MEMBER REPORT
MALAYSIA

ESCAP/WMO Typhoon Committee
19th Integrated Workshop
ESCAP – Shanghai, China
19 – 22 November 2024

CONTENTS

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

1. Meteorological Assessment

The Malaysian Meteorological Department (MET Malaysia) recorded three Typhoons (Tys) and four Tropical Storm (TS) within its designated area of responsibility (latitudes 0° - 20°N and longitudes 95°E - 130°E) between December 2023 and September 2024. They were Ty Ewiniar, Ty Gaemi, Ty Yagi, TS Jelawat, TS Maliksi, TS Prapiroon and TS Soulik. The track of the four Tropical Cyclones (TCs) are plotted using the latest data from the RSMC Tokyo Best Track dataset and International Best Track Archive for Climate Stewardship (IBTrACS) as shown in **Figure 1**. The red boundary on the map indicates the maritime areas monitored by the MET Malaysia for the issuance of marine warnings on strong wind and rough sea conditions are depicted in **Figure 2**.

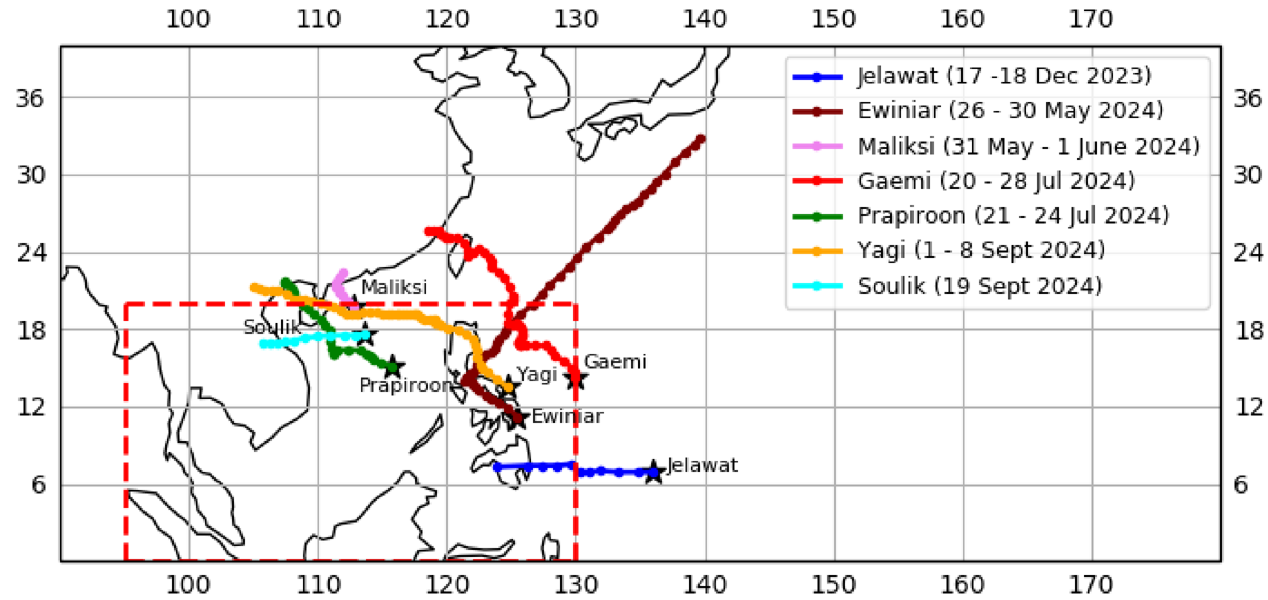


