MEMBER REPORT

Republic of the Philippines

ESCAP/WMO Typhoon Committee
20th Integrated Workshop
Macao, China
02-05 December 2025

CONTENTS

I. Overview of the tropical cyclones that have affected or impacted Member's area since the last Committee Session

1. Meteorological Assessment (highlighting forecasting issues/impacts)

Overview

A total of 21 tropical cyclones (TCs) were observed within the Philippine Area of Responsibility (PAR) from 01 January to 21 November 2022 (Fig 1.1). Fifteen of the 21 TCs developed within the PAR. A total of 9 TCs made landfall over the Philippine archipelago - Typhoon EMONG (CO-MAY), Typhoon ISANG (KAJIKI), Severe Tropical Storm MIRASOL (MITAG), Super Typhoon NANDO (RAGASA), Typhoon OPONG (BULAOI), Typhoon PAOLO (MATMO), Severe Tropical Storm RAMIL (FENGSHEN), Typhoon TINO (KALMAEGI), Super Typhoon UWAN (FUNG-WONG). The strongest TC that entered the PAR was Super Typhoon NANDO (RAGASA) with peak intensity of 110 kt (205 km/h) and a minimum central pressure of 905 hPa. This was followed by Super Typhoon UWAN (FUNG-WONG) with peak intensity of 100 kt (185 km/h) and 935 hPa.

In general, majority of the TCs observed within the PAR moved west northwestward or northwestward, the rest are northward moving or recurving TCs.

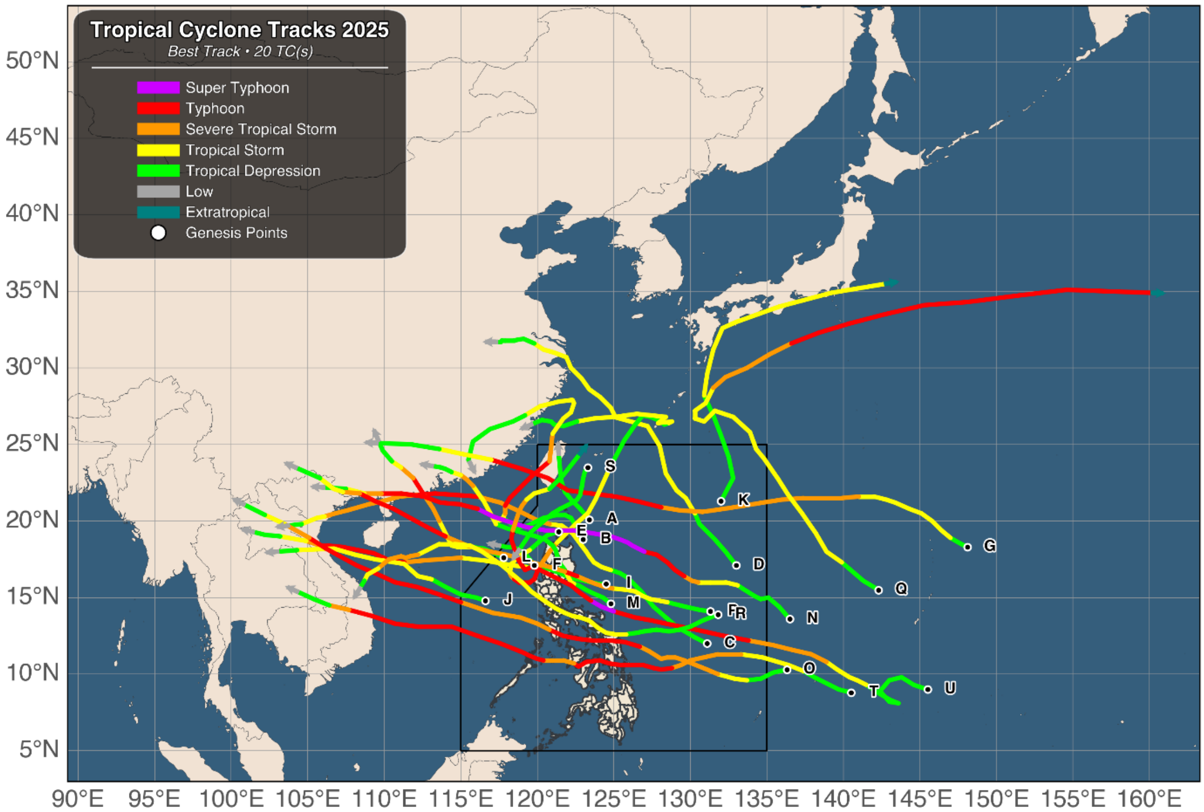

Fig. 1.1 | PAGASA preliminary best track of TCs that entered or developed within the PAR in 2025. The filled circles in the tracks are the genesis points or locations where the TC was first noted as tropical

depression. The tracks are identified using the first letter of the domestic name of the TCs. Line color indicates the category of TC. The black line marks the limits of the PAR.

Near Landfall TC Intensification

For this 2025 season, several TCs exhibited a notable pre-landfall intensification, strengthening to tropical storm or typhoon category within one to six hours before landfall. These were Typhoon EMONG (CO-MAY), Tropical Storm MIRASOL (MITAG), Typhoon OPONG (BULAOI), and Typhoon PAOLO (MATMO).

