ANNEX I

MEMBER
REPORT
MALAYSIA

ESCAP/WMO Typhoon Committee

20th Integrated Workshop

Macao, China

02 – 05 December 2025

CONTENTS

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

1. Meteorological Assessment

MET Malaysia monitors and issues tropical cyclone (TC) advisories or warnings within the red boundary shown on the map in **Figure 1**. This region includes the South China Sea (SCS), parts of the Western Pacific, and areas surrounding Peninsular and East Malaysia. While Malaysia is not typically subject to direct cyclone landfalls, systems passing through this area can cause indirect impacts such as strong winds, heavy rainfall, flooding and disruption marine activities. From October 2024 to October 2025, a total of 32 TCs were recorded, comprising 17 Typhoons (Ty), 6 Severe Tropical Storms (STS), and 9 Tropical Storms (TS). Nineteen (19) TCs occurred within MET Malaysia's area of responsibility, which spans latitudes from 0° to 20°N and longitudes from 95° to 130°E. They were STS Trami, Ty Kongrey, Ty Man-yi, Ty Toraji, Ty Man-yi, Ty Usagi, TS Pabuk, STS Wutip, Ty Danas, Ty Wipha, STS Co-may, Ty Kajiki, TS Nongfa, Ty Tapah, TS Mitag, Ty Ragasa, Ty Bualoi, Ty Matmo and STS Fengshen. The TC tracks were derived using the latest data from the RSMC Tokyo Best Track dataset and International Best Track Archive for Climate Stewardship (IBTrACS). MET Malaysia also monitors weather conditions in sea areas and issuing maritime warnings within 24 nautical miles (~45km) from the Malaysian coastline and shipping areas especially when the tropical cyclones are in the vicinity of the region as shown in **Figure 2**. The maritime warning system is divided into three levels based on severity. The first level (yellow category) is issued with wind speeds from 40-50 kmph and/or rough seas with wave heights of up to 3.5 meters. The second level (orange category) applies when strong winds with wind speeds of 50-60 kmph and/or rough seas with wave heights of up to 4.5 meters. The most severe, third level (red category) is issued when strong winds with speeds exceeding 60 kmph and/or rough seas with wave heights exceeded 4.5 meters. The areas of Malaysian waters affected by tropical cyclones between October 2024 and October 2025 are listed in **Table 1.** During TS Pabuk, MET Malaysia issued nineteen (19) strong wind and rough sea warnings, which are the highest number of warnings issued in these tropical cyclones season. Westerly wind speeds of 50 - 60 km/h and/or rough seas with wave heights of up to 4.5 meters were observed in some parts of Malaysian waters during these TS events. The highest significant rainfall during TS Pabuk was recorded at nearly 120 mm.

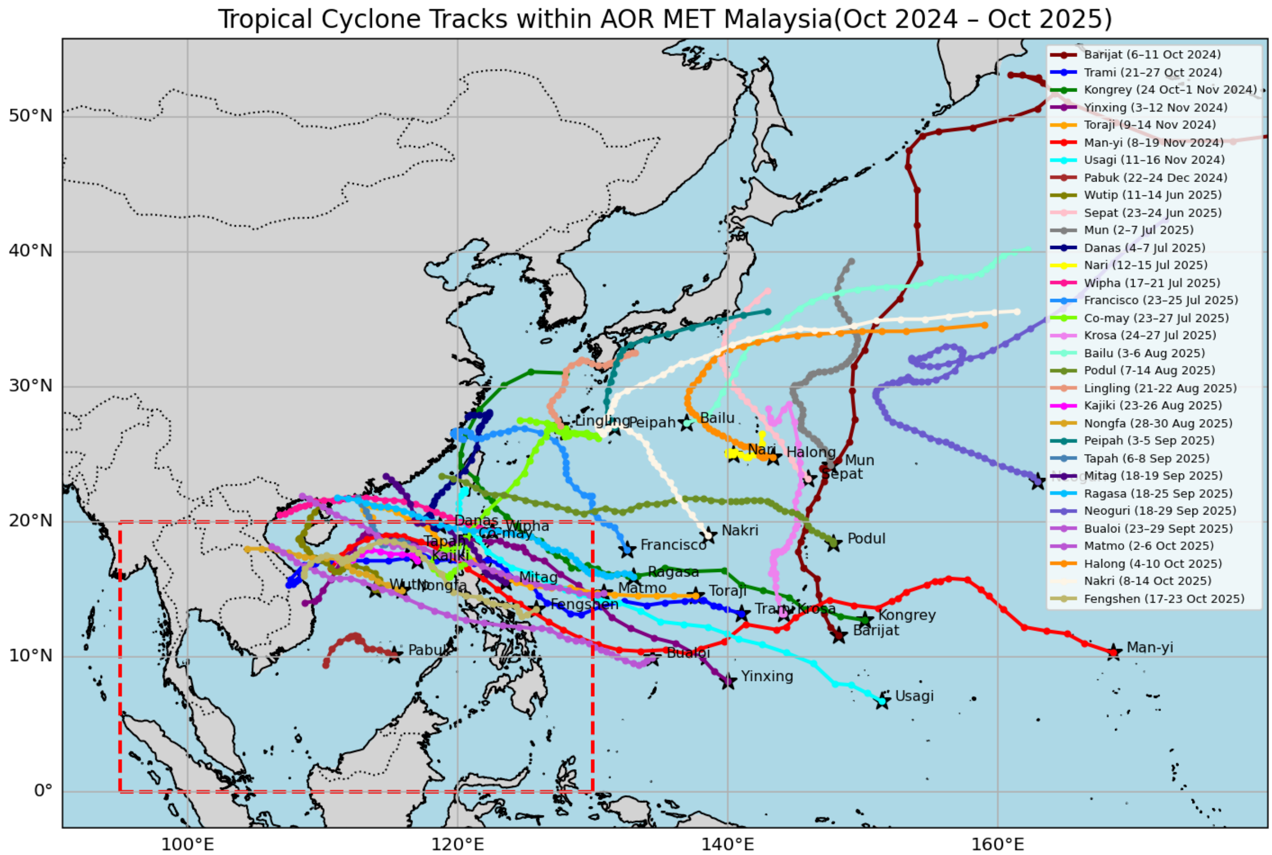


Figure 1: TC track occurred within the area of responsibility for MET Malaysia

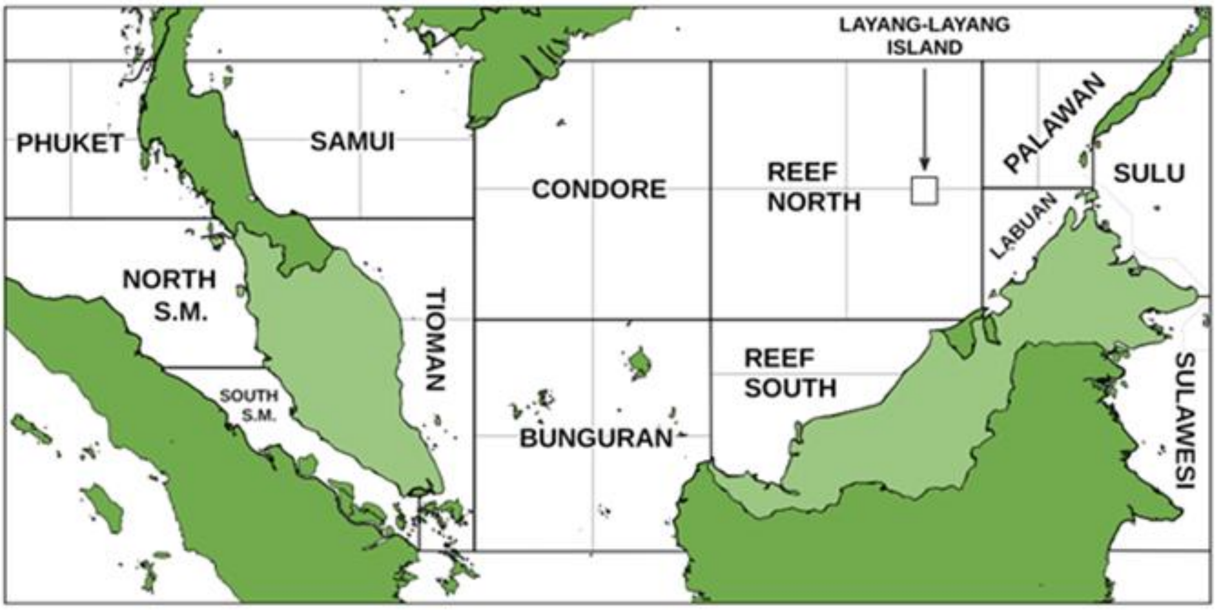


Figure 2: National Waters and Shipping Monitoring Area

Table 1: Total Number of Areas Affected in Malaysia due to Tropical Cyclones between October 2024 and October 2025

No.	Tropical Cyclone (TC)	Class	MWS (kt)	Date		Strong Wind / Rough Seas Warnings due to Tropical Cyclones (area affected)
				Birth	Dissipation	
1	Barijat	TS	45	6/10/2024	11/10/2024	-
2	**Trami**	STS	60	21/10/2024	27/10/2024	(6) eastern part of Condore • Reef North • Layang-Layang • Labuan • Palawan • Sulu
3	**Kongrey**	Ty	100	24/10/2024	1/11/2024	(6) eastern part of Condore • Reef North • Layang-Layang • Labuan • Palawan • Sulu
4	**Yinxing**	Ty	100	3/11/2024	12/11/2024	(3) Northern and southern part of Condore • northern part of Reef North • Layang-Layang
5	**Toraji**	Ty	70	9/11/2024	14/11/2024	(3) Northern and southern part of Condore • northern part of Reef North • Layang-Layang
6	**Man-yi**	Ty	105	8/11/2024	19/11/2024	(3) Northern and southern part of Condore • northern part of Reef North • Layang-Layang
7	**Usagi**	Ty	95	11/11/2024	16/11/2024	(3) Northern and southern part of Condore • northern part of Reef North • Layang-Layang
8	**Pabuk**	TS	35	22/12/2024	24/12/2024	(19) waters of Condore • northern part of Bunguran • Reef North • Reef South • Layang-Layang • eastern part of Samui • Tioman • southern part of Bunguran • Labuan • Palawan • Sulu • waters of Sarawak waters of East Johor • Pahang • Terengganu • Kelantan • Western Sabah • Labuan

