ESCAP/WMO Typhoon Committee
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SUMMARY OF MEMBERS' REPORTS 2017

(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 2017.

Action Proposed

The Committee is invited to:

(a) take note of the major progress and issues in meteorology, hydrology and DRR aspects under the Key Result Areas (KRAs) of TC as reported by Members in 2017; and

(b) review the Summary of Members' Reports 2017 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 2017

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 2017 as submitted for the 12th IWS in Jeju, Republic of Koreq, highlighting the key tropical cyclone impacts on Members in 2017 and the major activities undertaken by Members under the various KRAs and components during the year.*

2. *The Committee expressed its appreciation to AWG Chair for preparing the Summary of Members' Reports. It is noted the new KRA and supporting Priorities structure contained developed in the new TC Strategic Plan 2017-2021 caused some confusion in the format of the Member Reports.*

Recommendations of AWG

3. *AWG recommended the Committee to:*

   (a) *Consider the key tropical cyclone impacts on Members in 2017 and review the initiatives to be pursued under the various KRAs and components for mitigating such impacts.*
   (b) *Adopt Section 2.1 of the Summary of Members' Reports 2017 as an "Executive Summary" to be distributed to Members' governments for information and reference.*

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

APPENDIX B:

SUMMARY OF MEMBERS'
REPORTS 2017

Raymond Tanabe (AWG Chair)

The summary is based on Members' Reports as submitted by Members of the Typhoon Committee for the 12th IWS in Jeju, Republic of Korea on 30 October-03 November 2017, details of which can be found in:

http://www.typhooncommittee.org/12IWS/Members12IWS.html

1.   Objectives

1.1   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 with a view to allocating the necessary resources strategically 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 2017

2.1   Overview

        In the Typhoon Committee region covering the western North Pacific and South China Sea, there were 27 named tropical cyclones in 2017, near the long term average of 26. Eleven of these tropical cyclones reached typhoon intensity. Notable in the 2017 season was 8 named tropical cyclones in July, which equaled the highest number of formation in July of 1971 since 1951 when the statistical record started at RSMC Tokyo. Also notable was 4 of these tropical cyclones formed in the South China Sea. These 4 TCs were attributed to high seas surface temperatures and an active MJO phase in the region. La Nina conditions caused a large westward deviation in the mean genesis point during the autumn period from September through November due to higher sea surface temperatures and active convection east of the Philippines.

2.1.1   At the 49th Annual Session in Yokohama, Japan, the Typhoon Committee adopted a new Strategic Plan covering the years 2017-2021. The new plan is closely aligned to the Sendai Global Framework and the existing KRA structure was modified into three distinct parts. At the highest level, two targets were outlined to reduce the mortality rate and direct economic loss caused by typhoon related disasters of Members. Supporting these two targets are 5 KRAs. New to the Strategic Plan is the establishment of 21 Priorities categorized by Working Groups.

2.1.2 Typhoon Committee Strategic Plan 2017-2021

Target 1: Substantially reduce total mortality caused by typhoon-related disasters of the Members in the decade 2020-2030 compared to the period 2005 – 2015.

Target 2: Reduce direct economic loss caused by typhoon-related disasters in relation to the total gross domestic product (GDP) of the Members by 2030.

KRA 1: Enhance capacity to monitor mortality and direct economic loss caused by typhoon-related disasters.
KRA 2: Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings
KRA 3: Improve typhoon-related flood control measures and integrated water resource management.
KRA 4: Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.
KRA 5: Enhance Typhoon Committee's Regional and International collaboration mechanism.

	Priorities
1	Enhance activities to develop impact-based forecast and risk-based warning.
2	Strengthen cross-cutting activities among working groups in the Committee.
3	Enhance collaborative activities with other regional/international frameworks/organizations, including TC and PTC cooperation mechanism.
4	Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.
5	Develop and enhance typhoon analysis and forecast technique from short- to long-term.
6	Enhance and provide typhoon forecast guidance based on NWP including ensembles and weather radar related products, such as QPE/QPF.
7	Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.
8	Strengthen the cooperation with WGH and WGDRR to develop impact-based forecast and risk-based warning.
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	Enhance RSMC capacity to provide regional guidance including storm surge, responding to Member's needs.
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.
12	Enhance capacity in typhoon-related flood risk management (including dam operation), integrated water resources management and flood-water utilization.
13	Enhance capacity in impact-based and community-based operational flood forecasting and early warning, including methodology research, hydrological modeling, and operation system development.
14	Enhance capacity in flood risk (hazard, inundation) information, mapping, and its application.
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.
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.
17	Provide reliable statistics of mortality and direct disaster economic loss caused by typhoon-related disasters for monitoring the targets of the Typhoon Committee.
18	Enhance Members' disaster reduction techniques and management strategies.
19	Evaluate socio-economic benefits of disaster risk reduction for typhoon-related disasters.
20	Promote international cooperation of DRR implementation project.
21	Share experience/know-how of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

2.2 Summary of Members' Reports

2.2.1 **Cambodia.** No Member Report was received by Cambodia for the 2017 typhoon season.

