HKO will support the WMO's initiative in establishing GMAS in the region. HKO has revamped the SWIC and WWIS websites in support of the GMAS effort.

HKO, in collaboration with the Hong Kong Government Flying Service, continues to operate the only routine airborne dropsonde reconnaissance flights for tropical cyclones in the region, focusing on the South China Sea. Through October, 7 missions were flown covering 5 tropical cyclones.

2.3.5 Japan.

In 2018, 15 tropical cyclones of tropical storm strength or higher had come within 300 km of the Japanese islands as of 9 October 2018. Japan was affected by 8 of these, with 5 making landfall. Typhoon Jebi in August caused the most significant impacts, leaving 14 people dead and more than 900 injured. Serious residential and agricultural damage, power and water outages, communication downtime and transport disruptions were reported in western, eastern and northern Japan. Kansai International Airport and port facilities were seriously damaged by storm surge waves and had to close for several days.

The Heavy Rain Event of July 2018 was defined by rainfall with unprecedented intensity in western Japan and elsewhere. Severe flooding, landslides, and a levee break contributed to 231 people killed or missing, 91 seriously injures, over 6,000 residences destroyed, and over 21,000 residences flooded above floor level.

JMA noted several major advances in support of tropical cyclone monitoring, analysis, forecasting, and disaster risk reduction. The installation of their new supercomputer provides an effective peak performance 10 times faster than its predecessor. This increase allows JMA greater capacity to produce a wide array of guidance products. JMA's global spectral model for tropical cyclones was extended to 132 hours and JMA will produce 5-day track and intensity forecasts starting in early 2019.

JMA also established the JMA Emergency Task Team (JETT) to provide meteorological guidance to municipal governments or disaster management headquarters during tropical cyclones and other severe weather events. Within the first six months of establishing the program, JETTs were dispatched during 5 events across Japan.

JMA upgraded several products on the RSMC Tokyo-Typhoon Center's Numerical Typhoon Prediction Website and established the HimawariRequest system for members of WMO RA II and RA V to request rapid scan satellite service. RSMC Tokyo conducted its 18th Attachment Training course in October 2018. In addition to forecasters from three Typhoon Committee members, 2 from the Panel of Tropical Cyclones were also invited this year.

2.3.6 Lao PDR.

Up to October 2018, Lao PDR was directly impacted by two tropical cyclones, Son-Tinh and Bebinca, and indirectly impacted by Mangkhut. Son-Tinh made landfall over northern Vietnam on 19 July and its remnants tracked westward before passing over the central and northern sections of Lao PDR. Heavy rainfall associated with the remnant of Son-Tinh produced widespread flooding and landslides. Total rainfall amounts were generally between 150-250mm with maximums of 509.6mm in Xienkhuang and 554.5mm in Paksong.

Bebinca followed a similar track to Son-Tinh, making landfall in northern Vietnam before moving over the central and northern sections of Lao PDR. Bebinca was still a minimal tropical cyclone as it passed over Lao PDR so strong winds were reported in addition to heavy rainfall. Rainfall amounts were less than observed for Son-Tinh. Nonetheless, widespread landslides, floods, and flash floods were reported.

In addition to tropical cyclone impacts, the early onset of the monsoon in the north to central portions of Lao PDR contributed to above normal rainfall in June through August. This rainfall caused the Mekong River and its tributaries to continuously remain at elevated levels through September 2018.Lightning and hail from thunderstorms also caused severe economic losses to cattle, agriculture, and homes.

2.3.7 Macao, China

Six tropical cyclones affected Macao, China from November 2017 through October 2018. These were Tropical Storm Ewiniar, Tropical Storm Son- Tinh, Severe Tropical Strom Bebinca, Super Typhoon Mangkhut, Tropical Storm Barijat and one unnamed tropical depression.