9	**Wutip**	STS	60	11/6/2025	14/6/2025	(10) Northern Straits of Melaka • northern part of Samui • western part of Condore • northern part of Reef South • southern part of Phuket • southern part of Reef North • Layang-Layang • Labuan • Sulu • Palawan
10	Sepat	TS	35	23/6/2025	24/6/2025	(2) waters of Northern Straits of Melaka • waters of Phuket
11	Mun	STS	50	2/7/2025	8/7/2025	(5) waters of Phuket • waters of northern part of Condore • northern part of Reef North • Layang-Layang • western part of Palawan
12	**Danas**	Ty	65	4/7/2025	9/7/2025	(5) waters of Phuket • waters of northern part of Condore • northern part of Reef North • Layang-Layang • western part of Palawan
13	Nari	STS	50	12/7/2025	15/7/2025	(5) northeastern part of Condore • northern part of Reef North • Layang-Layang • Palawan • waters of Phuket
14	**Wipha**	Ty	60	17/7/2025	22/7/2025	(9) waters of Phuket • northern part of Reef North • Palawan • waters of Northern Straits of Melaka • northern part of Condore • southern part of Reef North • Layang-Layang • Labuan • Sulu
15	Francisco	TS	40	23/7/2025	25/7/2025	(7) waters of northern part of Reef North • Palawan • Northern Straits of Melaka • waters of Phuket • northern part of Condore • Layang-Layang • Sulu

16	**Co-may**	STS	50	23/7/2025	31/7/2025	(7) waters of northern part of Reef North • Palawan • Northern Straits of Melaka • waters of Phuket • northern part of Condore • Layang-Layang • Sulu
17	Krosa	Ty	75	24/7/2025	31/7/2025	(7) waters of Phuket • northern part of Reef North • Palawan • waters of Northern Straits of Melaka • northern part of Condore • Layang-Layang • Sulu
18	Bailu	TS	35	3/8/2025	6/8/2025	-
19	Podul	Ty	65	7/8/2025	14/8/2025	-
20	Lingling	TS	40	21/8/2025	22/8/2025	(4) waters of Phuket • northern part of Reef North • Layang-Layang • Palawan
21	**Kajiki**	Ty	80	23/8/2025	26/8/2025	(10) waters of Phuket • northern part of Reef North • Layang-Layang • Palawan • northern part of Samui • northern part of Condore • northwestern and southeastern parts of Reef North • Layang-Layang • Labuan • Sulu
22	**Nongfa**	TS	40	28/8/2025	30/8/2025	(9) waters of Phuket • northern part of Reef North • Palawan • waters of Northern Straits of Melaka • northern part of Samui • northern part of Condore • southern part of Reef North • Layang-Layang • Labuan
23	Peipah	TS	45	3/9/2025	5/9/2025	(3) waters of Phuket • Northern Straits of Melaka •

24	**Tapah**	Ty	65	6/9/2025	8/9/2025	(3) waters of Phuket • Northern Straits of Melaka
25	**Mitag**	TS	45	18/9/2025	19/9/2025	(3) waters of Phuket • northern part of Reef North • Palawan
26	**Ragasa**	Ty	110	18/9/2025	25/9/2025	(4) southern part of Phuket • northeastern part of Condore • northern part of Reef North • Palawan
27	Neoguri	Ty	105	18/9/2025	29/9/2025	(4) southern part of Phuket • northeastern part of Condore • northern part of Reef North • Palawan
28	**Bualoi**	Ty	75	23/9/2025	29/9/2025	(4) northeastern part of Condore • northern part of Reef North • Palawan • northern part of Phuket
29	**Matmo**	Ty	70	2/10/2025	6/10/2025	-
30	Halong	Ty	100	4/10/2025	10/10/2025	(1) waters of southern part of Condore
31	Nakri	Ty	70	8/10/2025	14/10/2025	(1) waters of southern part of Condore
32	**Fengshen**	STS	55	17/10/2025	23/10/2025	(2) southern part of Condore, waters of Phuket

Note: *TCs in bold indicate those located within Malaysia's Area of Responsibility (AOR)*

The tracks of tropical cyclones between October 2024 and October 2025 are shown in **Figure 3**. These tropical cyclones tracked within the MET Malaysia area of responsibility. The tracks were classified by intensity, with color codes representing storm categories which green for TS, yellow for STS and red for Ty. The positions of tropical cyclone tracks within Malaysia's monitoring area indicate that 3 TCs which are Trami, Man-yi, and Pabuk had an impact on rainfall in several parts of Malaysia.

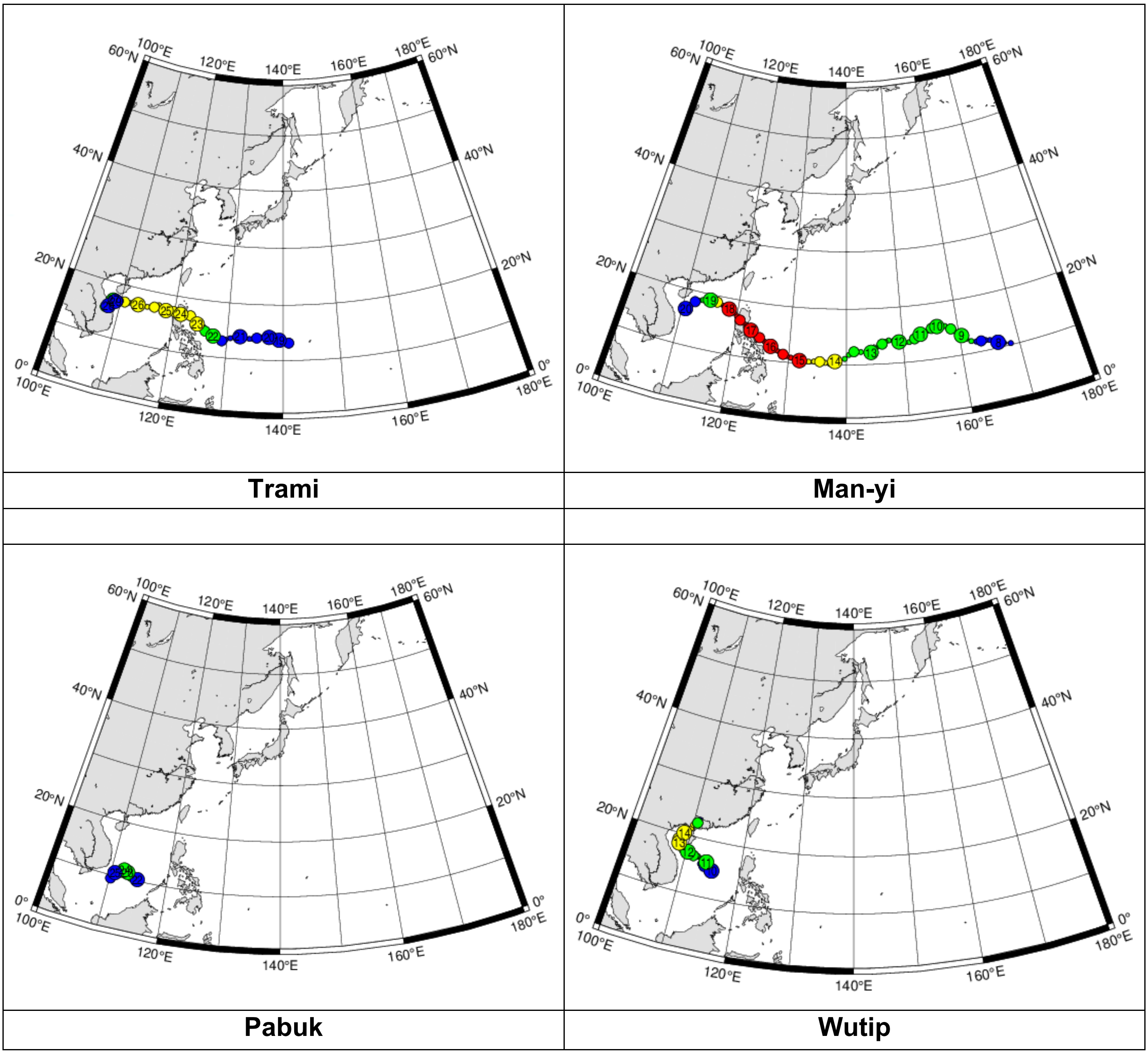


Figure 3: Tracks of four Tys and TS within Malaysia's area of responsibility from December 2024 until October 2025. The circled numbers represent the date of occurrence of the TYs and TSs (Source: National Institute of Informatics (NII), Research Organization of Information and Systems (ROIS), Japan http://agora.ex.nii.ac.jp/digital-typhoon/latest/track).

The 850hPa wind circulation derived from the ERA-5 dataset during the passage of tropical cyclones is illustrated in **Figure 4**. The wind field exhibited a predominantly westerly flow across Peninsular Malaysia, influenced by the cyclonic circulation of TC Trami over the western Pacific, east of the Philippines. Stronger wind speeds were observed over the northern tip of Sabah. The wind flow over Peninsular Malaysia shows a dominant northeasterly flow, consistent with the onset of the Northeast Monsoon as shown in TC Man-yi and Pabuk. The enhanced wind convergence near the eastern coast influenced by a nearby tropical system, may contribute to increased moisture transport and rainfall activity across the region. Southwesterly winds dominate the region, curving into the cyclonic circulation associated with TC Wutip.

