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FOR PARTICIPANTS ONLY
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SUMMARY OF MEMBERS' REPORTS 2023

(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 Typhoon Committee (TC) Members with respect to tropical cyclones and related hazards in 2023

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 19 Priorities detailed in the Typhoon Committee Strategic Plan 2022-2026; and
- (b) Review the Summary of Members' Reports 2023 in APPENDIX B with the aim of adopting it as an "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 2023

**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 2023 highlighting the key tropical cyclone impacts on Members in 2023 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 19 Priorities identified in the TC Strategic Plan 2022-2026.*

Recommendations of AWG

3. *Consider the key tropical cyclone impacts on Members in 2023 and review the initiatives and activities to be pursued in support of the 19 TC Priorities to mitigate future impacts.*
4. *Adopt Section 2 of the Summary of Members' Reports 2023 as an "Executive Summary" to be distributed to Members' governments for information and reference.*
5. *Any other text to be included in the Session Report.*

APPENDIX B: SUMMARY OF MEMBERS' REPORTS 2023

T C Lee (AWG Chair)

This document concisely summarizes the key tropical cyclone activity/impacts in the Typhoon Committee region in 2023 and Members' major initiatives supporting the Typhoon Committee Priorities based on Members' Reports submitted for the 18th Integrated Workshop (18th IWS) hosted by ESCAP and TCS and held in the ESCAP - UN Conference Center, Bangkok, Thailand during 28 November – 1 December 2023. For detailed information and interpretation, please refer to the corresponding Member Report in the Member Report Section of the 18th IWS website:

(<https://www.typhooncommittee.org/18IWS/index18IWS.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 2023

2.1 Overview (courtesy of RSMC Tokyo – Typhoon Center)

In 2023, there were 17 named tropical cyclones formed in the western North Pacific and the South China Sea, less than the 30-year average of 25.1 during 1991–2020. Ten out of them reached typhoon intensity, which was also below the 30-year average of 13.3. There were only five named tropical cyclones formed since September, which was well below the normal value of 13.1 and the lowest number since the beginning of statistics. While further investigation is needed to understand the causes of this anomaly, the weaker than normal monsoon trough that extends from the South China Sea to the Philippines in autumn and inactive convective activity in this area could be one of the possible factors.

The mean genesis point of named tropical cyclones in 2023 was 15.1°N and 137.9°E, which showed a southeastward deviation from that of the 30-year average (16.3°N and 135.9°E). This shift of the mean genesis point throughout the year is presumed to be partly associated with the El Niño event which started in spring 2023. The mean duration of tropical cyclones sustaining tropical storm intensity or higher in the year was 6.1 days, longer than that of the 30-year average (5.2 days).

The 2023 tropical cyclone season started with Sanvu (2301) which formed over the sea southwest of the Marshall Islands on 19 April 2023. The last-named tropical cyclone in the year was Jelawat (2317). It formed in December 2023 over the sea east of the Philippines and dissipated west of Mindanao.

2.2 Stepping into the Post COVID-19 era

Since the outbreak of COVID-19 in early 2020, the activities of the Typhoon Committee have been significantly affected by the pandemic with many of the face-to-face events being converted to online or hybrid mode. With the health and travel restrictions of COVID-19 fading away in 2023, the activities of the Typhoon Committee resumed normal in phases during the intersession period of TC55. In 2023, Typhoon Committee Members continued to deliver professional services to protect the community from the impacts of tropical cyclones and extreme weather events. The resurgence of the face-to-face events resumed the important in-person communication which is very useful for Members to exchange views, sharing new ideas, iron out differences and fortify friendship. The annual meeting of WGM, WGH and WGDRR were held face-to-face in China, Japan and ROK respectively. Moreover, with the great effort of ESCAP, TCS and TRCG, the 18th Integrated Workshop/4th TRCG Forum was successfully held in Bangkok, Thailand during 28 November – 1 December 2023 with about 130 participants attended. Training of the Typhoon Committee were also carried out using face-to-face or hybrid approach with satisfactory results, including the forecaster training courses and attachment offered by the China Meteorological Administration (CMA) and Japan Meteorological Agency (JMA).