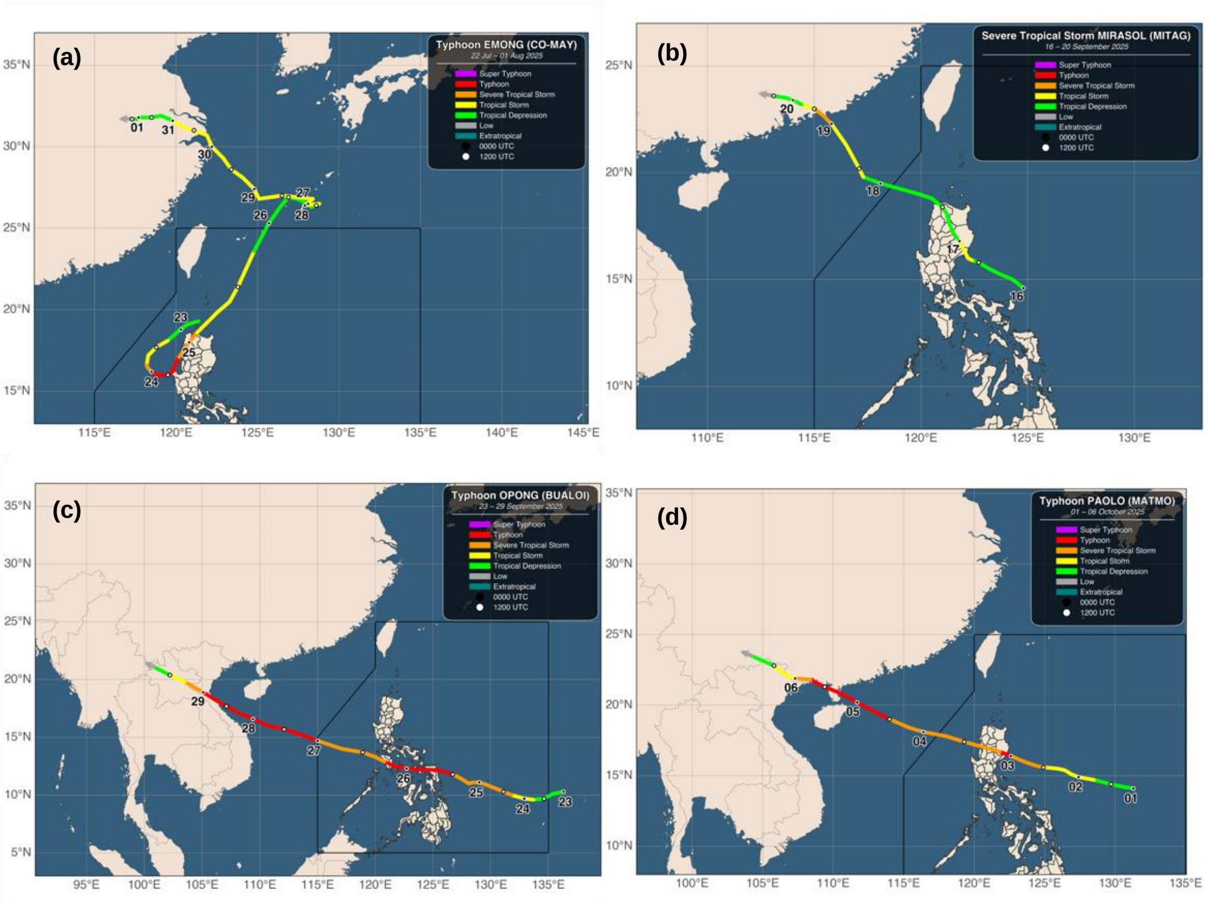

Fig. 1.2 | Preliminary best track positions and intensities (as categories) of **(a)** Typhoon EMONG (CO-MAY), **(b)** Tropical Storm MIRASOL (MITAG), **(c)** Typhoon OPONG (BUALOI), and **(d)** Typhoon PAOLO (MATMO). Line color indicates the category of tropical cyclone. Shaded circles with date labels indicated 00 UTC positions while open circles indicate 12 UTC positions.

EMONG (CO-MAY) (Fig. 1.2a) developed into a tropical depression while over the Luzon Strait on 18 UTC 22 July 2025 and rapidly intensified into a typhoon on 00 UTC 24 July, which triggered hoisting Wind Signal No.4 over the western portions of Northern and Central Luzon. At that time, only the ECMWF model was indicating intensification to a severe tropical storm category. However, with the improving TC structure with microwave eye, PAGASA opted to forecast the peak intensity to typhoon(65 kt). The center of EMONG (CO-MAY) made its initial landfall in Agno, Pangasinan, at 1440 UTC on 24 July and its second landfall in Narvacan, Ilocos Sur, at 22 UTC on 24 July. After these consecutive landfalls, EMONG (CO-MAY) gradually weakened, although it re-intensified into a tropical storm over the southern Ryukyu Islands. Typhoon EMONG (CO-MAY) is notable as the strongest TC to make landfall in the Ilocos Region in 16 years. Historically, only three TCs have made landfall in this region.

MIRASOL (MITAG) (Fig. 1.2b) spawned from an area of low pressure located east of Southern Luzon. This TC moved generally northwestward, except for the mountain range interaction, which caused the TC to move more north northwestward while over the landmass. Based on the preliminary reanalysis, MIRASOL (MITAG) intensified into a tropical storm five hours before its landfall. This analysis is supported by an improved TC structure observed from Baler Doppler Weather Radar.

OPONG (BUALOI) (Fig. 1.2c) developed into a tropical depression while outside PAR and continued to intensify while moving over the Philippine Sea. Based on the preliminary best track analysis, the TC intensified into a typhoon at 12 UTC on 25 September, four hours before its landfall. The preliminary best track intensity is based on the observed radar data from Guiuan and SAR pass. OPONG (BUALOI) moved generally westward over the inland seas of central Philippines and weakened into a severe tropical storm when it made another landfall in southern portion of Oriental Mindoro.

PAOLO (MATMO) (Fig. 1.2d) moved generally west northwestward and made landfall in Casiguran, Aurora at 0110 UTC, 03 October. Almost four hours before its landfall, the TC was upgraded into a typhoon category. Shortly after its landfall, it weakened into a severe tropical storm.

Intensification of TC prior to its landfall is an operational challenge. The model performance during the aforementioned TC cases shows a high uncertainty in forecast intensity, especially near-landfall intensification. These cases highlight the importance of forecasting how TCs rapidly intensify before landfall as this may affect the warning messaging and the preparation for the possible impacts.