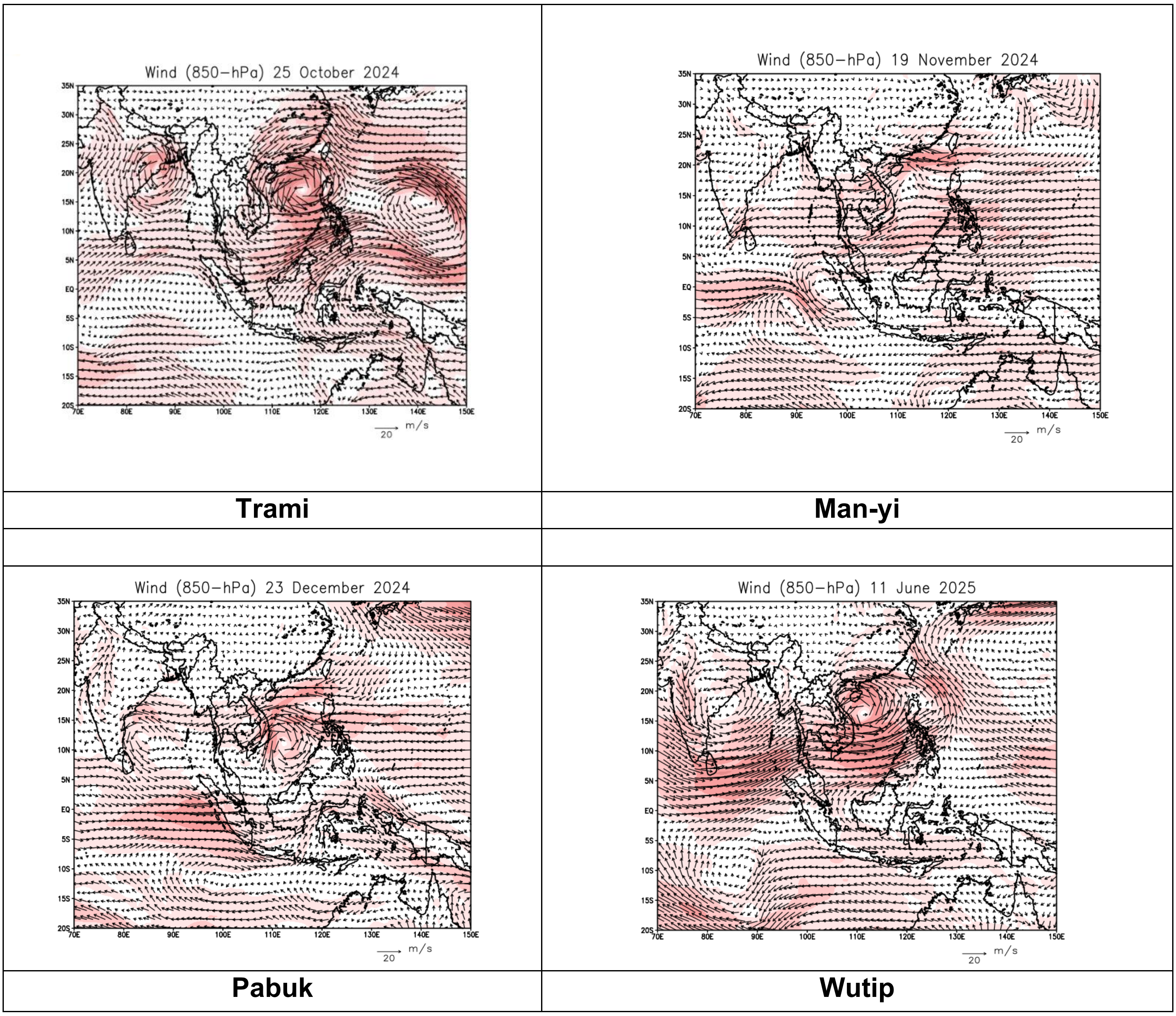
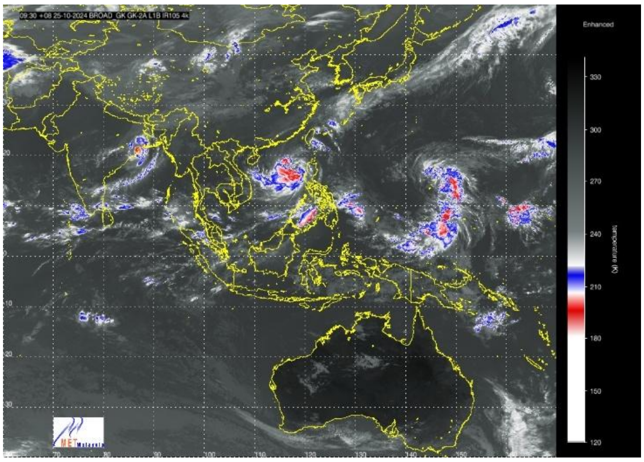
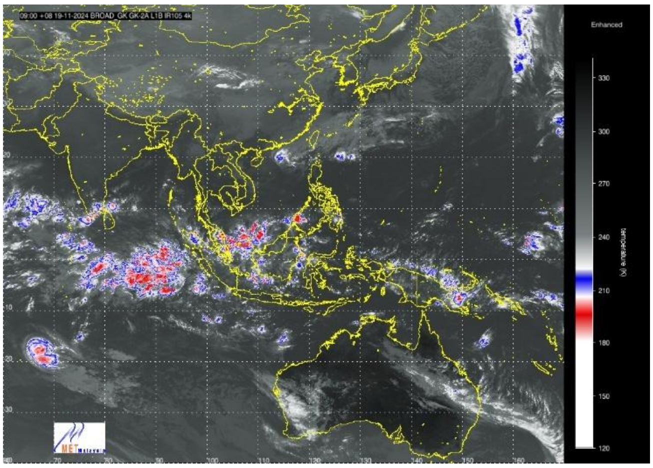


Figure 4: 850hPa wind circulation derived from the ERA-5 dataset during the passage of the four tropical cyclones within Malaysia's area of responsibility.

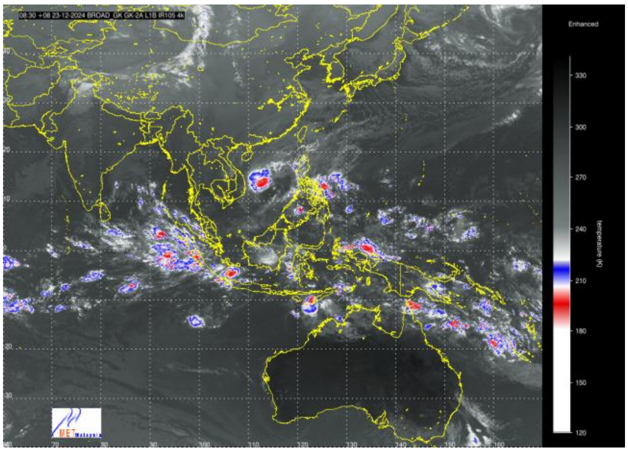
Figure 5 shows Himawari satellite imagery during the presence of tropical cyclones Trami, Man-yi, Pabuk and Wutip. Among the tropical cyclones observed, only TC Man-yi contributed to significant rainfall in Malaysia, whereas the others had only distant effects on the country's weather.



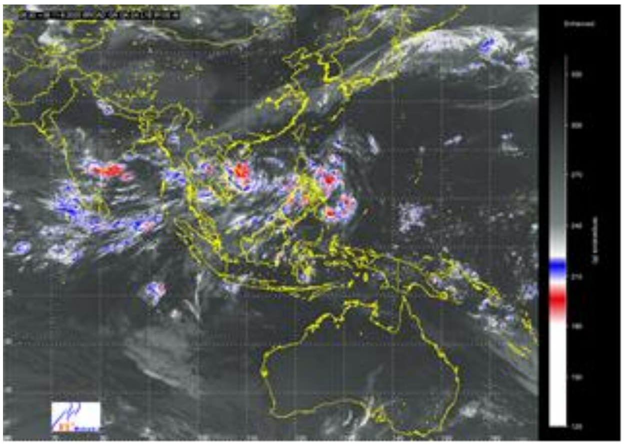
Trami (25 October 2024, 0540 UTC)



Man-yi (19 November 2024, 0100UTC)



Pabuk (23 December 2024, 0100 UTC)



Wutip (11 June 2025, 2000UTC)

Figure 5: GK-2A satellite imageries of tropical cyclones that affected the Malaysian region.

Figures 6 to 11 respectively show the daily accumulated rainfall of the main meteorological stations over Malaysia during each of the tropical cyclone occurrences. The rainfall data indicated that only the Kudat station recorded nearly 100 mm of rainfall during the passage of STS Trami and Typhoon Kong-rey. The highest recorded rainfall indicating a heavy rainfall event occurred during TC Man-yi, exceeding 200 mm on 19 November. While the Kerteh station recorded nearly 120 mm during TS Pabuk. Meanwhile, the daily rainfall in June 2025 showed that most stations recorded less than 100 mm. In conclusion, during the Northeast Monsoon season (November–March), heavy rainfall in Malaysia was associated only with TC Man-yi on 19 November 2024, while TC Pabuk, which occurred on 22 December 2024, was the only tropical cyclone that coincided with a monsoon surge event.