2.2.2 **China.** In 2017, eight tropical cyclones (Merbok, Roke, Nesat, Haitang, Hato, Pakhar, Mawar, and Khanun) affected or made landfall over **China.** Of these 8 tropical cyclones, 6 made landfall in Guangdong. China noted an average landing intensity of 29 m/s, weaker than the average of 32.8 m/s. Tropical cyclones impacted 19 provinces or municipalities, Hato and Khanun produced the largest rainfall impacts with widespread flooding reported in 6 provinces. Strong winds, heavy rainfall, and storm surge from Hato's landfall combined with astronomical high tides, resulting in widespread intrusion of sea and river water into urban areas. While Khanun was weakening as it made landfall in Guandong as a severe tropical storm, widespread rainfall totals of 100-500 mm was reported and a maximum of 1238 mm was reported in Taiwan.

China continues to actively support regional collaboration efforts and hosted several key meetings/activities in 2017, including the 2nd organizing Committee Meeting of EXOTICCA, the TC Research Fellowship, the 10th China-Korea Joint workshop on tropical cyclones, and the CMA International Training Course on Typhoon Monitoring and Forecast.

Finally, thanks to the rapid development of new media in China represented by microblog (Weibo) and WeChat, China's Central Meteorological Observatory worked hard to engage the public using social media platforms and diversified means. As a result of their efforts, there are 850,000 fans for the daily weather forecast, weather disaster warnings, weather conditions, and weather relates scientific knowledge. The microblog win the Award of Top Ten Government Service Cases in 2017.

2.2.3 **DPR Korea.** No Member Report was received by DPR Korea for the 2017 typhoon season.

2.2.4 **Hong Kong, China.** Seven tropical cyclones affected Hong Kong, China in 2017. These tropical cyclones included Severe TS Merbok, TS Roke, Super Typhoon Hato, Severe TS Pakhar, Severe TS Mawar, a tropical depression over the South China Sea, and Severe Typhoon Khanun. Hato necessitated the issuance of the highest tropical cyclone warning signal, the No.10 Hurricane Signal, in Hong Kong, the first time since Severe Typhoon Vicente in 2012. The combination of storm surge and astronomical high tides resulted in saltwater inundation of many low-lying areas. Including Hato, the Gale or Storm Signals were raised five times in 2017 by HKO, a joint record with 1964 and 1999).

With regards to regional cooperation activities, HKO continued to operate the Severe Weather Information Centre (SWIC) and the WMO Tropical Cyclone Forecaster Website on behalf of WMO. HKO in collaboration with the Hong Kong Government Flying Service, continued to undertake dropsonde reconnaissance flights for TCs over the South China Sea in 2017. A total of seven missions were conducted up to October 2017 and the dissemination of dropsonde observations through GTS on a near real-time basis has commenced starting from October 2017.

2.2.5   **Japan.** In 2017, six tropical cyclones (TCs) of tropical storm (TS) intensity or higher had come within 300 km of the Japanese islands as of 2 October. Japan was affected by five of these, with three making landfall. These five included STS Nanmadol, TY Noru, TY Nesat, TY Sanvu, and TY Talim. There were 3 major landfalls (Nanmadol, Noru, and Talim) which caused significant damage and some deaths in Japan.

In January 2017, JMA unified its Typhoon Ensemble Prediction System (TEPS) and One-week EPS (WEPS) to create the Global Ensemble Prediction System (GEPS) with upgraded physics, resolution, and parameterization schemes. The results of experiments performed to evaluate these upgrades showed a positive impact on tropical cyclone (TC) track forecasts over the western North Pacific. Further verification additionally showed better accuracy in TC prediction.

2.2.6   **Lao PDR.** Up to October, Lao PDR was directly affected by four tropical cyclones in 2017, STS Talas, TS Sonca, TY Doksuri, and a Tropical Depression. STS Talas produced landslides, flash floods, and urban flooding across portions of central and northern Lao PDR. TS Sonca affected central and southern provinces with similar impacts. TY Doksuri crossed over central Lao PDR in September. Heavy rain from Doksuri produced widespread flooding and landslides the central and northern regions. Finally, TD 23W produced heavy rain and some flooding in some areas of central and northwestern parts of Lao PDR.