Figure 1: TC track occurred within the area of responsibility for MET Malaysia

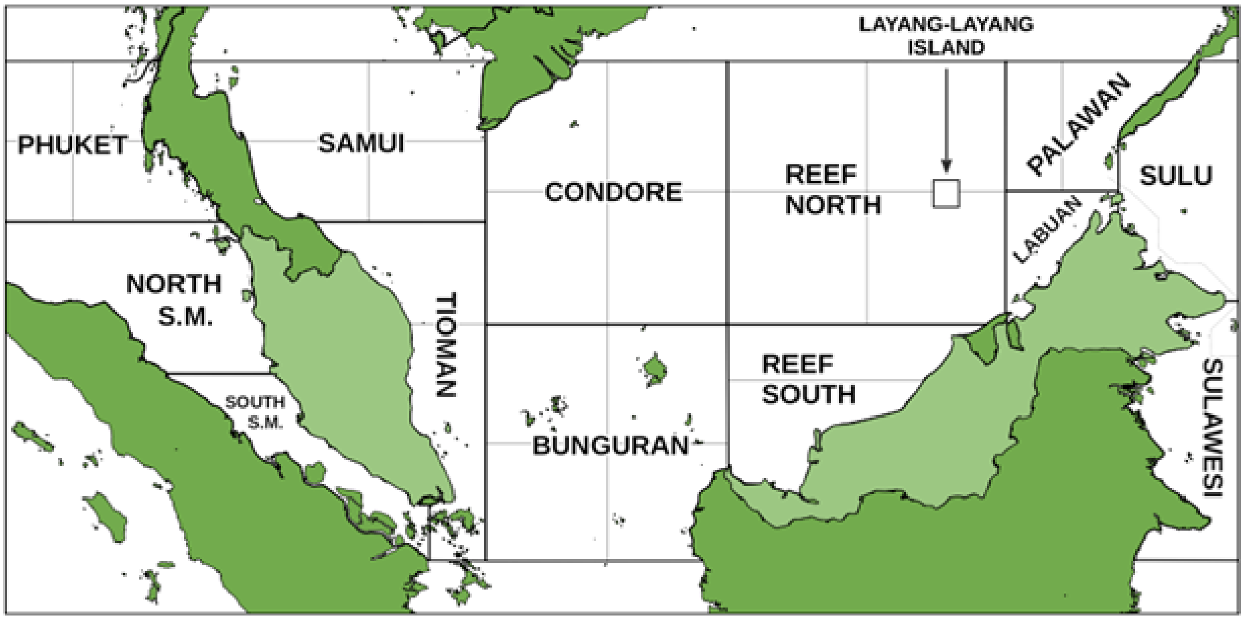


Figure 2: Maritime Area Monitored by MET Malaysia

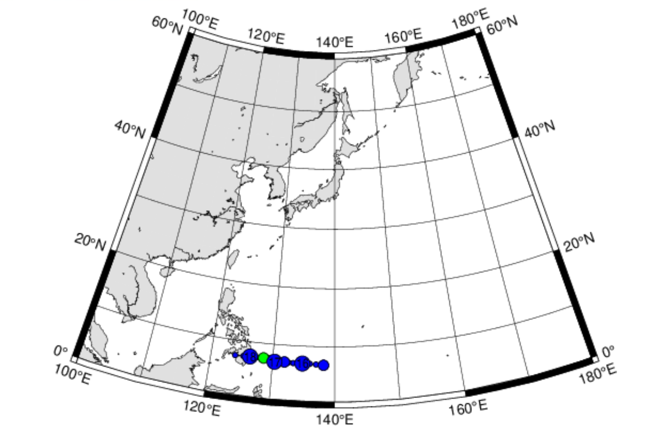
The areas of Malaysian waters affected by TCs between December 2023 and September 2024 are listed in **Table 1.** TCs that are located in the vicinity of the South China Sea (SCS) can lead to strong winds and rough seas over the coastal areas of Malaysia. During TS Pulasan, MET Malaysia issued fourteen (14) strong wind and rough sea warning, the highest number of warnings issued during this TCs season. Simultaneously, another tropical depression (TD) also entered the Malaysia's maritime area and developed into TS Soulik. Strong westerly wind speeds exceeding 60 km/h and rough sea conditions with waves over 4.5 meters were observed in parts of Malaysian waters during these TS events. Heavy rainfall has caused flooding across the northern Peninsular Malaysia during this period.