TCs with Highly Uncertain Track Forecast

The TC season in 2025 has notable TCs that are challenging to forecast mainly due to the high uncertainty of track prediction of the models. The first example is Typhoon OPONG (BUALOI) (Fig. 1.2c). During the real-time analysis, the models predicted a west northwestward or a northwestward track when it traverses over the central Philippine Sea. However, the observed TC center showed otherwise. On the preliminary best track, it showed a more westward track while passing the areas of Eastern Visayas and Southern Luzon. It is to be noted that this shift happened during nighttime. In the absence of radar data and relying only on the satellite imageries, the true TC center can easily be misinterpreted. Fortunately, the radar data from Guiuan, Laoang, and Masbate provided crucial support in accurately tracking the TC. Among the available models, GFS and AI-based models (specifically theDeepmind) were able to predict the westward track between 25 and 26 September 2025.

The next TC which was the most challenging to forecast the track was Severe Tropical Storm RAMIL (FENGSHEN) (Fig. 1.30. The TC was depicted as highly complex system, with an extremely tilted and disorganized vortex and potentially multiple vortices. Due to the highly-erratic movement of RAMIL, the track forecast was frequently adjusted based on the initial position.

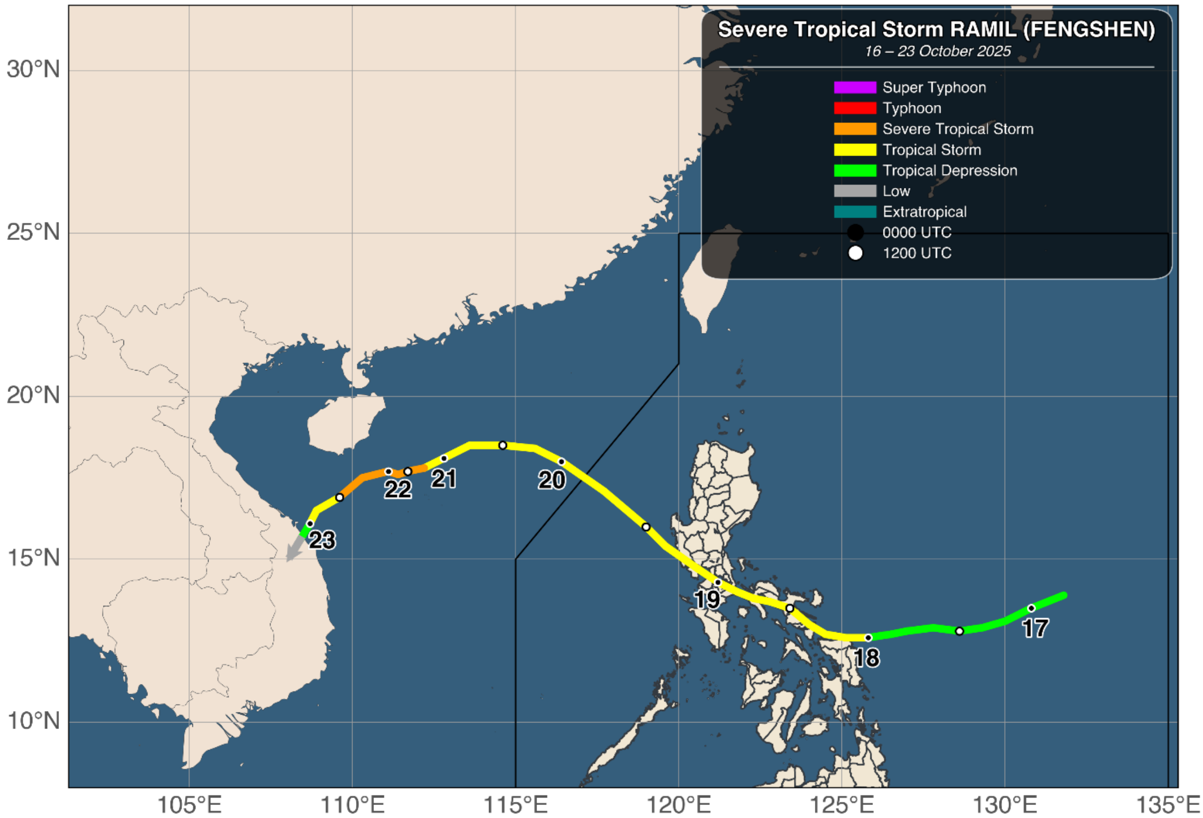

Fig. 1.3 | Preliminary best track positions and intensities (as categories) of Severe Tropical Storm RAMIL (FENGSHEN). Line color indicates the category of tropical cyclone. Shaded circles with date labels indicated 00 UTC positions while open circles indicate 12 UTC positions.

Integrating AI models in TC Track Forecasting

Due to the increasing good performance of the AI models in TC track predictions, the PAGASA typhoon forecasters began incorporating these models in its analysis. One example was Typhoon PAOLO (MATMO) (Fig. 1.2c), in which the deterministic models were suggesting a northward shift of the track before its landfall. However, PAGASA typhoon forecasters maintained the southern Isabela or northern Aurora landfall due to its consideration of the output from the AI models. In Fig. 1.4, it shows the comparison of the track error of PAGASA's TC track forecast and AI-based model forecast for PAOLO (MATMO). It suggests that Deepmind is superior up to 108-hour lead time, although Graphcast has the lowest track error in 72-hour forecast lead time.