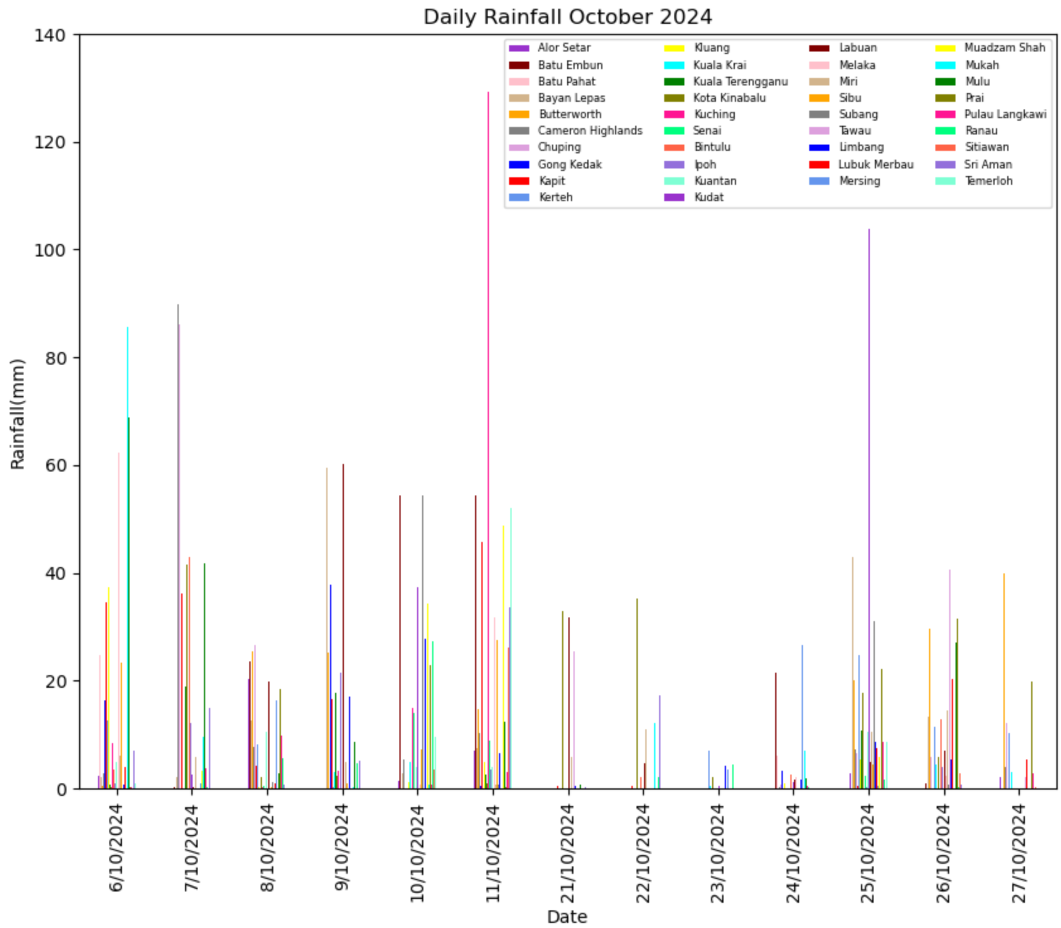


Figure 6: Daily rainfall during October 2024 for STS Trami (21/10/2024 - 27/10/2024) and Ty Kongrey (24/10/2024 – 1/11/2024)

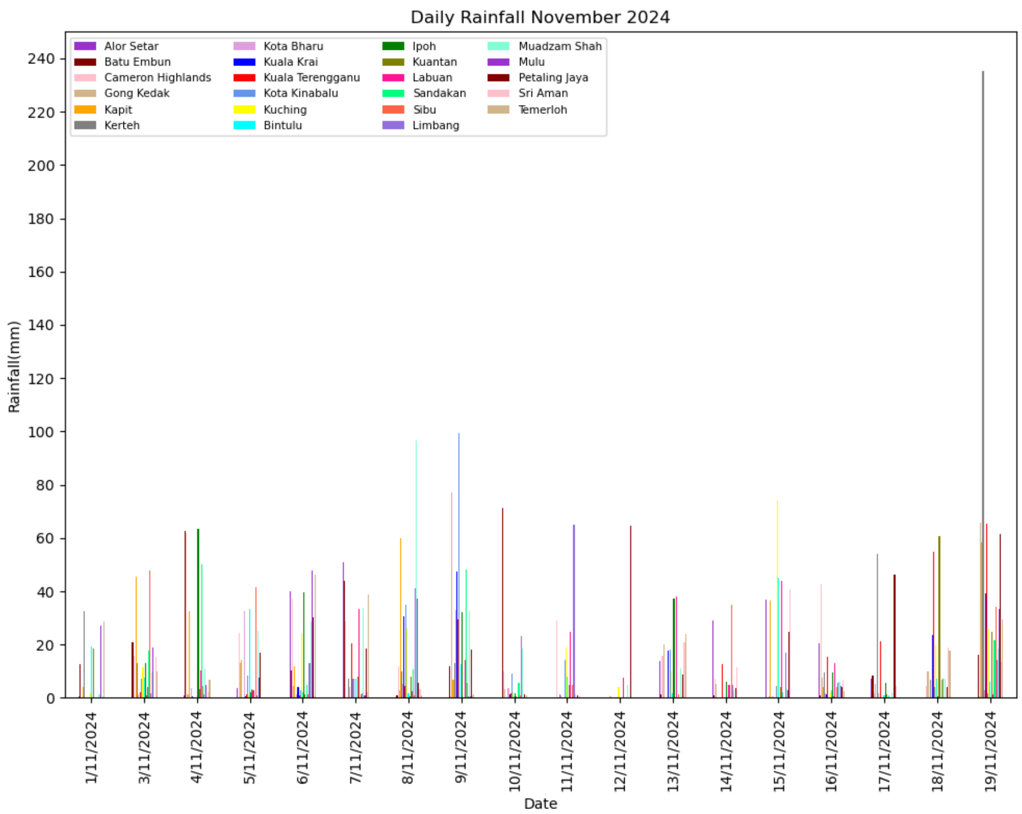


Figure 7: Daily rainfall during November 2024 for Ty Yinxing (3/11/2024 – 12/11/2024), Ty Toraji (9/11/2024 – 14/11/2024), Ty Man-yi (8/11/2024 – 19/11/2024) and Ty Usagi (11/11/24 – 16/11/2024)

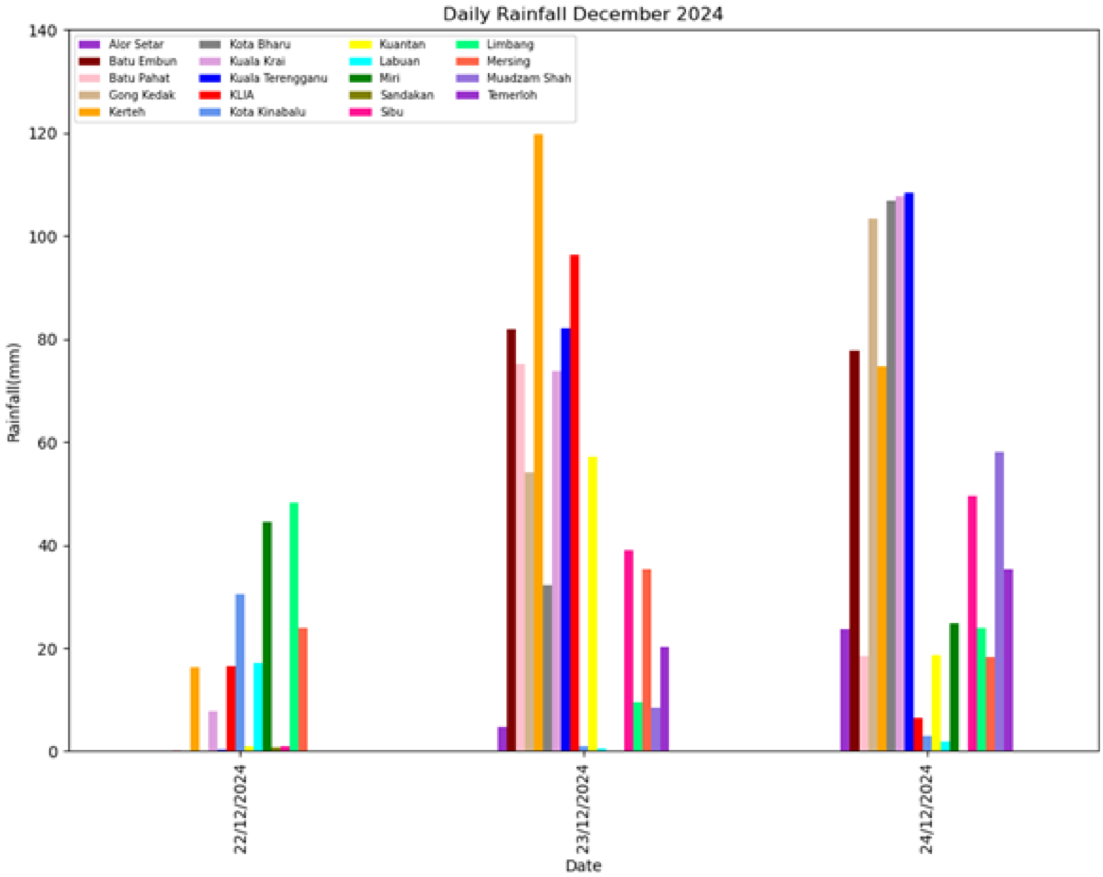


Figure 8: Daily rainfall during December 2024 for TS Pabuk (22/12/2024 - 24/12/2024)

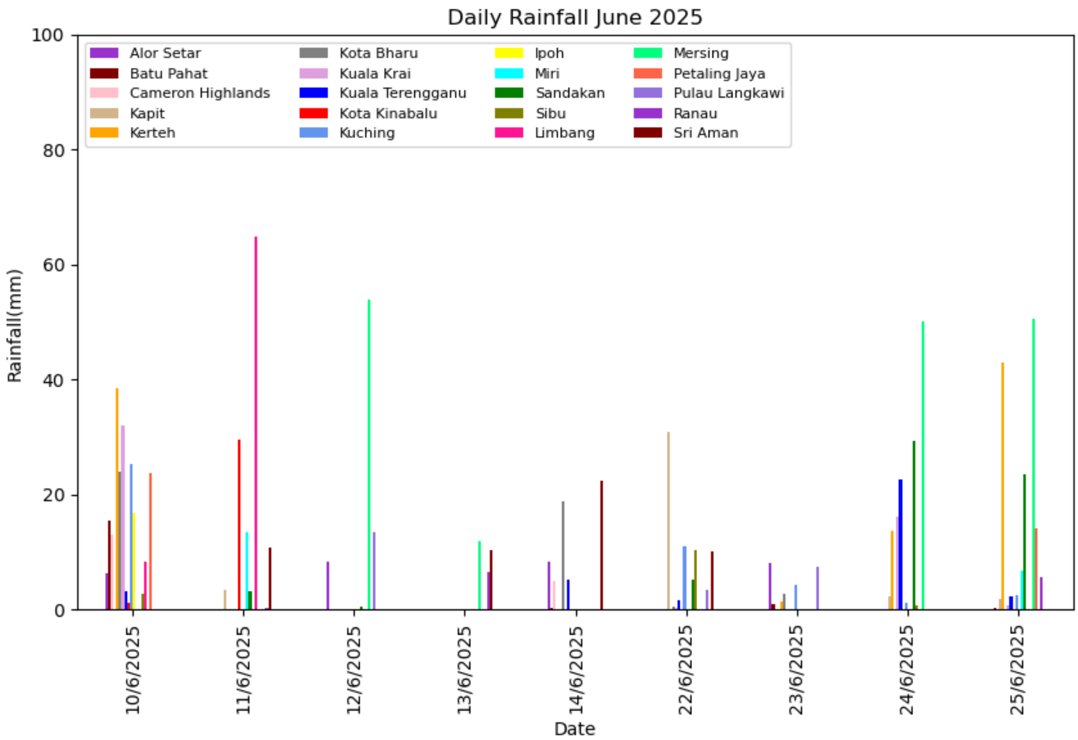


Figure 9: Daily rainfall during June 2025 for STS Wutip (11/6/2025 - 14/6/2025) and TS Sepat (23/6/2025 – 24/6/2025)