Table 1: Total Number of Areas Affected in Malaysia due to Tropical Cyclones between December 2023 and September 2024

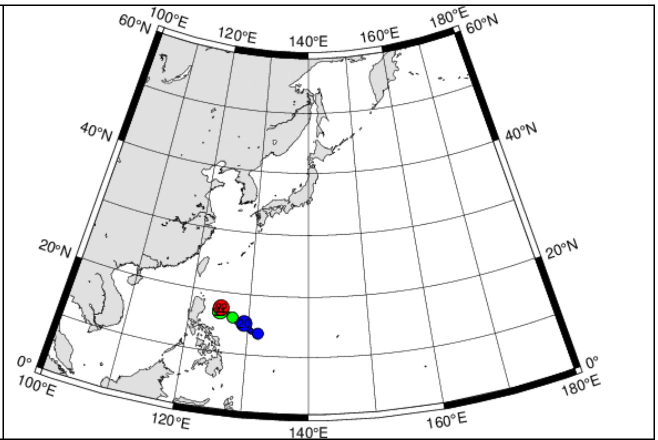
No.	Tropical Cyclone (TC)	Classification	Date		Strong Wind / Rough Seas Warnings due to Tropical Cyclones (area affected)
			Birth	Dissipation	
1	**Jelawat**	Tropical Storm	17/12/2023	18/12/2023	4 (northern part of Condore • northern part of Reef North • Layang-Layang • western part of Palawan)
2	Ewiniar	Typhoon	25/5/2024	30/5/2024	2 (Phuket • Northern Straits of Melaka)

3	Maliksi	Tropical Storm	31/5/2024	31/5/2024	-
4	**Gaemi**	Typhoon	20/7/2024	27/7/2024	5 (northeastern part of Condore • northern part of Reef North • Layang-Layang •Palawan • Phuket)
5	Prapiroon	Tropical Storm	21/7/2024	23/7/2024	4 (northeastern part of Condore • northern part of Reef North • Layang-Layang • Palawan)
6	Maria	Severe Tropical Storm	7/8/2024	12/8/2024	-
7	Son-Tinh	Tropical Storm	11/8/2024	13/8/2024	-
8	Ampil	Typhoon	12/8/2024	19/8/2024	-
9	Wukong	Tropical Storm	13/8/2024	15/8/2024	-
10	Jongdari	Tropical Storm	18/8/2024	20/8/2024	-
11	Shanshan	Typhoon	21/8/2024	1/9/2024	6 (Phuket • Condore • Reef North • Layang-layang • Labuan • Palawan)
12	**Yagi**	Typhoon	1/9/2024	8/9/2024	5 (Phuket• northern part of Condore • northern part of Reef North • Layang-Layang • Palawan)
13	Leepi	Tropical Storm	5/9/2024	7/9/2024	5 (Phuket• northern part of Condore • northern part of Reef North • Layang-Layang • Palawan)
14	Bebinca	Severe Tropical Storm	10/9/2024	17/9/2024	7 (Phuket • Condore • Reef North • Layang-Layang • Labuan • Sulu• Palawan)
15	Pulasan	Tropical Storm	15/9/2024	21/9/2024	12 (Phuket • northern Straits of Melaka • Condore • Reef North • Layang-Layang • Labuan • Sulu• Perlis & Kedah • Penang • Perak • Western Sabah & Labuan• Palawan)
16	**Soulik**	Tropical Storm	19/9/2024	19/9/2024	7 (Reef North • Layang-Layang • Labuan • Northern Straits of Melaka • Condore • Phuket• Sulu)