Similar to Hong Kong, Super Typhoon Mangkhut produced the most severe impacts in Macau. Mangkhut was the strongest tropical cyclone to strike Macao after Hato in 2017. Mangkhut caused severe impacts to Macao and led to the issuance of Typhoon Signal No.10 and Black Storm Surge Warning. Due to its great intensity and large circulation, Mangkhut severely affected Macao for a long period even after landfall. Typhoon Signal No. 10 lasted for 9 hours, marking the longest duration of Typhoon Signal No.10 in Macau history. s

Macau noted the benefits of the video teleconference with HKO and CMA held as Mangkhut approached the coast. The sharing of observations and discussion of track/intensity forecasts was found to be very useful in mitigation and disaster risk reduction activities.

An expert meeting supporting the "The third assessment report on the Climate Change Impacts on Tropical Cyclones in the Typhoon Committee region (TCAR3)" was held on 26-27 November 2018 in Macao. This meeting served as a platform for experts from China, Hong Kong, USA, Japan, and Korea to share their progress and provide further guidance on the compilation of the report.

2.3.8 Malaysia

For the period from 1 November 207 through 6 October 2018, three tropical cyclones entered the area of responsibility of the Malaysia Meteorology Department. These were Tropical Storm Kai-Tak, Typhoon Tembin, and Tropical Storm Sanba. All three produced heavy rainfall and flooding across many areas of Malaysia. The formation of Typhoon Damrey over Vietnam in November 2017 helped to enhance an area of low pressure over the northern Peninsula, producing a lengthy period of heavy rainfall and flash flooding on Penang Island and parts of mainland Malaysia. Over 4,800 people were affected by flash flooding in the states of Penang, Kedah, and Perak.

In March 2018, the Department of Irrigation and Drainage, Malaysia (DID) successfully established the new National Flood Forecasting and Warning Centre (PRABN). The objectives of PRABN are to strengthen the operational flood forecasting and warning activities and develop new flood forecasting and warning systems.

Ongoing regional cooperation initiatives include collaboration between MMD, TMD, and JMA to produce composite radar maps and refine quantitative precipitation estimate algorithms. Individually, MMD implemented the Radar Integrated Nowcasting System (RaINS) which blends reflectivity data and MMD NWP output. RaINS is based on a similar system developed by HKO and fine-tuned by MMD for optimal results in Malaysia.

2.3.9 Phillipines.

In 2018, 18 tropical cyclones entered and/or developed inside the Philippine Area of Responsibility (PAR); 5 tropical depressions, 5 tropical storms, 2 severe tropical storms 3 typhoons. Five of these tropical cyclones made landfall (local name in parentheses); Tropical Storm Bolaven (Agaton), Tropical Storm Sanba (Basyang), two unnamed tropical depressions (Henry, Josie), and Typhoon Mangkhut (Ompong).

Agaton developed into a tropical depression on 1 January 2019. Agaton made six landfalls while traversing over northeastern Mindanao and the southern Visayas. Agaton caused widespread damage to agricultural areas and private properties. Tropical Storm Sanba followed a similar track as Agaton and made landfall in eastern Mindanao as a tropical storm. Landslides and flooding were reported however there were no casualties.

Ompong made landfall over the remote area of Baggao, Cagayan on 15 September. Ompong caused widespread damage across northern and central Luzon due to its intensity and large size. The interaction of Ompong with the topography of the islands exacerbated the flooding and landslides. There were 82 casualties attributed to Ompong.

New C-band and S-band Doppler Radars were installed in Agno, Bohol, Samar, and Masbate to cover blind areas of the existing radar network. In addition to these radars, PAGASA has also installed High Frequency Doppler Radars (Coastal Radar) along the nautical highway that connect the three main islands, Luzon, Visayas and Mindanao. These coastal radars monitor the main inter-island shipping lanes used by many ferry boats and small vessels.

PAGASA continues to be very active in their outreach and education programs to increase resilience and disaster risk reduction efforts nationwide.