2.3 Members' initiatives supporting the Priorities of the Typhoon Committee Strategic Plan (2022-2026)

The table below consolidates Members' key initiatives as reported in their respective Member reports submitted for the 18th IWS. The numbers of initiatives are an indication of which Priorities received relatively more emphasis from the initiatives reported by the Members.

WG	No.	Priorities	No. of initiatives
Integrated	1	Strengthen the cooperation between TRCG, WGM, WGH, and WGDRR to develop impact-based forecasts, decision-support and risk-based warning.	20
	2	Strengthen cross-cutting activities among working groups in the Committee.	8
	3	Enhance collaborative activities with other regional/international frameworks/organizations, including technical cooperation between	12

		TC/AP-TCRC and TC/PTC cooperation mechanism.	
Meteorology	4	Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.	20
	5	Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.	19
	6	Enhance and provide typhoon forecast guidance based on NWP including ensembles, weather radar and satellite related products, such as QPE/QPF.	9
	7	Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.	12
	8	Enhance training activities with TRCG, WGH, and WGD RR in accordance with Typhoon Committee forecast competency, knowledge sharing, and exchange of latest development and new techniques.	9
	9	Enhance RSMC capacity to provide regional guidance including storm surge, in response to Member's needs.	1
Hydrology	10	Improve typhoon-related flood (including riverine flood, flash flood, urban flood, and coastal flood) monitoring, data collection and archiving, quality control, transmission, processing, and sharing framework.	10
	11	Enhance capacity in typhoon-related flood risk management (including land-use management, dam operation, etc.) and integrated water resources management and flood-water utilization.	7
	12	Strengthen capacity in effective flood forecasting and impact-based early warning, including hazard mapping and anticipated risk based on methodological and hydrological modelling, and operation system development.	15
	13	Develop capacity in projecting the impacts of climate change, urbanization and other human activities on typhoon-related flood disaster vulnerability and water resource availability.	1
	14	Increase capacity in utilization of advanced science and technology for typhoon-related flood forecasting, early warning, and management.	7
DRR	15	Provide reliable statistics of mortality and direct disaster economic loss caused by typhoon-related disasters for monitoring the targets of the Typhoon Committee.	2
	16	Enhance Members' disaster risk reduction techniques and management strategies.	24
	17	Evaluate socio-economic benefits of disaster risk reduction for typhoon-related disasters.	1
	18	Promote international cooperation of DRR implementation project.	6
	19	Share experience/knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.	13

2.4 Members' activities related to the Early Warnings for All initiative

In echoing the Early Warnings for All (EW4All) initiative of the United Nations, Members are also invited to report the relevance of their activities with the four pillars of EW4All in the Member Report for the 18th IWS. The table below summarizes the number of initiatives addressing the four pillars of EW4All as reported in the Member Reports available for the 18th IWS.

Key Pillars of EW4All (https://public.wmo.int/en/earlywarningsforall)	No. of initiatives
Disaster risk knowledge and management	31
Detection, observation, monitoring, analysis, and forecasting	43
Warning dissemination and communication	28
Preparedness and response capabilities	28

3. Summary of Members' Reports

3.1 Cambodia

No member report was submitted by Cambodia for 2023.