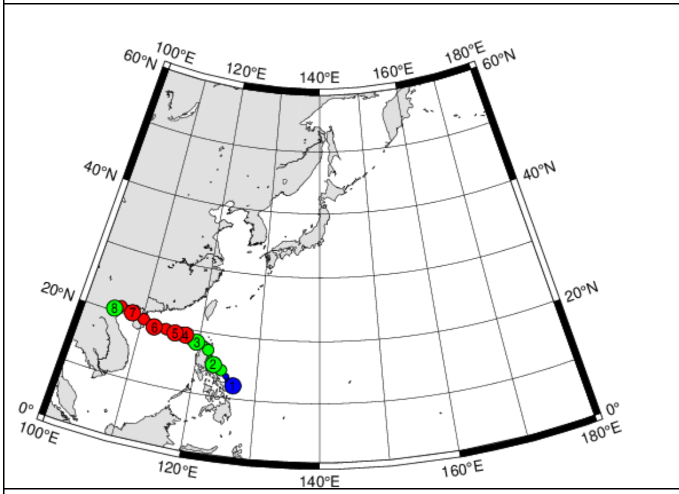
The trajectories of TCs Jelawat, Gaemi, Yagi and Soulik closest to Malaysia are illustrated in **Figure 3**. These TCs tracked within the MET Malaysia area of responsibility. However, none of these typhoons or tropical storms was close enough to directly or indirectly cause significant loss of neither life nor properties within Malaysia.



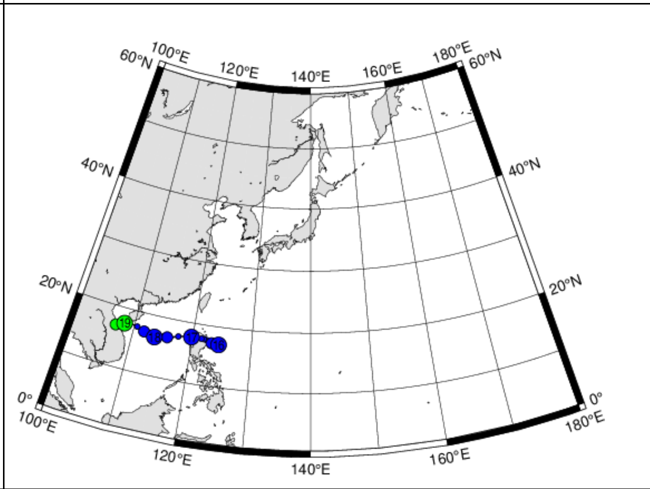
Jelawat



Gaemi



Yagi



Soulik

Figure 3: Tracks of four TCs within Malaysia's area of responsibility from December 2023 until September 2024. 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 TCs are illustrated in **Figure 4**. Northeasterly winds were observed over the Malaysian region during the passage of TS Jelawat. Simultaneously, heavy rainfall was recorded over the east coast of Peninsular Malaysia, influenced by the Northeast Monsoon. Whereas, southwesterly winds prevailed during the passage of Ty Gaemi, TS Yagi and TS Soulik.