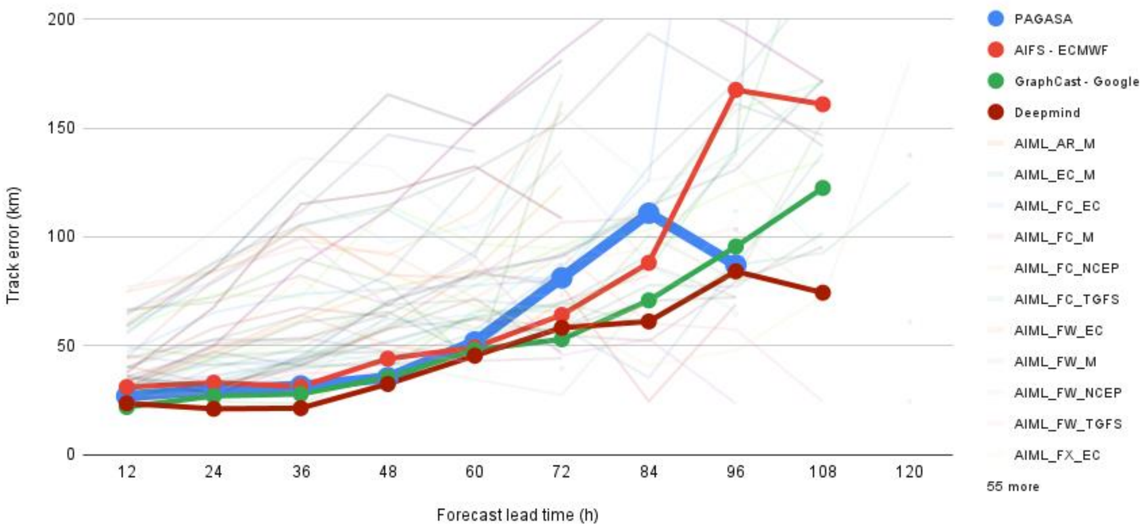

Fig. 1.4 | The tropical cyclone track error of PAOLO (MATMO) for different forecast lead times of forecast tracks from PAGASA and AI.

Interaction of TC with the Southwest Monsoon

The Philippines not only suffered direct impacts from landfalling TCs but also experienced indirect impacts, such as the intensification of the Southwest Monsoon when TCs traverse the seas north of the country. One example was the passage of Typhoon CRISING (WIPHA) (Fig.1.5, right). Although CRISING (WIPHA) is a nonlandfalling TC, it brought heavy rains with accumulated rainfall of at least 100 mm over most of Luzon and the western portions of Visayas and Mindanao (Fig.1.6). The enhancement of the Southwest Monsoon caused a long period of continuous rains in Metro Manila, which resulted in flooding in the metro(Fig 1.7).

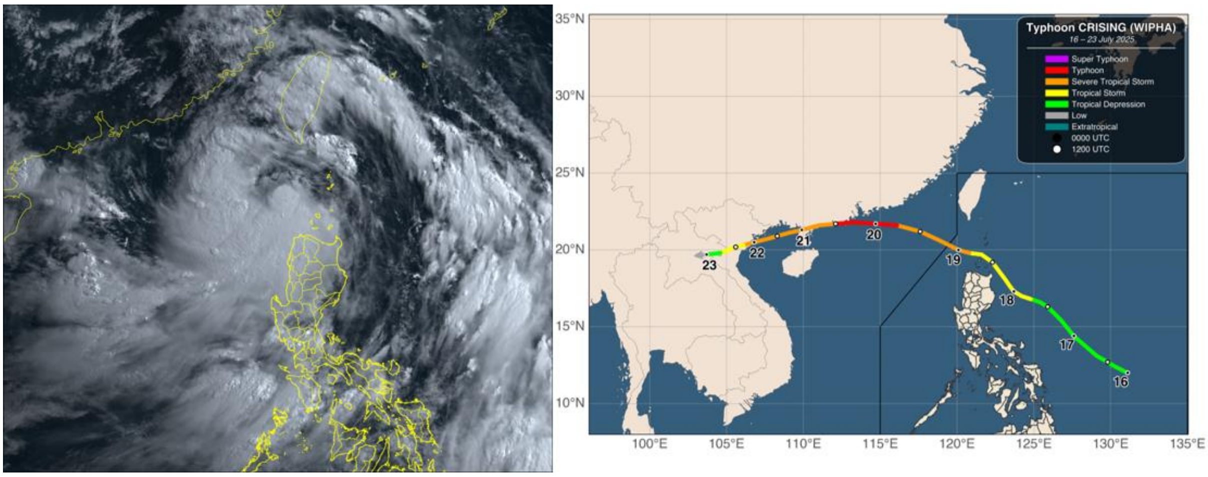

Fig. 1.5 | (Left) Himawari-9 AHI true color RGB of CRISING (WIPHA) at 00 ITC on 19 July 2025, data courtesy of JMA/JAXA. (Right) Same as in Fig 1.3, but for CRISING (WIPHA).