2.2.7   **Macao, China.** 11 tropical cyclones affected Macao, China in 2017, including STS Merbok, TS Roke, TY Hato, STS Pakhar, STS Mawar, TY Doksuri, an unnamed TD, and TY Khanun. Their tracks and periods of hoisting of Tropical Cyclone Signals are shown in Figure 1 and Table 1 respectively. Typhoon Hato, Severe Tropical Storm Pakhar and Typhoon Khanun necessitated the issuance of Signal No.8 or above in Macao.

Typhoon Hato was the strongest of the tropical cyclones which struck Macao in the since 1953, and it was also the first time of hoisting Signal No.10 (Hurricane Wind Signal) by Macao Meteorological and Geophysical Bureau (SMG) in the last 18 years. The maximum mean winds recorded at cross-sea bridge (PS station) was 132 km/h with a record-breaking gusts of 217.4 km/h. Serious flooding were reported in various districts. At the noon, the high tide, together with the storm surge induced by Hato, caused sea levels to rise nearly 3 meters above normal tide levels. A high water level over 2 meters above road had been recorded in the Inner Harbor. During the passage of Hato, 10 people were killed and 47 were injured. Furthermore, a combination of Typhoon Hato and high tides that caused 64 severe flooding in low-lying areas, causing a city-wide blackout, water supply stoppages and telecommunication breakdowns.

2.2.8   **Malaysia.** Two typhoons and five tropical storms, respectively, warranted the issuance of strong wind/rough sea warnings over marine regions under the responsibility of the Malaysian Meteorological Department (MMD). However, none of these typhoons or tropical storms was close enough to directly or indirectly cause significant loss of neither life nor properties within Malaysia. The impacts of typhoons and tropical storms over the Malaysian region were restricted to rainfall events and gusting due to the tail effect of the typhoons and tropical storms. The tail effect is generally responsible for enhancing afternoon convective weather over Malaysia, especially in northern Peninsular Malaysia, Sabah and coastal Sarawak.

Typhoon Doksuri caused heavy rainfall over northern parts of Peninsular Malaysia. The northwesterly wind blew from Bay of Bengal brought moisture across northern peninsular towards the center of Typhoon Doksuri located over southern Vietnam. Heavy and continuous rainfall caused flash flood over Penang and Kedah states and hundreds were evacuated. Preliminary study found that heavy rainfall episode is due to the tail effect of Typhoon Doksuri.

Typhoon Lan had caused heavy and continuous rainfall over Sabah states and Labuan in East Malaysia. Flash flood, landslides, fallen trees and damage houses were reported over Sabah due to heavy rainfall and strong winds. Thousands were evacuated from the affected areas in Sabah and stationed at several relief centers during the period.

Malyasia continues to refine their composite radar maps with some technical assistance from JMA. Processed radar products radar products are disseminated via intranet and internet to the users and clients in the department and public near real- time. Malaysia is participating in an experimental test of radar data sharing along with Japan and Thailand.

2.2.9 **Philippines.** In 2017 only 14 tropical cyclones entered and developed inside the Philippine Area of Responsibility (PAR), 5 were Tropical Depressions, five Tropical Storm, one Severe Tropical Storm (STS) and two Typhoons (TY). There were 5 tropical cyclones which make landfall in the Philippines; TD Auring, TD Crising, TS Doksuri, STS Hato and TS Pakhar.

Of the 15 tropical cyclones that impacted Philippines, only TD Auring caused severe damages to properties and agriculture due to flooding and landslides. After developing east of Mindanao, Auring made landfall in Surigao Del Norte. There were 32 casualties caused by drowning and buried due to landslides. PAGASA issued Flood Bulletins for telemetered River Basin and Flood Advisories for Non-Telemetered River Basin in Luzon and some regions in Visayas and Mindanao during the passage of these tropical cyclones.

PAGASA and KOICA have collaborated in the automation of Flood Early Warning System for Disaster Mitigation in Greater Metro Manila. The issuance of Flood Warning in the Urban and River Flooding will now be easy and fast as well as the warning sounding of siren along the river banks if the water reach critical level. This is the 3rd Early Warning Project of Koica in the Philippines. This project will greatly benefit people living near river banks and creeks because they will be warn immediately about the impending threat of river flooding and can evacuate to safer areas.

2.2.10 **Republic of Korea.** There were no typhoons in the West Sea and the East Sea that could affect the Korean peninsula and the Korean peninsula suffered little damage from typhoons in 2017. However, three typhoons, Nanmadol, Noru, and Talim, moved from the southern sea of Jeju Island to Japan and necessitated severe weather warnings on the jurisdiction area. Strong winds were recorded in Jeju Island and southern part of the Korean peninsula. While Nanmadol and Noru did not make direct landfall on the Korean Peninsula, these typhoon brought heavy rainfall which produced some damage to roads. Oh the positive side, the rain brought benefits to securing dam water storage of over 2.3 billion tons of water.