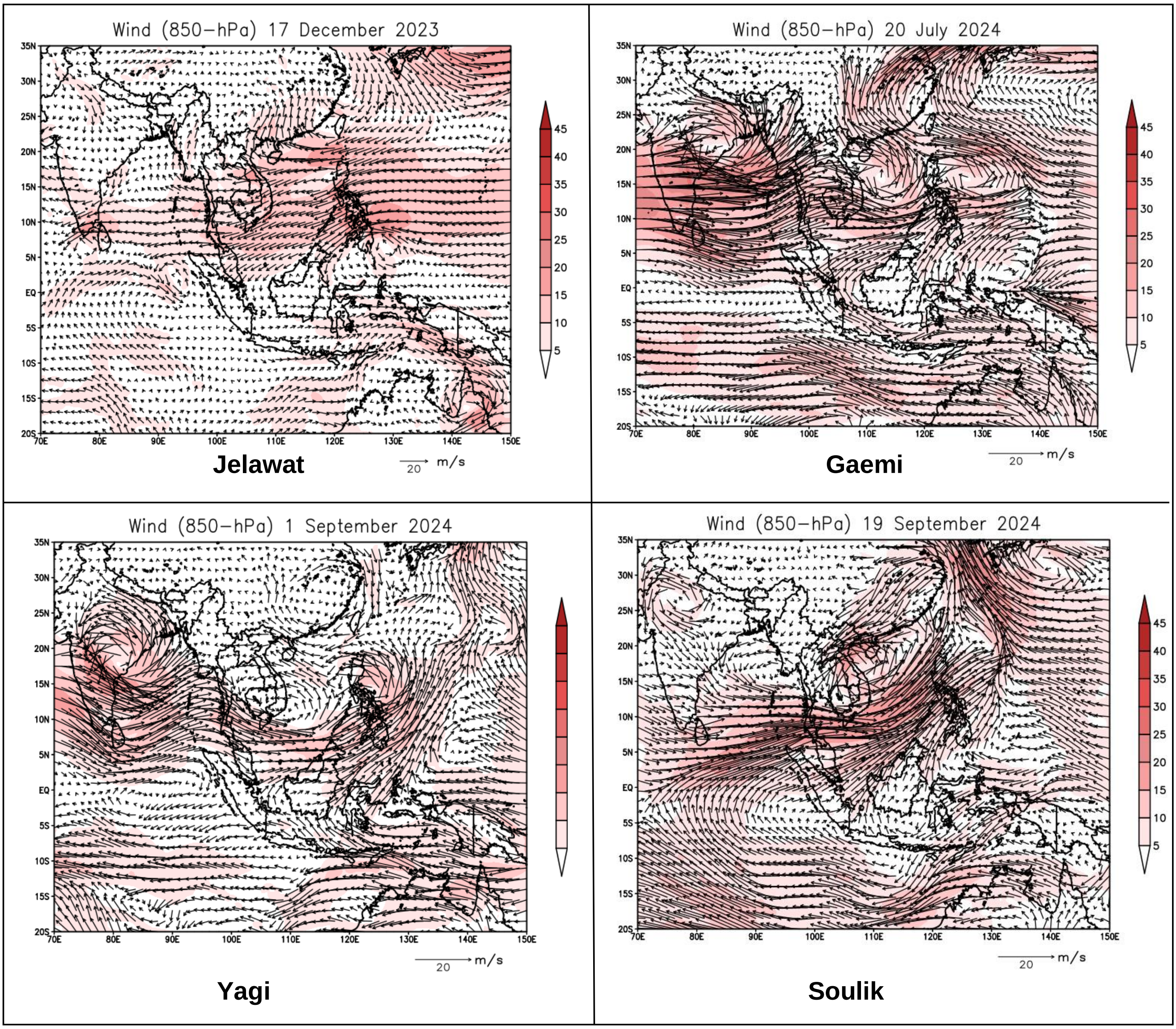


Figure 4: 850hPa wind circulation derived from the ERA-5 dataset during the passage of the four tropical cyclones within Malaysia's area of responsibility.

Figure 5 shows Himawari satellite imagery during the presence of TCs Jelawat, Gaemi, Yagi and Soulik. Most of the TCs, except for TS Jelawat did not contribute to heavy rainfall in Malaysia and the TCs only have a distant impact on Malaysia's weather. Depending on the path, intensity and location of the TCs, it might cause the weather to be drier or wetter as they could influence the wind flow over the Malaysia's region.