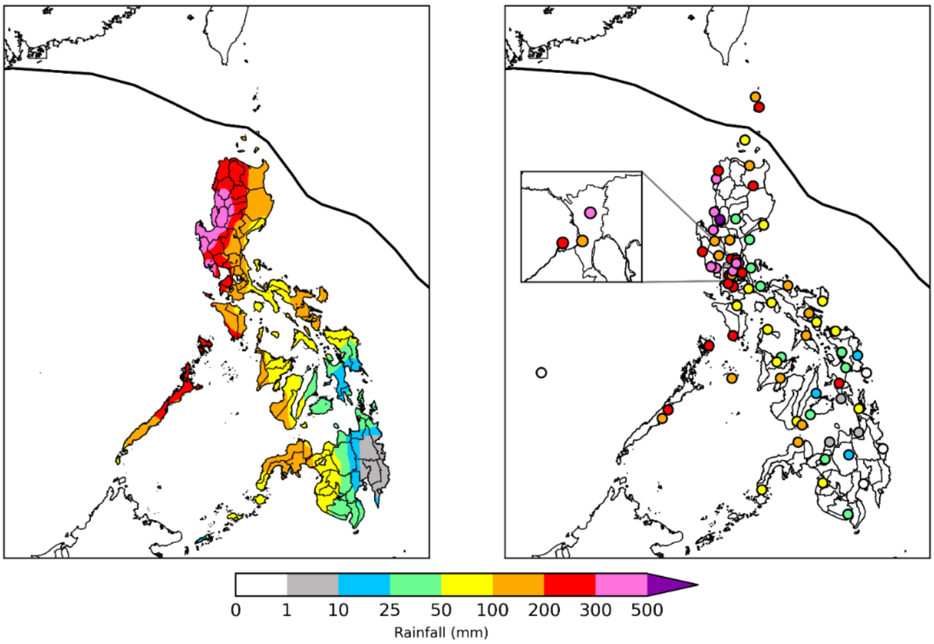

Fig. 1.6 | Nationwide satellite-derived estimates and corresponding gauge observations from PAGASA manned surface weather stations of accumulated rainfall for the period of 16 to 20 July 2025. The preliminary best track is shown as a thick black line.

Fig. 1.7 | Waist deep floods due to continuous pouring of heavy rains in different areas in Metro Manila and Central Luzon.

High-Impact Events due to TCs

Several notable high-impact events happened due to hazards associated by TCs. First was during the passage of Typhoon EMONG, which brought heavy rains and typhoon-force winds particularly in the western portions of Luzon. Heavy rains were further enhanced due to the combined effects of the Southwest Monsoon and the TC. In Fig. 1.8, accumulated rainfall of more than 200 mm was observed in Ilocos Region, Cordillera Administrative Region, most of the portions of Central Luzon and western portion of Southern Luzon. Reported damages in Pangasinan and La Union due to typhoon-force winds are shown in Fig. 1.9.

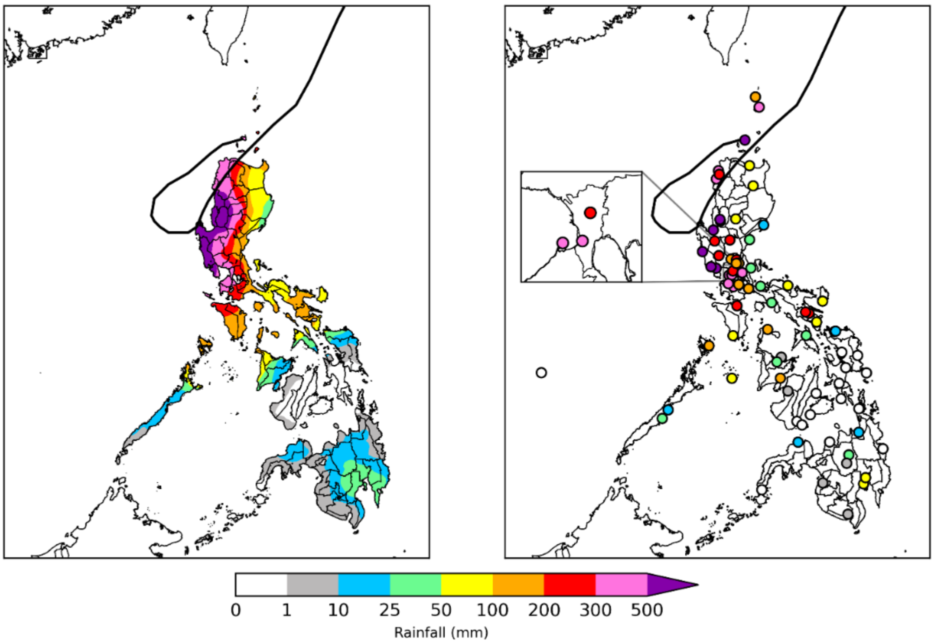

Fig. 1.8 | Same as in Figure 1.6, but the accumulated rainfall for the period of 22 to 30 July 2025 of Typhoon EMONG (CO-MAY).

Fig. 1.9 | Reported impacts during the passage of Typhoon EMONG. Images sourced from publicly news outlets and social media posts.

In September, one of the strongest TCs that affected the Philippines was Super Typhoon NANDO (RAGASA). Most of the heavy rainfall recorded in the western portions of Luzon and Visayas was associated with the enhanced Southwest Monsoon. The accumulated rainfall during the passage of NANDO dumped 100 mm over Luzon and the western portions of Visayas and Mindanao. NANDO traversed over the Luzon Strait, and most of the reported damages were confined to Northern Luzon (Fig. 1.11).

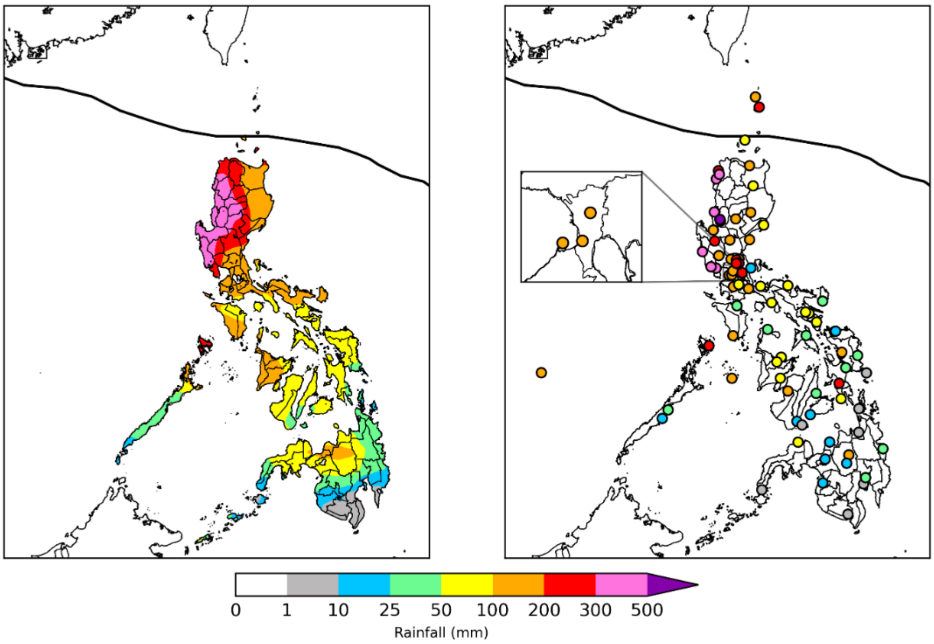

Fig. 1.10 | Same as in Figure 1.6, but the accumulated rainfall for the period of 17 to 24 September 2025 of Super Typhoon NANDO (RAGASA).