3.2 China

In 2023, seven tropical cyclones affected China and six of them (namely Talim, Doksuri, Saola, Haikui, Koinu and Sanba) made landfall in China. Doksuri was the strongest TC to make landfall over the mainland China this year and the second-strongest to strike Fujian since 1949. After rapidly weakening over land, its remnant circulation moved further north and remained over land for an extended period, bringing extreme rainfall to regions in northern China. Besides, torrential rain associated with Haikui and its remnant affected Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, and Taiwan during 3 to 13 September. Specific areas, including eastern Fujian, central and western Guangdong, southern Guangxi, Hong Kong, and eastern Taiwan, recorded rainfall ranging from 400-902mm. In some places such as eastern Taiwan's Hualien, rainfall exceeded 1100mm. 17 meteorological observation stations in Fujian, Guangdong, Guangxi, and Jiangxi experienced rainfall that exceeded historical September records, with 6 stations surpassing historical records. Shenzhen in Guangdong recorded 7 historical rainfall records for 2hours, 3hours, 6hours, 12hours, 24hours, 48hours, and 72hours since meteorological records began in 1952. In total, about 11.5 million people were affected and there were 12 deaths/missing during the passage of the seven tropical cyclones.

China reported on 8 major initiatives supporting the Typhoon Committee Priorities. They are application and evaluation of AI weather model in tropical cyclone forecast, advances in numerical modeling of tropical cyclones, tropical cyclone observation experiment, collaborative sky observation, applications of Fengyun satellites in tropical cyclone operation and research, improvement of typhoon-related disaster management, tropical cyclone operational skill training in CMA and other advances in tropical cyclone scientific research.

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

In 2023, DPRK was directly impacted by one typhoon (Khanun). Owing to the impact of Khanun, it rained nationwide and there were many disastrous hydro-meteorological events such as torrential rain, strong wind and storm surge in some areas. Gales of 15~19m/s were observed in some areas of KangWon Province including WonSan City and in RakWon County of South HamGyong Province. From 0900UTC on 10 August to 1400UTC on 11August, accumulated rainfall was more than 100mm in some areas on the east sea coast including 337mm in KoSong meteorological station, 231 mm in AnByon meteorological station and 218mm in MumChon meteorological station.

DPRK reported on 4 major initiatives in support of the Typhoon Committee Priorities, including improvements of typhoon forecasting and typhoon information service, activities for reducing typhoon-related disasters and strengthening of regional cooperation.

3.4 Hong Kong, China

In 2023, five tropical cyclones, namely Talim, Doksuri, Saola, Haikui and Koinu, affected Hong Kong, China. Saola necessitated the issuance of the Hurricane Signal No. 10, the highest tropical cyclone warning in Hong Kong. During the passage of Saola, destructive high winds, storm surge and squally heavy rain associated with Saola affected Hong Kong on 1 and 2 September. According to preliminary reports, there were over 3,000 reports of fallen trees, 21 reports of flooding and 2 reports of landslides in Hong Kong. While more than 80 people were injured, there was no fatality in Hong Kong during the passage of Saola. In terms of rainfall, Haikui was the wettest tropical cyclone affecting Hong Kong by far in 2023. A trough of low pressure associated with the remnant of tropical cyclone Haikui brought a record-breaking rainstorm to Hong Kong on 7 and 8 September. During the torrential rain, the Hong Kong Observatory Headquarters registered a record-breaking hourly rainfall of 158.1 mm from 11 p.m. to midnight on 7 September, the highest since records began in 1884. The 2-hour total rainfall of 201.0 mm and 12-hour total rainfall of 605.8 mm recorded at the Observatory Headquarters during this rainstorm also broke their respective records. According to preliminary reports, there were 60 reports of flooding and over 200 reports of landslides. At least two people were killed and more than 140 were injured during the rainstorm.

Hong Kong, China reported on 10 major initiatives in support of the Typhoon Committee Priorities. Notable achievements include the continued effort in conducting tropical cyclone reconnaissance flights in the Hong Kong Flight Information Region and deploying drifting buoys over the South China Sea for tropical cyclone monitoring, development of an automated storm tide forecast system, a new deep learning model for radar and satellite nowcast using generative adversarial network and automation of tropical cyclone position analysis and intensity estimation from satellite images by Artificial Intelligence. Other initiatives are enhancement in public understanding of tropical cyclones and various typhoon hazards, tropical cyclone outlook briefing, enhancements of systems and tools to support tropical cyclone forecast operations, training workshop on public communication and media handling, and the smart flood prevention system.