2.3.10 Republic of Korea (ROK).

There were 5 tropical cyclones which impacted the Korean Peninsula during the period from July to September 2018; Prapiroon, Soulik, Trami and Kong-Rey. Prapiroon affected the southern part of the peninsula. Rumbia and Trami passed by the southern coast of Jeju Island, entering into KMA's area of warning responsibility. In particular, Soulik, Kong-Rey and Prapiroon mpacted the Korean Peninsula with strong winds and heavy rain.

Of note in 2018, both Soulik and Kong-rey passed over Jeju Island bringing strong winds and heavy rainfall. Soulik alone damaged 362 facilities and caused a power outage affecting nearly 27,000 homes. Over 3,000 ha of farmlands were flooded. With Kong-Rey, two people were killed and one man was missing while crossing a flooded bridge.

ROK continues to be very proactive in assisting and building capacity of other members. KMA issues the seasonal outlook for the western north Pacific based on three types of models. KMA also delivered the Typhoon Operation System (TOS) to Lau PDR and Thailand. NTC and KMA hosted the Typhoon Research Fellowship Program of the TRCG and co-hosted 11th Korea-China Tropical Cyclone Workshop. KMA also successfully launched Korea's latest generation satellite, Geo-KOMPSAT-2A with advanced AHI and ABI imagers.

Korea also expanded their flood forecasting program to reflect the increasing trend in heavy rainfall due to climate change and is strengthening flood management accordingly. One of the main projects in support of this expansion is enhancement of flood forecasting reliability with radar observed rainfall data.

Finally, NDMI through the WGDRR was very active in Typhoon Committee activities throughout 2018, including setting up early warning and alert systems in Vietnam and Lao PDR, participating in iCoWIN workshops, supporting and hosting the 13th annual WGDRR meeting, organizing and participating in the Pacific Risk Management Ohana (PRiMO) conference in Hawaii, and active sharing of information related to DRR efforts in the region.

2.3.11 Singapore.

Due to its geographic location close to the equator, Singapore is rarely impacted directly by tropical cyclones. During the 2018 Pacific Typhoon season, there were a few occasions tropical storms had an indirect influence on the weather in Singapore.

The development of Tropical Storm Ewiniar over the South China Sea in early June triggered widespread thunderstorms over Singapore and the surrounding region on 2 June 2018 and a squall line on 4 June 2018. Around the same time as Tropical Storm Son-Tinh was making landfall, Severe Tropical Storm Ambil started to develop in the western Pacific Ocean, east of the Philippines. Ambil tracked northwestwards and eventually made landfall over China. In addition, tropical depression 13W developed over the South China Sea on 20 July 2018. Under the influence of these three storms during this period, mesoscale convergence of winds was observed in the surrounding region of Singapore. Between 19 and 21 July 2018, squall lines developed to west of Singapore and moved eastwards, bringing about widespread thundery showers across Singapore on three consecutive nights.

Meteorological Services Singapore expanded their automated weather station network, bringing their total automated rain gage network to 100 sites, many of which also monitor other parameters such as wind, pressure, and temperature.

Singapore, along with other Typhoon Committee Members and Indonesia, continues to strongly support the ASEANCOF and SEA RCC-Network. Singapore participated in several training workshops, conferences, and meetings in 2018.

2.3.12 Thailand.

There were 11 tropical cyclones having some effects on rainfall of Thailand from 1 October 2017 to 30 September 2018. Four tropical cyclone affected Thailand during 1 January to 30 September 2018; Tropical Storm Son-tinh in July, Tropical Storm Bebinca in August, and Tropical Storms Mangkhut and Barijat in September. Tropical Storm Bebinca" was the only one tropical cyclone to make landfall in Thailand.