Fig. 1.11 | Impacts due to passage of Super Typhoon NANDO (RAGASA) in Calayan, Cagayan. Images sourced from publicly news outlets and social media posts.

The most recent TC that caused massive destruction and casualties was Typhoon TINO. Although TINO brought typhoon-force winds during its passage, most of the reported casualties and damage were caused by heavy rains (Fig. 1.12) that triggered flooding in Central Visayas (Fig. 1.13).

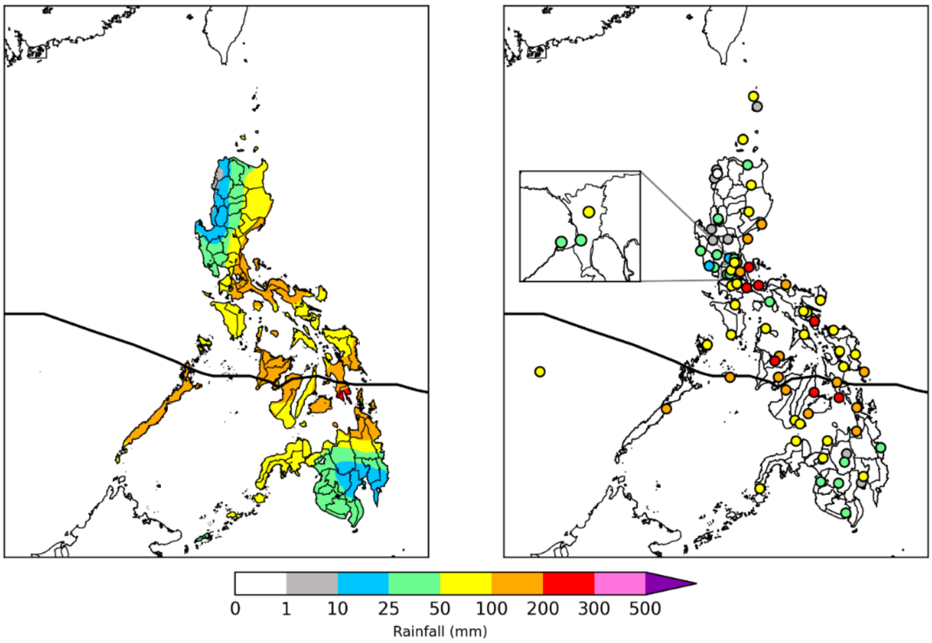

Fig. 1.12 | Same as in Figure 1.6, but the accumulated rainfall for the period of 02 to 07 November 2025 of Typhoon TINO (KALMAEGI).

Fig. 1.13 | Impacts due to passage of Typhoon TINO (KALMAEGI). Images sourced from publicly news outlets and social media posts.

As of the writing of this report, the most recent TC to affect the country was UWAN, which was upgraded to Super Typhoon before its close approach to the Bicol Region. As a result, typhoon-force winds were much felt in Catanduanes. Also, heavy rains (Fig. 1.14) and almost zero visibility were reported in the said area. Furthermore, this TC was exceptionally large, prompting the issuance of a Wind Signal over a vast portion of the country. Due to its close approach to Cataduanes, the land interaction of its rainbands caused the TC to weaken before making its initial landfall in Aurora. Flooding, landslides, and impacts due to storm surge were reported (Fig. 1.15).

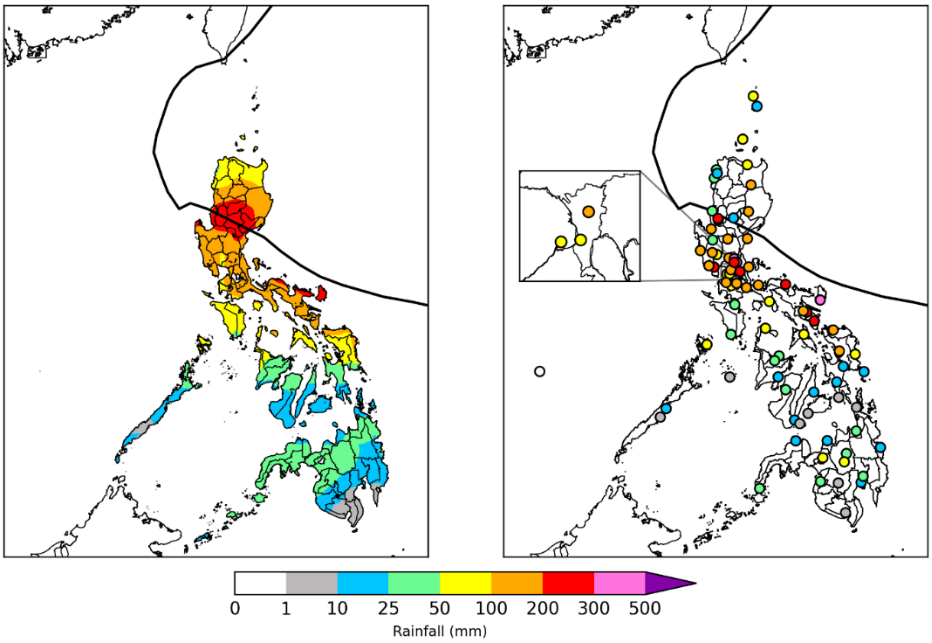

Fig. 1.14 | Same as in Figure 1.6, but the accumulated rainfall for the period of 07 to 12 November 2025 of Super Typhoon UWAN (FUNG-WONG).