3.5 Japan

In 2023, 9 tropical cyclones (namely Mawar, Guchol, Khanun, Lan, Damrey, Haikui, Kirogi, Yun-yeung and Koinu) of tropical storm intensity or higher had come within 300 km of the Japanese archipelago and one of them made landfall. Part of the southern Kyushu region, with continuous rain that started prior to the approach of Khanun, received over 1,000mm of rainfall in total, and maximum sustained wind speed of over 50m/s was recorded in part of Okinawa Prefecture. Khanun caused 1 fatality, 7 heavily injured and 90 slightly injured. During the passage of Lan, Some areas of Tottori and other Prefectures observed more than double the amount of monthly average rainfall for August and there were squalls with maximum sustained wind speed of over 30m/s. Lan caused 8 heavily injured and 58 slightly injured. Besides, Yun-yeung caused heavy rain on the Pacific side of Tohoku and Kanto regions. It also brought maximum sustained wind speed of over 30m/s in part of Tokyo and Shizuoka Prefectures. Yun-yeung caused 3 fatalities and 21 slightly injured.

Japan reported on 8 major initiatives in support of Typhoon Committee Priorities. They

are the update of the probability-circle radii for tropical cyclone track forecasts, attachment training in 2023, updates on JMA's numerical weather prediction system, UN 2023 Water Conference, the 12th WGH Annual Meeting, Asian Conference on Disaster Reduction 2022, the Visiting Researchers (VR) Program and the GLocal unique disaster Identifier (GLIDE) system.

3.6 Lao PDR

In 2023, a low-pressure channel associated with a tropical cyclone in the South China Sea passed through northern and central Laos, triggering heavy to very heavy rain in some regions by the end of July. Several days of continuous heavy rain caused flash floods in Xayabuly Province, particularly affecting Ban Sibounhueng and Ban Thenkham which are nestled amidst the mountains. This flash flood resulted in damage to people's properties and livestock on 29 and 31 July. Besides, a low-pressure trough related to a tropical cyclone in the South China Sea brought varying rainfall to northern and central Laos between August and September 2023, leading to widespread flash floods and landslides. The flood damage in Lao PDR in 2023 significantly affected the socio-economic landscape of the country. According to the National Disaster Management Committee, during July to August the devastation spanned 12 provinces, 69 districts, and 590 villages, impacting more than 29,700 households and more than 134,000 people. There were 2 injuries, 12 fatalities, and substantial property damage.

Lao PDR reported on 2 major initiatives in support of Typhoon Committee Priorities, which are the weather forecasting cooperation with KMA and flood risk mapping (CREW Project).

3.7 Macao, China

In 2023, 5 tropical cyclones, namely Talim, Doksuri, Saola, Haikui and Koinu, affected Macao, China. Under the influence of Talim, winds in Macao reached up to 79.6 km/h with maximum gust of 100.8 km/h, necessitating the issuance of the Tropical Cyclone Signal No.8. Furthermore, Talim induced a storm surge in Macao, leading to the issuance of blue storm surge warning. Flooding occurred in low-lying areas, with water levels reaching approximately 0.33m high. Tropical cyclone signal No. 10 was issued for the first time in three years as Saola edged closer to the city shortly after midnight on 2 September. Under the direct impact of Saola, winds in Macao reached up to 106.6 km/h with maximum gust of 147.2 km/h, and the red storm surge warning was issued. Koinu was the third tropical cyclone that necessitated the issuance of TC signal No.8 in 2023. Although Koinu was very close to the territory, the size of its circulation was small and its intensity weakened as it approached the city. Winds in Macao reached up to 57.2 km/h. Furthermore, due to the combined effect of Koinu and the northeast monsoon, heavy showers continued to affect Macao on 9 October. Nearly 300 mm of rainfall was recorded during the passage of Koinu. In total, Talim, Saola and Koinu have caused 5 people injured in Macao.