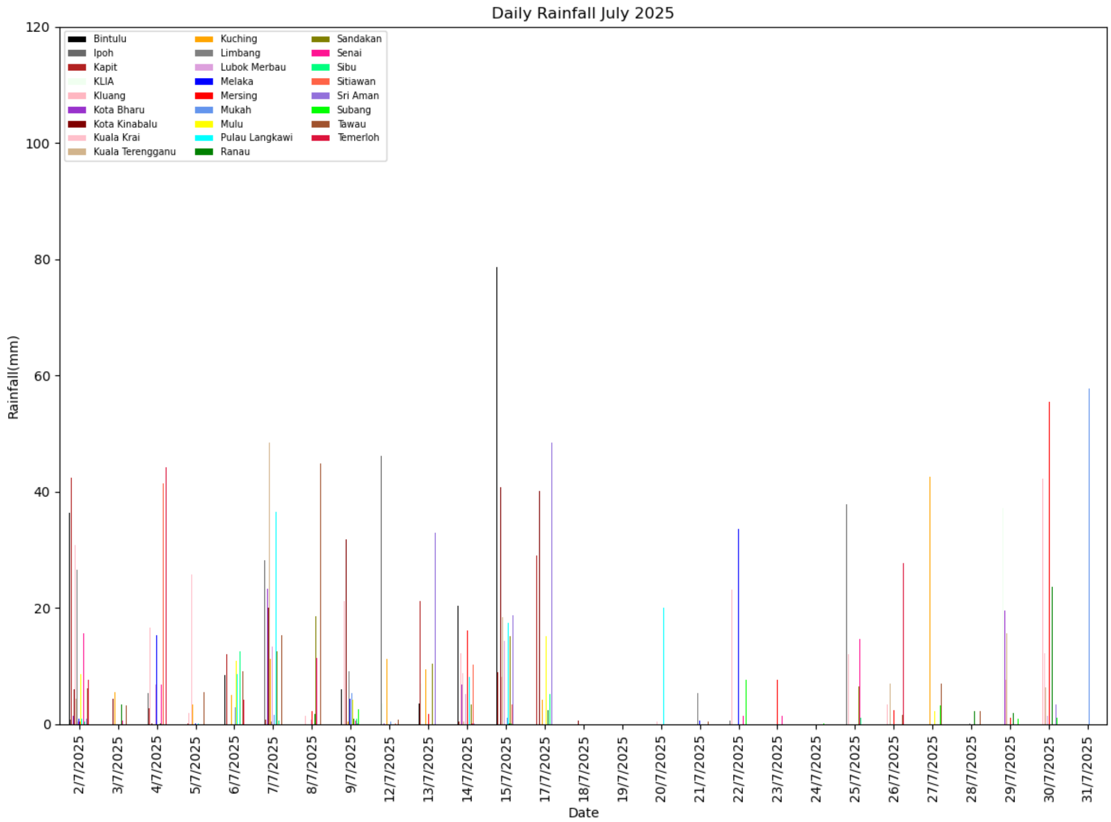


Figure 10: Daily rainfall during July 2025 for STS Mun (2/7/2025 - 8/7/2025), Ty Danas (4/7/2025 – 9/7/2025), STS Nari (12/7/2025 – 15/7/2025), Ty Wipha (17/7/2025 – 22/7/2025), TS Francisco (23/7/2025 – 25/7/2025), STS Co-may (23/7/2025 – 31/7/2025) and Ty Krosa (24/7/2025 – 31/7/2025)

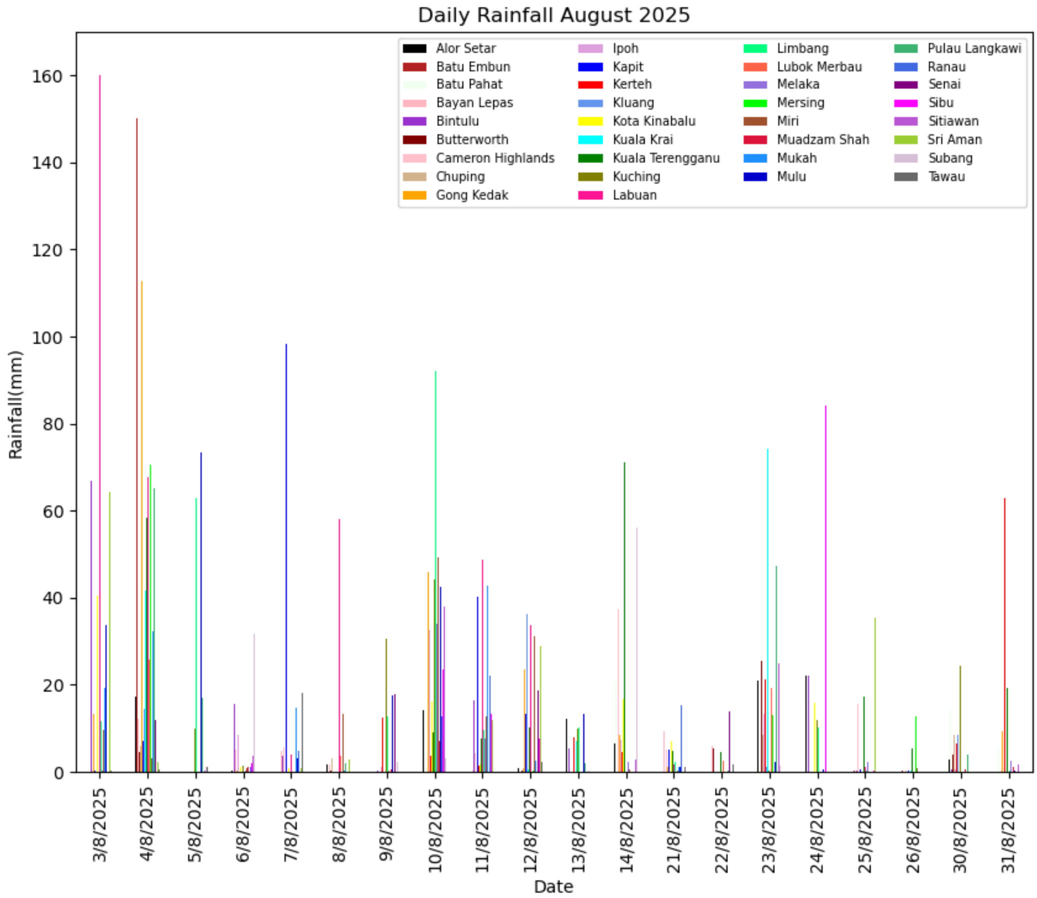


Figure 11: Daily rainfall during August 2025 for TS Bailu (3/8/2025 - 6/8/2025), Ty Podul (7/8/2025 – 14/8/2025), TS Lingling (21/8/2025 – 22/8/2025), Ty Kajiki (23/8/2025 – 26/8/2025) and TS Nongfa (30/8/2025 – 30/8/2025)

2. Hydrological Assessment (highlighting water-related issues/impact)

2.1 Escalating Hydrological Risk and Criticality Data

Malaysia is currently facing increasingly significant hydrological risks, where extreme rainfall patterns and local factors have amplified the frequency and scale of flood events. Current data from the Department of Irrigation and Drainage (JPS) shows a worrying trend: in 2024, a total of 1,345 flood incidents were recorded, an increase of over 66% compared to the previous year. This rise reflects not only weather challenges but also critical weaknesses in the management of urban surface water and river basins.

Floods are classified into four main types, with Flash Floods (47.6%) and Monsoon Floods (46.1%) dominating the statistics. Monsoon Floods, common in East Coast states like Terengganu and Kelantan, are often associated with long durations and extreme depths. For example, Terengganu recorded the highest rainfall of 517 mm in 24 hours, leading to a maximum flood depth reaching 5.0 meters. Conversely, in urban areas like Selangor or Kuala Lumpur, flash floods are the primary problem, driven by high-intensity rainfall over short periods that overwhelm the capacity of existing urban drainage systems.

2.1.1 Causes and Water-Related Issues

The analysis of flood causes indicates that hydrological risk is closely tied to the management of water infrastructure and environmental factors. While heavy rainfall is the main trigger (39%), several structural and maintenance factors play a critical role:

a. River Basin Capacity: About 28% of flood incidents were due to river overflow exceeding bank capacity. This is aggravated by issues of increasingly shallow, narrow, and poorly maintained rivers, compromising the natural ability of the river to adequately discharge floodwater.

b. Drainage Systems: Problems with internal drainage contribute to 13% of flood incidents. This phenomenon occurs when urban drainage infrastructure is either undersized or heavily clogged, primarily due to waste and siltation from development activities. In coastal areas, the influence of high tides inhibits the runoff of floodwater, worsening Coastal Floods and Stagnant Floods.

c. Infrastructure Damage: The direct implication of this hydrological crisis is seen in severe socio-economic losses. The monetary loss in 2024 is not as high as in 2023.