Fig. 1.15 | Impacts due to passage of Typhoon UWAN (FUNG-WONG). Images sourced from publicly news outlets and social media posts.

2. Hydrological Assessment (highlighting forecasting issues/impacts)

Typhoon TINO (KALMAEGI) brought intense and widespread rainfall across Central Visayas and nearby regions from 3 to 4 November 2025, triggering significant hydrological responses in major and principal river basins. More than 400 mm of rainfall was recorded in Hinulawan River Basin in Cebu from 3 to 4 November, while rainfall of around 180 mm was observed in other parts of the island, including the Guinsay ARG and Mactan synoptic station on the eastern side of the island where a lot of flash flood incidents were reported. Meanwhile, other areas in Central Visayas, together with the surrounding regions, experienced 100-200 mm of rainfall. It was noted that numerical weather prediction models were mostly able to forecast a similar trend in rainfall for these regions, although rainfall was a bit underestimated in some areas. Within a few hours after experiencing the peak of heavy rainfall associated with TINO (KALMAEGI), several water level stations exhibited a rise in water levels in the following monitored river basins, namely: Agusan, Ilog-Hilabangan, Agus-Iligan-Mandulog, and Jalaur, for a magnitude of up to 1 m for Agusan and Agus river basins to around 4-6 m in Ilog-Hilabangan and Jalaur river basins. The water levels in the river then seemed to recede from a few hours to around half a day after reaching peak levels.

Between 2 and 7 November, PAGASA issued a total of 34 flood advisories and bulletins for nine major river basins, together with 91 General Flood Advisories in 13 regions, including the National Capital Region, while the highest number of GFAs were issued in Central Visayas, Bicol Region, MIMAROPA, CALABARZON, and Central Luzon.

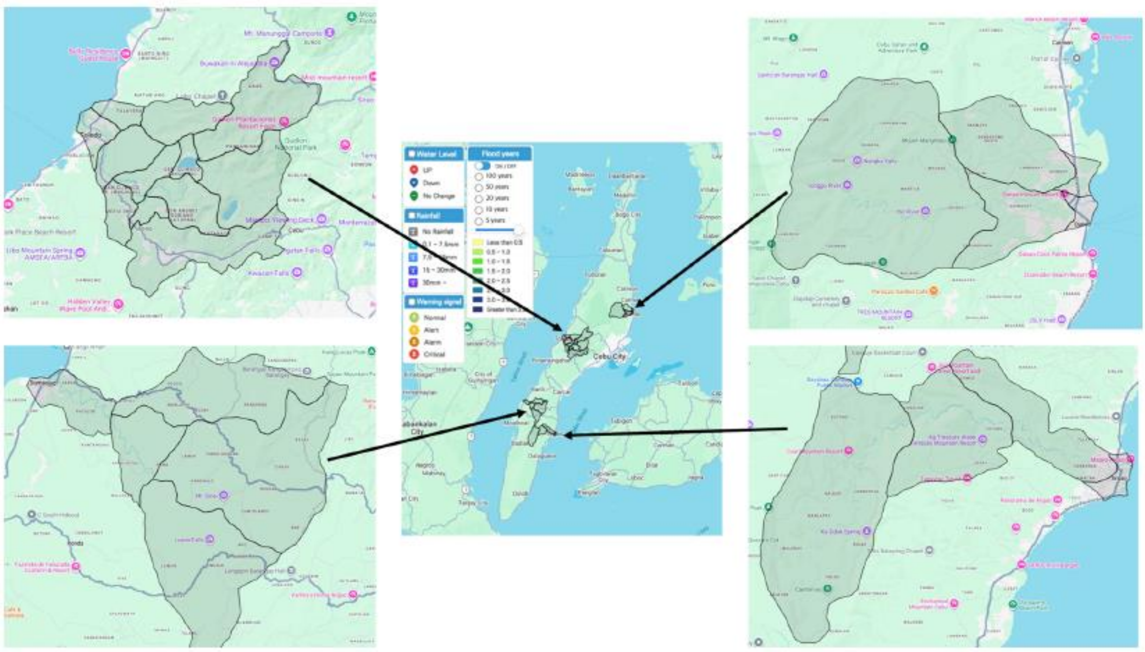

Fig. 2.1 | Locations of principal river basin in Cebu Island.

3. Socio-Economic Assessment (highlighting socio-economic and DRR (issues/impacts)

Based on the official report provided by the National Disaster Risk Reduction and Management Council (NDRRMC), the 21 TCs directly and indirectly (e.g., distant precipitation through monsoon) resulted in 1,131 casualties – 366 dead, 621 injured, and 144 missing individuals. Combined cost of damage to agriculture and infrastructure amounted to PHP 31.9 billion.

Table 1 | Official report of casualties and cost of damages directly and indirectly associated with the TC events in 2025. Data provided by NDRRMC.