Macao reported on 7 major initiatives in support of Typhoon Committee Priorities, which are enhancement of public weather service strategy, upgrade of forecast tools and systems, improvement in the "Tropical Cyclone Interdepartmental Video Meeting" mechanism, personnel capacity-building, promotion of the knowledge of meteorology

and disaster risk reduction, annual emergency exercise and public education and promotion among communities and schools.

3.8 Malaysia

The Malaysian Meteorological Department (MET Malaysia) recorded three Typhoons (Mawar, Koinu and Doksuri) and one Severe Tropical Storm (Talim) within its designated area of responsibility (latitudes 0° - 20°N and longitudes 95°E - 130°E) between November 2022 and October 2023. For Mawar, MET Malaysia issued 13 strong wind and rough sea warnings, the highest number of warnings issued during this tropical cyclone season. Most of this year's tropical cyclones have had no significant impact on the weather over Malaysia.

Malaysia reported on 2 major initiatives in support of Typhoon Committee Priorities, which are the verification of the Radar Integrated Nowcasting System (RaINS) during a squall-line event in Malaysia and the Annual Operating Plan for Working Group of Hydrology (AOP6: Flood Risk Watch Project for Live – Saving).

3.9 The Philippines

No member report was submitted by the Philippines for 2023.

3.10 Republic of Korea (ROK).

In 2023, one typhoon, Khanun, influenced the Korean Peninsula and made landfall. Khanun crossed the Korean Peninsula on a northward track, causing heavy rainfall and strong wind damage. From 9 to 10 August, an accumulation of over 200 mm of precipitation was recorded in the southeastern Korean Peninsula. A peak gust of 34.9 m/s was observed at Gadeokdo, located in the southern part of the Korean Peninsula. In particular, along Khanun's northward path after landing, the eastern region recorded the heaviest rainfall in August since observations began in 1968. Nationwide, 361 cases of facility damage were recorded, and 2 casualties occurred. More than 15,000 people were temporarily evacuated.

ROK reported on 12 major initiatives in support of Typhoon Committee Priorities, including improvement of the algorithm for summer typhoon prediction (POP1), deployment of drifting buoys for typhoon forecasts and analysis, development of AI models for tropical cyclone analysis, GEO-KOMPSAT-2A Utilization for Tropical Cyclones (AOP10), construction of hydrological data quality control system in Typhoon Committee members, and the enhancement of flood forecasts and the provision of customized flood information. Other initiatives are the 2023 TRCG Research Fellowship Scheme by KMA, the 13th Korea-China Joint Workshop on Tropical Cyclones, capacity building / knowledge sharing in DRR, set up of early warning and alert system, the 18th Annual Meeting of Typhoon Committee Working Group on Disaster Risk Reduction and information sharing related to DRR.

3.11 Singapore

During the 2023 tropical cyclone season, there were few occasions during which tropical

storms resulted in the convergence of prevailing winds around the surrounding region of Singapore. On 17 July 2023, Talim made landfall over at Guangdong, China, before dissipating on 18 July as it moved further inland. Possibly due to the influence of Talim making landfall, Singapore experienced two spells of widespread heavy thunderstorms on 18 July 2023.

Singapore reported on 6 major initiatives supporting Typhoon Committee Priorities. They are the enhancement of weather observation and remote-sensing network, ASEAN Climate Outlook Forum (ASEANCOF) and Southeast Asia Regional Climate Centre Network (SEA RCC-NETWORK), capability-building programme in Subseasonal-to-Seasonal Predictions for Southeast Asia (S2S-SEA) and Subseasonal-to-Seasonal Southeast Asia Pilot Project (S2S-SEA Pilot Project), collaborations with the National Water Agency, other hydrological achievements and results, and participations in training workshops, conferences, and meetings.