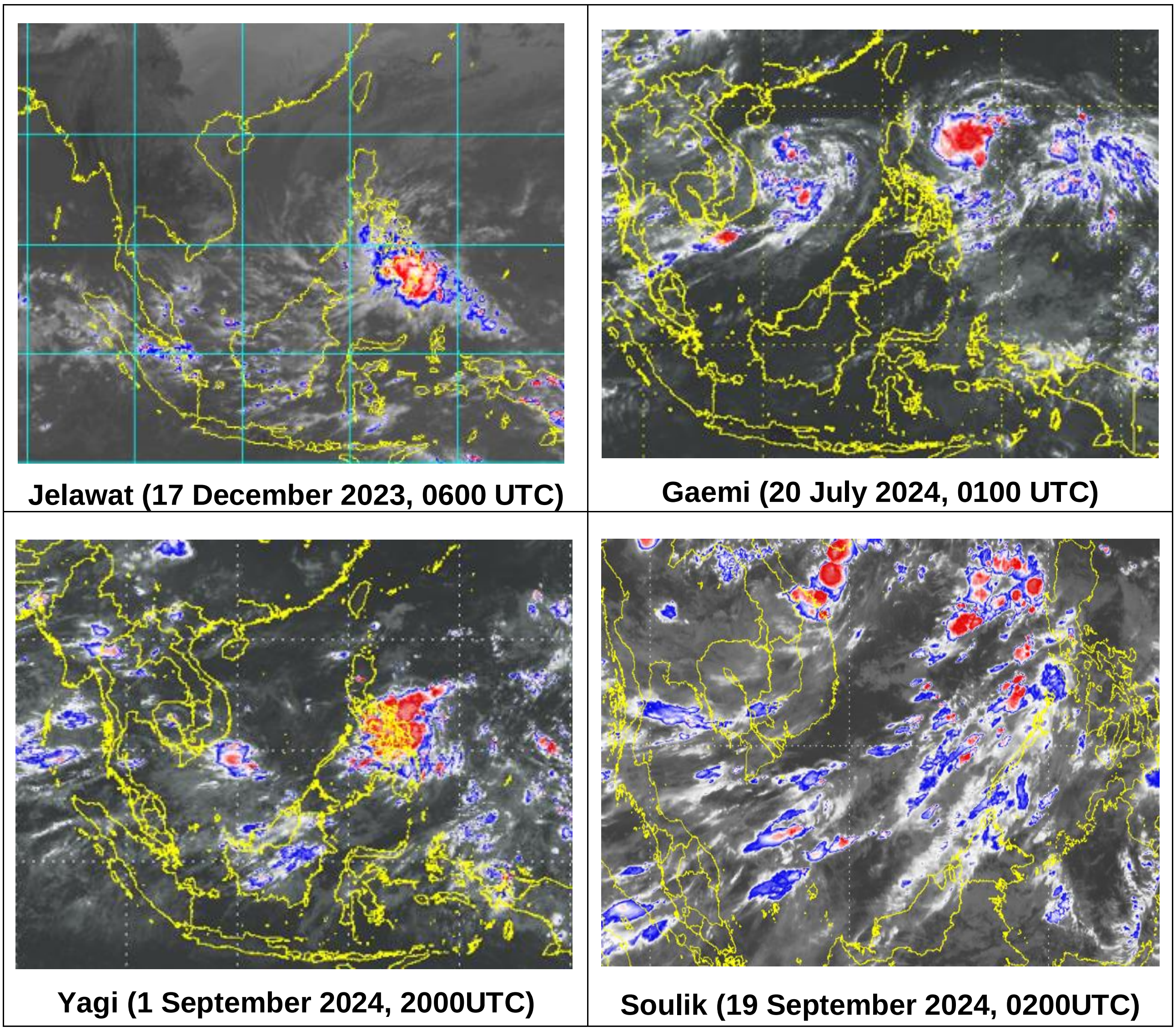


Figure 5: Himawari satellite imageries of TCs that affected the Malaysian region.