TROPICAL CYCLONE NAME	CASUALTIES			COST OF DAMAGE (PHP)			
	Dead	Injured	Missing	Agriculture	Infrastructure	Housing	Total
AURING (UNNAMED)	3	1	0	-	-	50,000	-
BISING (2504 DANAS)	1	0	0	-	12.4M	-	12.4M
CRISING (2506 WIPHA) DANTE (2507 FRANCISCO) EMONG (2508 CO-MAY)	34	29	7	4.9B	16.5B	6.3M	21.4B
FABIAN (UNNAMED)	0	0	0	-	-	-	-
GORIO (2511 PODUL)	0	0	0	-	-	-	-
HUANING (2512 LINGLING)	0	0	0	-	-	-	-
ISANG(2513 KAJIKI)	0	0	0	-	-	-	-
JACINTO (2514 NONGFA)	0	0	0	-	1.0M	10,000	1.0M
KIKO (2515 PEIPAH)	0	0	0	-	-	-	-
LANNIE (2516 TAPAH)	0	0	0	-	-	-	-
MIRASOL (2517 MITAG) NANDO (2518 RAGASA) OPONG (2520 BUALOI)	42	41	14	3.1B	1.9B	20,000	5.0B
PAOLO (2521 MATMO)	0	0	0	105.4M	1.0M	-	106.2M
QUEDAN (2523 NAKRI)	0	0	0	-	-	-	-
RAMIL (2524 FENGSHEN)	7	1	2	11.7M	-	-	11.7M
SALOME (UNNAMED)	0	0	0	-	-	-	-
TINO (2525 KALMAEGI)	253	502	119	562.4M	490.1M	60,000	1.1B
UWAN (2526 FUNG-WONG)	26	47	2	2.1B	2.3B	1.3M	4.4B
TOTAL	**366**	**621**	**144**	**10.7B**	**21.2B**		**31.9B**

4. Regional Cooperation (highlighting regional cooperation and related activities)

None

II. Summary of Progression in Priorities Supporting Key Result Areas

1. Establishment of Integrated Platform for Typhoon Monitoring and Forecasting in the Philippines

Main Text:

This project involves developing and establishing an advanced, integrated platform for monitoring and forecasting typhoons, primarily based on the Typhoon Operation System (TOS) currently operated by the National Typhoon Center (NTC) of the Korea Meteorological Administration (KMA). The overarching goal is the **Strengthening Disaster Risk Management (DRM) and climate change adaptation (CCA) capacity of the Philippines**.

The implementing organization is the **Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)**, and the project is targeted for completion over 48 months (2022–2025). The total budget is US$ 6.0 million, funded by KMA. The project activities are conducted at the PAGASA HQ Weather and Flood Forecasting Center in Quezon City, Metro Manila.

The Integrated Platform for Typhoon Monitoring and Forecasting is fundamentally a TOS-based system. The **TOS (Typhoon Operation System) system** is designed to integrate, store, and manage typhoon forecast and analysis information. It utilizes database management systems to integrate and manage meta information derived from typhoon observations and forecasts.

The system collects various data critical for forecasting, including foreign data, weather satellite data (such as Himawari-8 and GeoKompsat-2A/GK-2A), and domestic observation data. This system enhances forecast reliability and accuracy by integrating diverse auxiliary data—including Numerical Weather Prediction (NWP) data, Satellite data, Observation data (AWSs, Radar), and GTS data—into a single integrated database for efficient forecasting and analysis tasks.

Identified opportunities or challenges, if any, for further development or collaboration:

The project presents significant opportunities for long-term development, alongside specific risks and challenges that must be addressed for success and sustainability:

Opportunities

1. **Enhanced System Integration and Linkage:** A key opportunity for further development lies in focusing on **Software (S/W) design to integrate and link the new platform with existing PAGASA systems**. This maximizes the utilization of current infrastructure and future data sources.

2. **Continuous Capacity Building:** The structure of the capacity building, which includes annual invitational training and long-term expert dispatch, provides a

framework for **sustained technical exchange and application development**. PAGASA officials can learn how KMA utilizes the TOS system in its national weather services.

3. **Regional Cooperation via KMA/NTC:** The project strengthens technical cooperation with the Korea Meteorological Administration (KMA), particularly the National Typhoon Center (NTC), offering a continuous avenue for learning and adopting best practices in typhoon forecasting and operations.

4. **Strengthening Disaster Preparedness:** By improving the reliability and accuracy of forecasts, the platform directly contributes to the country's broader goal of reducing vulnerability to natural disasters and enhancing overall disaster preparedness.

Challenges and Risks

1. **Maintenance and Sustainability:** A major risk identified is the **insufficient utilization of the system or reduction in system operation due to lack of maintenance**. This is linked to the risk factor of **insufficient technicians** or **lack of post-management**. Mitigations require securing budget for maintenance and frequent training to foster technicians and professionals.

2. **Project Implementation Delays:** There is a risk of delay in system establishment due to delayed decision-making. The proposed solution is to implement the TOS after analyzing cases from the typhoon center in Korea.

3. **Effective Trainee Selection:** To avoid unsatisfactory capacity building, there is a challenge in ensuring the selection of trainees who are experts in related fields.

Priority Areas Addressed:

The priority areas addressed align with the following national mandates and plans:

- **Disaster Risk Management (DRM) and Climate Change Adaptation (CCA):** The primary objective is strengthening DRM and CCA capacity. The project supports the government's priority tasks to protect people and properties from natural disasters.

- **The Philippine Development Plan (PDP) 2017–2022:** The project is strongly related to **Part III (Inequality-Reducing Transformation)**, specifically **Chapter 11 (Reducing Vulnerability of Individuals and Families)**, by decreasing exposure to risks and increasing adaptive capacities.

- **National Legislation:** The project supports the goals outlined in the **Philippine Climate Change Act of 2009** and the **Philippine Disaster Risk Reduction and Management Act of 2010 (DRRM Act)**, particularly concerning disaster reduction and prevention, and disaster preparation.

- **National Science and Technology Plan 2002–2020:** It addresses the identified priority sector of **'natural disaster risk reduction'**.

- **PAGASA Modernization Act of 2015:** The project directly contributes to five of the six main goals of the Act, including:

    1. Modernization of Physical Resources and Operational Techniques.
    2. Enhancement of Research and Development Capability.
    3. Establishment of PAGASA Data Center (by creating a single integrated database).
    4. Enhancement of Weather Data Collection and Information Dissemination Services (via the data collection and service subsystems).
    5. The project aims to enable more accurate and timely forecasts, advisories, and warnings, which are essential services for mitigating damage from typhoons

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	✓
Preparedness and response capabilities	

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Discussion with KMA experts and PAGASA personnels.