The dramatic rise in flood incidents in Malaysia, highlighted by 1,345 occurrences in 2024, underscores a national hydrological crisis rooted in systemic vulnerabilities like river overflow and clogged urban drainage systems. Since traditional warnings based solely on water levels proved ineffective in compelling timely action against these specific structural failures and mitigating costly damages to Public Assets and Infrastructure, the strategic shift to the Malaysia Impact-based flood forecasting System (MyIBF) is essential. MyIBF addresses this critical deficiency by quantifying hazard, exposure, and vulnerability data to produce clear, color-coded warning messages based on anticipated potential consequences, enabling rapid and targeted preparedness and mitigation efforts at the local level.

2.2 Hydrological Innovation Through the Malaysia Impact-based Flood Forecasting System

The Malaysia Impact-based flood forecasting System (MyIBF) aims to bridge the gap between forecasters and users in communicating risk information by combining hazard, exposure, and vulnerability data to support decision-making. Traditionally, hazard-focused warnings communicate impending extreme weather conditions (e.g., predicted water levels). However, it is critical to communicate specific and relevant potential consequences with respect to local contexts, not just for the public but also for different sectors and agencies. This is the core objective of the MyIBF system, which seeks to prepare understandable and useful warning messages based on colour codes of risks that can be used for preparedness and mitigation actions at the local level.

2.2.1 The MyIBF system is fundamentally built upon a structured, three-part development process designed to translate complex hydrological data into simple, actionable risk matrices. The entire process relies heavily on advanced Geospatial Analysis.

a. Input : Data Integration and Risk Factors
   The assessment begins by consolidating three key data streams required for hazard, expose, and vulnerability analysis:

   - Numerical Weather Prediction (NWP) and Rainfall Likelihood from the Malaysian Meteorological Department (MMD).
   - Flood Hazard Map (FHM) from JPS (DID), providing simulated flood depth and velocity.
   - Impact Library data compiled from various sources, including the Department of Statistics, land-use data, and geospatial information.

b. Process : Risk Scoring and Categorization
   This stage involves defining the impact level across the affected areas:

   - The Flood Hazard Map was overlaid on the land use data supplied by PLANMalaysia.
   - A total of eight receptors were calculated based on the scoring of their impact within dedicated 1km² grids for homogenous impact estimation. These receptors are: Agriculture, Commercial, Industrial, Utilities, Population, Critical Infrastructure, Residential, and Transportation.
   - The final score is categorized and mapped within a 4x4 matrix, linking the severity of potential impacts (Minimal, Minor, Significant, Severe – X-axis) with the likelihood of rainfall occurrence (Low, Medium, High, Very High – Y-axis). This colour-coded matrix facilitates the determination of appropriate actions for each category, enabling JPS to connect weather forecasts, flood levels, and flood areas via a single, simple code.

c. Output : Actionable Risk Maps
   The ultimate output components of this project are products designed for immediate use by agencies and the public:

   - Forecasted Flood Risk Matrix (FFRM) maps, which provide information on flood events and receptors impacted by the flood.

- Forecasted Flood Impact Damage (FFID) offering quantitative estimates of expected damages and the receptors impacted by the flood.
- Flood Guidance Statement (FGS) is a warning dissemination typically issues with different severity levels, reflecting the expected impact of the flooding. These levels can include "Flood Alert", "Flood Warning", and "Severe Flood Warning" with each level indicating an increased level of threat and urgency.

The basic idea is that communicating hazard impacts effectively can influence an individual's risk perception, resulting in the acceptance and personalization of warning messages. This approach calls for adjusted policy frameworks and new resource allocations for skills development and technological innovation at all levels from national to local.

2.3 The Role of AI : Strategic Oversight and Dissemination

Artificial intelligence (AI) serves as the strategic framework and primary tool for delivering actionable warnings within the MyIBF system.

AI Component	Core Function	Description
Warning Dissemination	AI-FGS Track	AI automatically generates user-friendly Flood Guidance Statements (FGS) based on complex risk calculations, communicating risk using clear color codes, focusing on what users need to know to act.
Data Synergy	Integrated System	AI ensures the seamless alignment of the three core warning system components: Hazard, Exposure, and Vulnerability, maximizing early action effectiveness.
Policy & Roadmap	Transformation Driver	The implementation of AI within MyIBF is integral to JPS's long-term strategy, driving technological and skill development across all levels of disaster management

2.4 The Role of ML : Predictive Risk Modelling and Scoring

Machine Learning (ML) constitutes the core computational engine responsible for quantifying and predicting flood impacts.

a. ML Model Inputs and Data Integration (Standard Development Tool – SDT)
   ML models are rigorously trained to calculate the Impact Score using a holistic combination of inputs:

   - Hydrological Input: Flood Hazard Maps (FHM) for various flood scenarios based on rainfall depth and storm duration across different river basins from JPS hydrodynamic model data and Rainfall Likelihood from MMD are utilized.
   - Socio-Economic Input: Vulnerability and Exposure data is extracted from the Impact Library, sourcing critical information on demographics, land use, and assets from agencies like the Department of Statistics and PLANMalaysia.

b. Risk Scoring Methodology
   The ML process relies on advanced Geospatial Analysis and Classification:

   - The FHM is overlaid onto the land use data supplied by PLANMalaysia.
   - The analysis divides the area into granular 1km x 1km grid cells to ensure a homogeneous and localized impact estimation.
   - ML classification models—including the Decision Tree Classifier (DTC), Random Forest Classifier (RFC), and K-Nearest Neighbors Classifier (KNNC), which are specifically tested for each river basins to understand the ML model performance.

c. ML Model Output and Risk Metrics
   The predictive outputs generated by the ML models are translated into essential decision-making tools:

   - Forecasted Flood Risk Matrix (FFRM): This is a critical 4x4 matrix that categorizes the combined risk:

- X-Axis (Impact): Categorized based on the severity of the receptors into 4 levels: Minimal (Green), Minor (Yellow), Significant (Orange), and Severe (Red).
- Y-Axis (Likelihood): Categorized based on the probability percentage of rainfall events (Low, Medium, High, Very High).

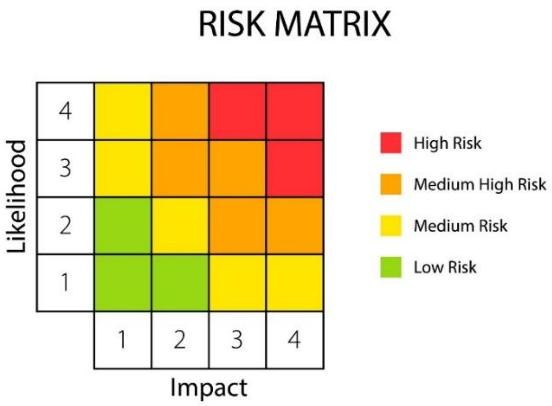


Figure 12: Risk matrix based on likelihood of rainfall and impact of flood

- Forecasted Flood Impact Damage (FFID): This provides quantitative estimates of the expected monetary loss and physical damage for each receptor based on the flood depth.

- Flood Guidance Statement (FGS): This warning dissemination provides alert to the public, emergency services and relevant agencies about the possibility of flooding to allow respective stakeholders to take early preparation based on possible impacts to the receptors and advice on actions offered to minimise the impact of flooding. It also provides information about the expected weather conditions, river levels and other factors that could lead to flooding for ensuring unified and effective response to flood threats.

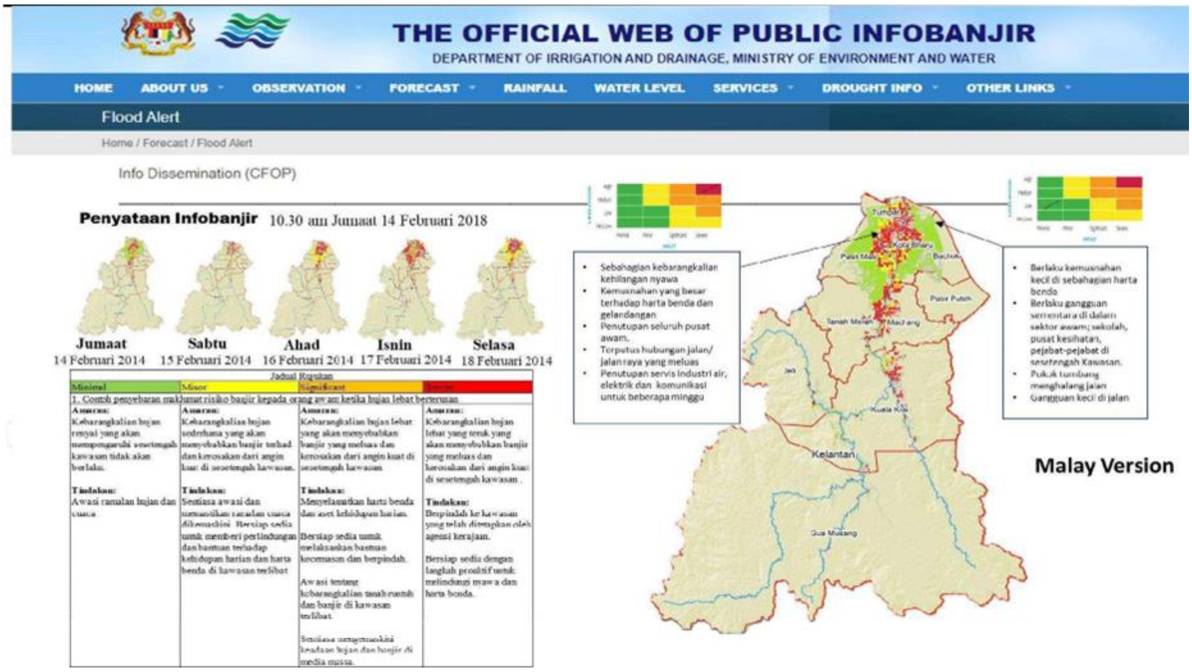


Figure 13: Flood Guidance Statement for Kelantan state

2.5 JPS Preparedness and Structural Measures

JPS JPS physical infrastructure remains essential as a mitigation measure. With planning allocated for Flood Mitigation Projects (RTB) and the development of environmentally friendly drainage projects, the accurate hydrological assessment provided by MyIBF is crucial to ensure these structural investments are optimized. MyIBF helps identify hotspot areas (3,683 locations recorded) that require immediate attention, ensuring that structural engineering works target the highest-risk areas.