After making landfall in Vietnam and passing over Lao PDR, Bebinca had weakened into a tropical depression as it passed over the northern provinces of Thailand. In particular, widespread rain and pockets of heavy to very rainfall fell over portion of Chiang Rai, Chiang Mai, Phayao, and Nan Provinces. The rainfall produced flash flooding and some landslides. Mangkhut and Barijat produced widespread heavy rainfall even though these tropical cyclones did not track directly over Thailand.

Thailand upgraded their numerical weather prediction system in 2018. The computing capacity upgrades allow TMD to run a 3 nested domain model down to 2km resolution and a high resolution WRF Bangkok model down to 1 km resolution. Thailand continues to contribute toward regional radar composite maps with neighboring Members. TMD also installed the Typhoon Operating System with the assistance of KMA.

2.3.13 United States of America.

30 tropical cyclones entered or formed in the WFO Guam AOR from October 2017 to September 2018. Continuing from the summer of 2017 with weak La Nina/ENSO-neutral conditions, tropical cyclone activity for the rest of 2017 remained slightly below average.

2018 remained under ENSO-neutral conditions through September and as such, tropical cyclone activity has been above average with activity occurring in every month except April. Except for Typhoon Jelawat in March 2018, the remaining tropical cyclones formed farther east and deeper in the tropics than any in the past two years. By mid-August, strong tropical cyclones began to form east of Guam every 7 to 10 days through the end of September. All of these tropical cyclones required watches and warnings for islands in the Marianas (Guam and the CNMI). Of significance, Super Typhoon Maria went over Guam in July as a strong tropical storm and Super Typhoon Mangkhut made a direct hit over Rota as a Category 2 typhoon, producing significant structural and agricultural damage to the island and bringing near typhoon conditions as far south as central Guam. Finally, Super Typhoon Jebi passed just north of the sparsely populated island of Pagan in September as a Category 5 typhoon (140 kts) but was well warned and caused no serious injuries. However, there was considerable destruction to agricultural.

Six tropical cyclones entered into, or formed in, the central North Pacific during the period from 1 January to 30 September 2018. These were Hurricanes Hector, Lane, Miriam, Norman, Olivia, and Walaka. Hurricane Lane passed very close to the main Hawaiian Islands and CPHC issued hurricane and tropical storm warnings for the State of Hawaii. Lane marked the first time the NOAA P-3 hurricane hunters conducted reconnaissance for CPHC. The Tailborne Doppler Radar imagery greatly assisted CPHC specialists in making very accurate track forecasts which verified better than long term averages.

The US continues to expand their Weather Ready Nation initiative by recruiting new WRN Ambassadors in their AOR. WRN Ambassadors act as message amplifiers for NWS products and services, watches, warnings, and advisories.

2.3.14 Vietnam.

In 2018, there were 6 tropical cyclones and 4 tropical depressions in the Bien Dong sea; Bolaven in early 2018, Ewiniar in June, a tropical depression in June, two tropical and Sontinh) in July, Bebinca in August, and Barijat and Mangkhut in September. Three of these tropical cyclones made landfall and produced strong winds of minimum force 6 in coastal areas and/or islands of Vietnam.

Son-Tinh and Bebinca produced the most severe damage in Vietnam. Both tropical cyclones made landfall in the Thanh Hoa Province. During an unusually wet period from June through August 2018, widespread heavy rainfall from these two landfalls contributed to historic flooding over many areas of central and northern Vietnam. Flash flooding and landslides caused many deaths and significant damage to property, livestock, and agricultural areas.

Vietnam continues the provide leadership in the Typhoon Committee region by leading the Severe Weather Forecasting Demonstration Project for Southeast Asia (SWFDP-SeA). In addition to provide 24/7 support of SWFDP-SeA products and services, Vietnam also hosted a training desk to provide direct and hands-on training. Vietnam also volunteered to host the landmark Typhoon Committee 50th Anniversary Annual Session and Technical Conference. These two events were a great success and the Local Organizing Committee should be commended for their tremendous achievement.