The Republic of Korea remains very active in regional and international cooperative activities, including seasonal typhoon prediction in the western north Pacific, implementation of the Typhoon Operating System for other Members, supporting various fellowships, conducting workshops, and hosting of the WGH and WGDRR annual meetings.

2.2.11   **Singapore.** During the 2017 Pacific Typhoon season, there were a few occasions in which tropical storms had an indirect influence on the weather in Singapore. For example, Tropical Storm Merbok developed over South China Sea, west of the Philippines on 9 June 2017. It tracked towards the north-northwest while intensifying, and reached peak intensity of 102 km/h on 12 June 2017. On 10 June 2017, a line of thunderstorms developed west of Singapore, and as it moved eastward, the squall brought heavy thundery showers over many areas of Singapore in the night. Singapore recorded a daily total rainfall of 238.2mm of rain that day.

Similarly, a tropical depression which formed over the western Pacific Ocean, east-northeast of Luzon, the Philippines on 20 August 2017 intensified into a typhoon (Typhoon Hato) on 23 August 2017. As Typhoon Hato tracked to the northwest towards Hong Kong, the extension of its rain bands and convergence of winds over Singapore and the surrounding vicinity brought thundery showers mostly over sea areas west of Singapore that day. While thundery showers fell over Singapore in the predawn hours, the showers were not widespread or heavy.

2.2.12   **Thailand.** Three tropical cyclones directly affected Thailand during 1st January to 30th September 2017. They were Tropical Storm, Tropical Storm Sonca, Typhoon Doksuri. These tropical cyclones produced heavy rainfall and flooding across northern provinces of Thailand. Tropical Storm Sonca in particular, persisted as a nearly stationary low pressure cell for over a day and produced maximum daily rainfall amount of 250.8 mm at Amphoe Phang Khon in Sakon Nakhon province on 28th July.

Thailand developed a new Operational Room the meteorologists to use observations, seismic, numerical weather prediction and climate models data in supporting the meteorologists, experts, administrators for making decision on weather forecast such as the very short range, short range, medium range and long range forecast that would be useful to relevant authorities, public and private sectors in data management.

2.2.13   **USA.** A total of 19 tropical cyclones entered or formed in the WFO Guam AOR from October 2016 to September 2017. Being a La-Nina/ENSO-neutral year, the genesis area for most of these stayed well to the west and north of the area. Except for the passage of Super Typhoon Haima (25W) in October 2016 and Super Typhoon Nock-ten (30W) in December 2016, no other tropical storms or typhoons required warnings or watches for any of the 37 island warning points within the WFO Guam area of responsibility during the past year. Two tropical cyclones entered into, or were generated in, the central North Pacific during the period from January 1 through September 30, 2017. These were: Tropical Storm Fernanda, and Tropical Depression Greg. There were no impacts to Hawaii from these two tropical cyclones.

NOAA continues to promote the Weather Ready Nation Ambassador initiative which is an effort to formally recognize NOAA partners who are improving the nation's readiness, responsiveness, and overall resilience against extreme weather, water, and climate events. As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather.

2.2.14   **Viet Nam.** There were eight tropical cyclones which impacted Viet Nam in 2017; STS Talas, TS Sonca, TS Hato, TS Pakhar, TS Doksuri, two TDs, and TS Khanun. Due to effects of tropical storms TALAS, HATO and PAKHAR from the end of July to the end of August, big floods occurred on upper reaches of the Red river system in which flood peaks were recorded above the alert level 3 at some positions.

From the 10th to the 12th of Oct, the combination of tropical depression and easterly winds have caused heavy rainfall of 200-400mm in South of Bac Bo region. As results, historical flood was recorded on Hoang Long river basin and extreme floods were occurred in Thao and Da river basin. In the first time, Hoa Binh reservoir had to open 8 gates for safety reservoir regulation leading to sharp rising of water level in downstream area. Flood and inundation caused terrible damage for many provinces, cities in the North of Viet Nam.

Since early 2017, the disaster situation in Vietnam was very complicated, unusual and extreme for various types of natural disasters such as heavy rain, flooding in the Northern, Southern Central provinces and Central Highlands, the extreme hot weather in the Northern provinces and from Thanh Hoa to Phu Yen, flash floods, landslides in the Northern mountainous provinces, whirlwinds, lightning occurring many places across the country, and especially the No. 10th typhoons hits Ha Tinh - Quang Binh which is the strongest storm in nearly 30 years historical record (since 1990), reach to level 4 of the Level of risk.