2.6 Significant Flood Events in Malaysia (2024)

In 2024, there are indicates a sharp escalation in flood incidents nationwide, with a total of 1,345 events recorded with a substantial increase compared to 809 cases in 2023. The national flood challenge is almost evenly divided between two major categories: Flash Floods (47.6%, 640 incidents) and Monsoon Floods (46.1%, 620 incidents).

2.6.1 Most Significant Flood Episodes (2024)

The highest flood impacts, measured by frequency, rainfall, and depth, were concentrated in the East Coast and East Malaysia, linked predominantly to extreme monsoonal intensity

State	Total Incidents	Max Rainfall (24 hrs)	Max Flood Depth	Dominant Type
Sarawak	459 (Highest Frequency)	233.5 mm	3.0 meters	Monsoon (261 incidents)
Terengganu	199	517 mm	5.0 meters (National Max)	Monsoon (194 incidents)
Kelantan	58	496.5 mm	4.0 meters	Monsoon (58 incidents)
WP Labuan	5	456 mm (in 3 hrs)	1.0 meter	Flash Flood (5 incidents)

2.6.2 Extreme Monsoon Intensity (East Coast)

- Terengganu recorded the national maximum flood depth of 5.0 meters and the highest rainfall reading (517 mm) on November 30, 2024, resulting from a strong monsoonal surge.

- Kelantan experienced severe monsoonal impacts, with all 58 recorded events classified as Monsoon Floods and depths reaching 4.0 meters.

2.6.3 Significant Flash Flood Events

- WP Labuan recorded an extremely significant flash flood event with 456 mm of rain falling in just 3 hours on May 25, 2024. Significantly, this catastrophic intensity occurred outside the traditional Northeast Monsoon period, indicating high vulnerability to intense, localised weather events.

- Flash Floods dominated reports in Peninsular Malaysia’s West Coast states (e.g., Kedah, Selangor, Melaka), often driven by concentrated, high-intensity rainfall in highly developed urban areas.

2.6.4 Dominant Flood Patterns by Region

The 2024 statistics confirm geographical split in flood typology:

Pattern	Regions	Characteristics
Monsoon Dominant	Kelantan, Terengganu, Sarawak	Prolonged and extensive flooding due to continuous, widespread rainfall, leading to high water levels and long duration.
Flash Flood Dominant	Perlis, Kedah, Pulau Pinang, Perak, Selangor, Melaka, N. Sembilan	Rapid, sudden inundation caused by high-intensity rainfall overwhelming undersized or poorly maintained internal drainage systems.

2.6.5 Key Contributing Causes

The primary factors contributing to the large volume of flood incidents in 2024 include:

a. River Overflow due to rivers exceeding capacity, river channel deposition (making them shallow and narrow), and overflow exacerbated by dam releases.
b. Inadequate Internal Drainage Systems (undersized, unsymmetrical, unmaintained, or clogged by waste and sediment).
c. Rapid Development and land use changes reducing permeable areas.
d. High Tide Influence affecting coastal drainage efficiency.

2.7 Conclusion

The 2024 hydrological review underscores a dual challenge: the increase in extreme weather events and the urgent necessity to upgrade and maintain critical water infrastructure. The development of the MyIBF system signifies a proactive and innovative leap forward in disaster management. By linking hydrological forecasts with the actual potential impact on infrastructure and communities, MyIBF empowers DID and other response agencies to make more informed and immediate decisions, successfully transitioning from a passive, reactive stance to a proactive and resilient risk management strategy.

II. Summary of Progress in Priorities supporting Key Result Areas

1. Key Reference Documents

a. National Disaster Risk Reduction Policy 2030

The National Disaster Risk Reduction Policy 2030 serves as the main reference for stakeholders by providing guidance for comprehensive disaster management at the national, local and cross-sectoral levels. The National Disaster Risk Reduction Policy 2023 outlines the country's strategic direction in reducing disaster risks, to shape Malaysia into a safe and disaster-resilient nation

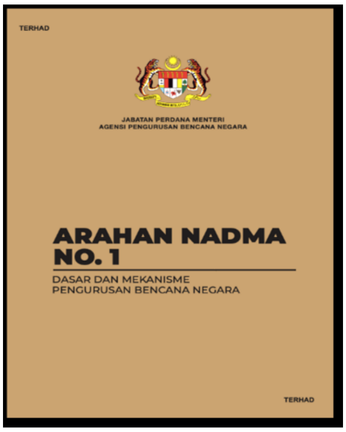
The main goal establishing this policy is to address existing and emerging hazards with the aim of reducing loss of life and disaster-related damages, while enhancing public well-being and environmental sustainability through efficient and effective governance, resource mobilization, stakeholder engagement and community empowerment.

i. Disaster Risk Reduction (DRR) Education Module

Malaysia’s Ministry of Education, UNICEF Malaysia, and NADMA have developed a Disaster Risk Reduction (DRR) Education Module. Through experiential learning and participatory methods, we aim to empower both teachers and students as community resilience leaders. This initiative aligns with ASEAN’s AADMER work plan and is set to benefit nearly 7,800 primary schools nationwide.

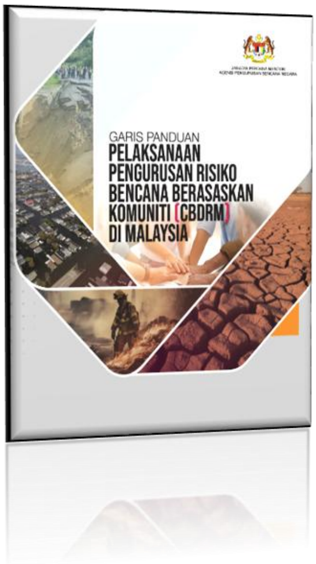
This module serves as a catalyst for fostering awareness, developing skills, and enhancing students’ self-confidence in dealing with disaster risks (before, during, and after). DRR education provides an understanding of environmental conditions and human actions that contribute to disasters, while also nurturing students who are sensitive and responsive to the environment.

b. NADMA Directive No.1



The National Disaster Management Agency (NADMA) Directive No. 1: The Policy and Mechanism for National Disaster and Relief Management is the main guideline for disaster management in Malaysia. The directive prescribes the mechanism for the management of disasters including the responsibilities and functions of related agencies under an integrated disaster management system.

c. Guidelines for the Implementation of Community-Based Disaster Risk Management (CBDRM)



The National Disaster Management Agency (NADMA) has been entrusted with the responsibility of formulating a comprehensive strategy for the implementation of the Community-Based Disaster Risk Management (CBDRM) program to enhance the preparedness of communities effort includes the development of the Guidelines for the Implementation of Community-Based Disaster Risk Management (CBDRM). The need to provide standardized and comprehensive guidelines for the CBDRM implementation should be prioritized to ensure that the CBDRM program can be effectively carried out at every level of the disaster management committee.

2. **Disaster Information / Warnings / Alerts Dissemination Process in National Disaster Command Centre (NDCC)**

National Disaster Management Agency (NADMA) was established in 2015 under the Prime Minister's Department as a focal point for disaster management in Malaysia. NADMA core functions is to coordinate disaster management activities across various agencies.

The dissemination of early disaster alerts or warnings is one of the core functions of the NADMA. It was executed by National Disaster Command Centre (NDCC) which is one of the units under NADMA. NDCC operates 24 hours every day. NDCC other functions is to provide daily disaster situation report.

All disaster alerts or warnings are provided by the relevant technical agencies such as continuous heavy rain and tsunami by the Department of Meteorological, flood and river water level alert by the Department of Irrigation and Drainage, landslide and road closer by the Public Works Department and air pollution index (API) by the Department of Environment.

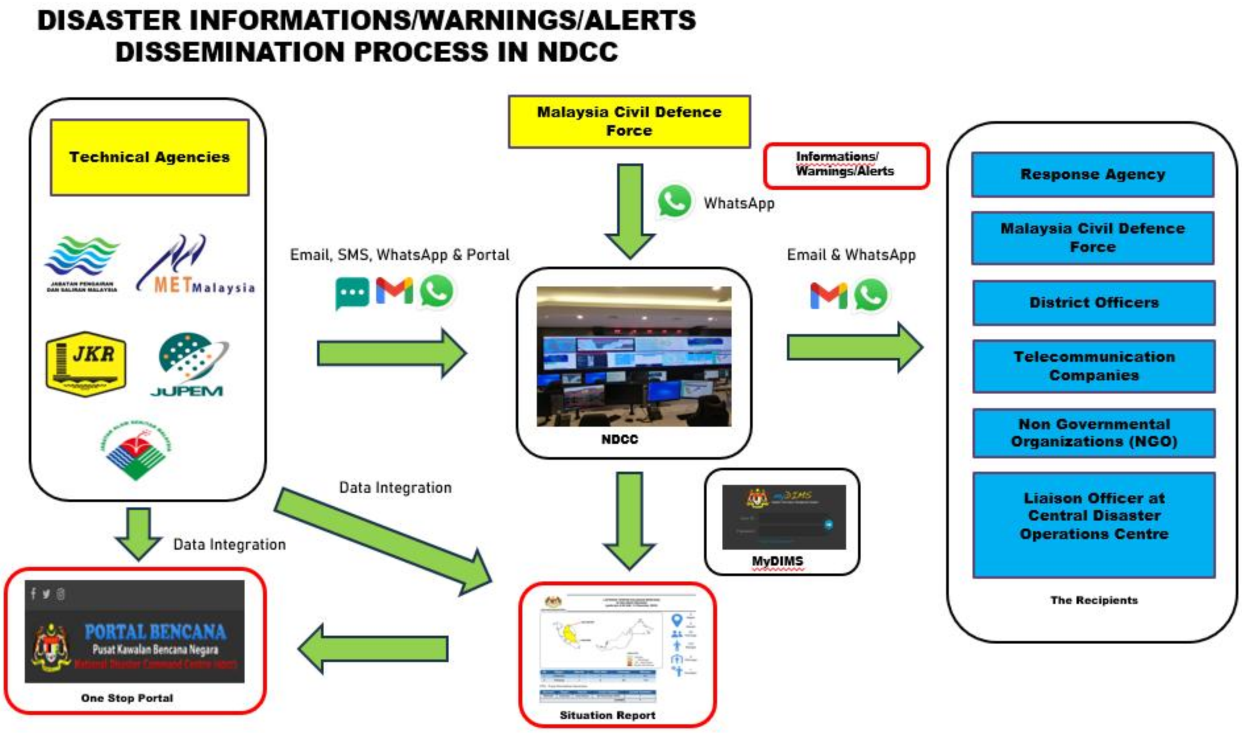


Figure 14 : Disaster Informations/Warnings/Alerts Dissemination Process in NDCC

3. Understanding and Managing Disaster Risks

a. Establishment of Permanent Relief Centre (PPKB)

As part of efforts to enhance disaster management, a major initiative is being introduced: the establishment of Permanent Relief Centres (PPKBs) near school zones in high-risk areas. This policy was developed based on lessons learned from previous flood disasters, where the use of schools as temporary relief centres resulted in infrastructure damage and disruptions to education.