3.12 Thailand

From 1 November 2022 to 31 October 2023, there is no tropical cyclone entering Thailand. However, rainfall in Thailand experienced some effects caused by two tropical cyclones, namely Talim forming in July and the tropical depression in September. Talim resulted in abundant rainfall in upper Thailand, primarily in northern and northeastern parts of Thailand, especially during 17-19 July when heavy to very heavy rainfall was observed in some areas. The highest daily rainfall was 160.0 mm in Chat Trakan, Phitsanulok provinces on 17 July. In the period of 17 - 19 July, Department of Disaster Prevention and Mitigation (DDPM), Thailand reported that Talim caused flooding which affected 2,850 households across 11 districts, 41 subdistricts and 134 villages in 5 provinces including Ranong, Chumphon, Nong Khai, Phayao and Chiang Mai. There were no casualties from this accident.

Thailand reported on 8 major initiatives supporting Typhoon Committee Priorities. They are development and exchange radar composite data, CAP implementation, improvement of Pasak Jolasid Dam operation system, enhancement of the capacity of flood forecasting and early warning system, knowledge enhancement for monitoring weather and developing water management plan, installation of telemeters to collect air quality and weather data, development of the Decision Support System (DSS) and implementation of the Cell Broadcast System (CBS).

3.13 United States of America

The 2023 tropical cyclone season featured near normal activity across the RSMC Honolulu Area of Responsibility (AOR). There were four tropical cyclones which entered the central North Pacific during the period from 1 January through 15 November 2023. Hurricane Dora brought distant but significant impacts to portions of the Hawaiian Islands as it moved east to west across the entire AOR. Dora entered the AOR on 6 August and exited to the RSMC Tokyo AOR on 12 August. Dora spent nearly the entire basin crossing as a major hurricane with winds 110 knots or greater, only weakening to 95 knots as it reached the Dateline and crossed the boundary to RSMC Tokyo's AOR. Dora's preliminary peak intensity was 125 knots on 6 August and again on 9 August. The most significant indirect impact from Dora was a disastrous wildfire which occurred during a

period of very strong winds as Dora passed far to the south of the Hawaiian Islands.

The USA reported on 9 major initiatives supporting Typhoon Committee Priorities, including Weather-Ready Nation Ambassador Program, the annual tropical cyclone exercises, “StormReady” and “TsunamiReady” programs, the Pacific International Training Desk, the resource mobilization during extreme events, the leverage of additional communications for EW4All and various technological improvements and other outreach and education activities.

3.14 Viet Nam

In 2023, there were one tropical depression and one tropical storm directly affected the mainland of Viet Nam. Moreover, Talim though made landfall over China, still caused wind strength of level 6, and gust up to level 8 of the Beaufort scale over the Quang Ninh – Hai Phong coastal area. The tropical depression in September brought wind strength of level 6-7, gust 8-9 over the offshore region of Quang Tri – Quang Ngai, then made landfall in Central Viet Nam. Due to the effect of the ITCZ and this tropical cyclone, heavy rainfall happened over the Northern Delta, Northern Sub-mountainous, North Central and South Central Viet Nam regions during 24 – 28 September. Highest amount was observed at Hóa Thanh (Quảng Bình) 673mm, Dân Hóa 2 (Quảng Bình) 571mm, Hương Trạch 1 (Hà Tĩnh) 517mm Thác Muối (Nghệ An) 528mm, Yên Mỹ (Thanh Hóa) 673mm, Nam Định 433mm, Hương Sơn (Hà Nội) 436mm.

Viet Nam reported on 3 major initiatives supporting Typhoon Committee Priorities, which are Central Data Hub, HPC and forecast supporting system, impact-based forecast and warning services and the Short-range Regional Ensemble Prediction System (SREP-32).