The dedicated centres — funded with RM135 million under the Federal Budget — are designed to strengthen disaster response capabilities while protecting the integrity of school facilities. Importantly, the initiative aligns with Malaysia's national development priorities outlined in the 12th Malaysia Plan.

When not activated during emergencies, the centres will function as multipurpose community learning hubs, contributing to long-term community resilience and educational continuity.

b. Early Warning Systems

i. Debris Flow Early Warning System (EWS) Equipment and Fault Movement Benchmark (Penanda Aras Pergerakan Sesar, PAPS)

As a proactive measure to enhance community preparedness, Malaysia remains committed to implementing a Multi-Hazard Early Warning System. Currently, NADMA, in collaboration with the State Government and the Department of Minerals and Geoscience (JMG) Sabah, is carrying out the installation of Debris Flow Early Warning System (EWS) equipment and Fault Movement Benchmark (Penanda Aras Pergerakan Sesar, PAPS) in geological disaster–prone areas around

Mount Kinabalu. The installation of the EWS and PAPS is expected to be fully completed by August 2026.

ii. **National Forecasting and Warning Programme**

At the same time, the Department of Irrigation and Drainage (JPS) operates the National Flood Forecasting and Warning Programme (PRAB), a 10-year initiative which involves the development of flood prediction models in 41 major river basins throughout the country. Through PRAB, JPS currently monitors 33 major river basins nationwide. Together with more than 1,700 telemetry stations, 624 sirens, 197 cameras, and real-time hydrological sensors, PRAB enhances the accuracy and timeliness of flood warnings.

JABATAN PENGAIRAN DAN SALIRAN MALAYSIA

AMARAN BANJIR NEGERI JOHOR

Dikeluarkan pada 19 Mac 2025, 4:30 Petang

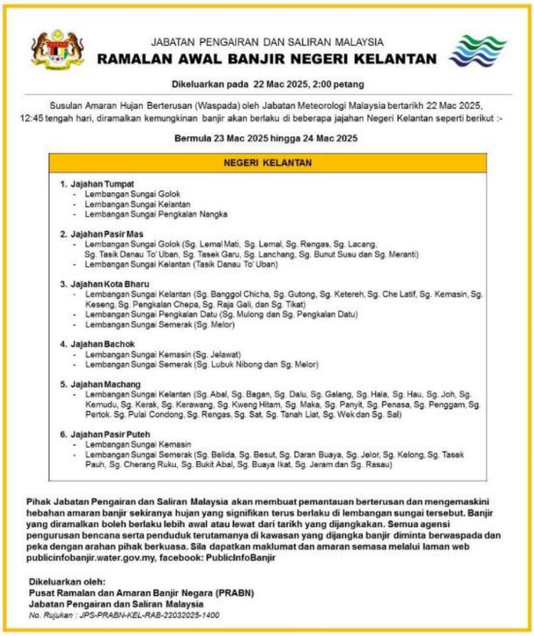
Susulan Amaran Hujan Berterusan (Buruk) oleh Jabatan Meteorologi Malaysia bertarikh 19 Mac 2025, 3:00 petang serta status air sungai yang diramalkan menaik dan akan melebihi aras bahaya, diramalkan banjir akan berlaku di lokasi di beberapa daerah Negeri Johor seperti berikut :-

Tarikh dan Waktu dijangka banjir : **20 Mac 2025, 08:00 pagi hingga 22 Mac 2025, 8:00 pagi**

Negeri	Lembangan Sungai	Daerah	Poskod	Lokasi Dijangka Banjir
Johor	Sg. Skudai	Johor Bharu	81200	Kg. Pasir, Kg. Sri Serdang, Tmn Lily Jasmine, Tmn Tampoi Indah, Kg. Usaha Jaya, Kg. Mohd Amin, Jalan Kolam Air, Kg Skudai Kiri

Banjir yang diramalkan boleh berlaku lebih awal atau lewat dari masa yang dijangkakan. Amaran ini dikeluarkan bagi membolehkan semua penduduk terutamanya di kawasan yang dijangka banjir berwaspada dan mematuhi arahan pihak berkuasa atau agensi-agensi pengurusan bencana banjir. Sila layari laman sesawang https://publicinfobanjir.water.gov.my dan Facebook @PublicInfoBanjir untuk maklumat lanjut.

Dikeluarkan oleh:
Pusat Ramalan dan Amaran Banjir Negara (PRABN)
Jabatan Pengairan dan Saliran Malaysia
No. Rujukan : JPS-PRABN-JHR-AB-19032025-1630



JABATAN PENGAIRAN DAN SALIRAN MALAYSIA

RAMALAN AWAL BANJIR NEGERI KELANTAN

Dikeluarkan pada 22 Mac 2025, 2:00 petang

Susulan Amaran Hujan Berterusan (Waspada) oleh Jabatan Meteorologi Malaysia bertarikh 22 Mac 2025, 12:45 tengah hari, diramalkan kemungkinan banjir akan berlaku di beberapa jajahan Negeri Kelantan seperti berikut :-

Bermula 23 Mac 2025 hingga 24 Mac 2025

NEGERI KELANTAN

1. **Jajahan Tumpat**
   - Lembangan Sungai Golok
   - Lembangan Sungai Kelantan
   - Lembangan Sungai Pengkalan Nangka
2. **Jajahan Pasir Mas**
   - Lembangan Sungai Golok (Sg. Lemal Mati, Sg. Lemal, Sg. Rengas, Sg. Lacang, Sg. Tasik Danau To' Uban, Sg. Tasek Garu, Sg. Lanchang, Sg. Bunut Susu dan Sg. Meranti)
   - Lembangan Sungai Kelantan (Tasik Danau To' Uban)
3. **Jajahan Kota Bharu**
   - Lembangan Sungai Kelantan (Sg. Banggol Chicha, Sg. Gutong, Sg. Ketereh, Sg. Che Latif, Sg. Kemasin, Sg. Keseng, Sg. Pengkalan Chepa, Sg. Raja Gali, dan Sg. Tikat)
   - Lembangan Sungai Pengkalan Datu (Sg. Mulong dan Sg. Pengkalan Datu)
   - Lembangan Sungai Semerak (Sg. Melor)
4. **Jajahan Bachok**
   - Lembangan Sungai Kemasin (Sg. Jelawat)
   - Lembangan Sungai Semerak (Sg. Lubuk Nibong dan Sg. Melor)
5. **Jajahan Machang**
   - Lembangan Sungai Kelantan (Sg. Abal, Sg. Bagan, Sg. Dalu, Sg. Galang, Sg. Hala, Sg. Hau, Sg. Joh, Sg. Kemudu, Sg. Kerak, Sg. Kerawang, Sg. Kweng Hitam, Sg. Maka, Sg. Panyit, Sg. Penasa, Sg. Penggam, Sg. Pertok. Sg. Pulai Condong, Sg. Rengas, Sg. Sat, Sg. Tanah Liat, Sg. Wek dan Sg. Sal)
6. **Jajahan Pasir Puteh**
   - Lembangan Sungai Kemasin
   - Lembangan Sungai Semerak (Sg. Belida, Sg. Besut, Sg. Daran Buaya, Sg. Jelor, Sg. Kelong, Sg. Tasek Pauh, Sg. Cherang Ruku, Sg. Bukit Abal, Sg. Buaya Ikat, Sg. Jeram dan Sg. Rasau)

Pihak Jabatan Pengairan dan Saliran Malaysia akan membuat pemantauan berterusan dan mengemaskini hebahan amaran banjir sekiranya hujan yang signifikan terus berlaku di lembangan sungai tersebut. Banjir yang diramalkan boleh berlaku lebih awal atau lewat dari tarikh yang dijangkakan. Semua agensi pengurusan bencana serta penduduk terutamanya di kawasan yang dijangka banjir diminta berwaspada dan peka dengan arahan pihak berkuasa. Sila dapatkan maklumat dan amaran semasa melalui laman web publicinfobanjir.water.gov.my, facebook: PublicInfoBanjir

Dikeluarkan oleh:
Pusat Ramalan dan Amaran Banjir Negara (PRABN)
Jabatan Pengairan dan Saliran Malaysia
No. Rujukan : JPS-PRABN-KEL-RAB-22032025-1400

c. Community-Based and Education Initiatives

Malaysia's DRR efforts are rooted in a whole-of-society and whole-of-government approach, recognizing that communities are the initial responders to disasters. NADMA's Guideline for Community-Based Disaster Risk Management (CBDRM) Implementation which was published in 2024, provides a standardized CBDRM programmes across Malaysia, promoting disaster simulations, local risk mapping, and volunteer mobilization. In total, 36,744 community members have been trained nationwide from January to September 2025.

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