Figures 6 and **Figure 7** respectively shows daily accumulated rainfall of the chosen meteorological stations over Malaysia during each of the TCs occurrences. Only, one rainfall stations showed rainfall amounts of more than 100mm, namely at Muadzam, during the passing of TS Jelawat. Meanwhile, the daily rainfall in July 2024 showed that most stations recorded less rainfall during Typhoon Gaemi. The daily accumulated rainfall in September shows seven (7) stations recorded rainfall exceeding 50mm namely Alor Setar, Bayan Lepas, Butterworth, Cameron Highlands, Pulau Langkawi, Batu Embun and Prai station, during the passing of Ty Yagi, TS Pulasan and TS Soulik as shown in **Figure 8**.

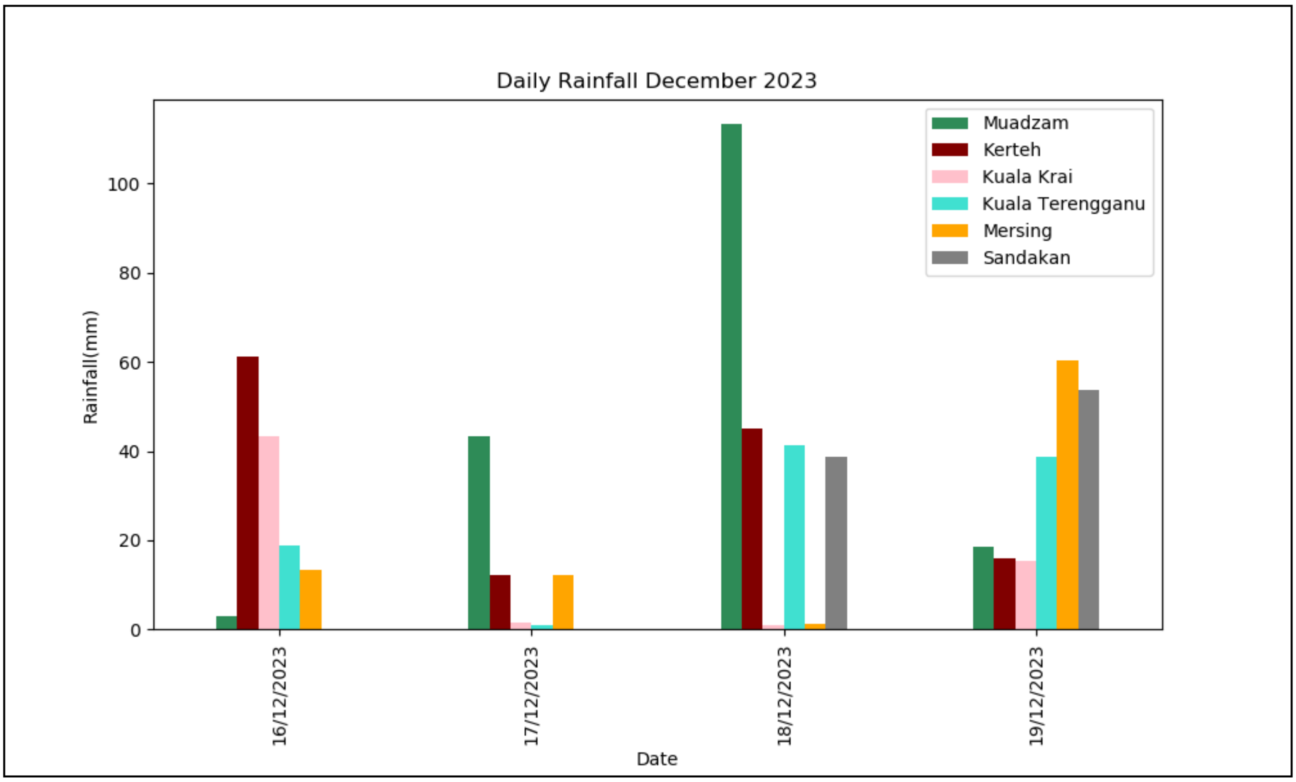


Figure 6: Daily rainfall during December 2023 for TS Jelawat (17/12/2023 - 18/12/2023)

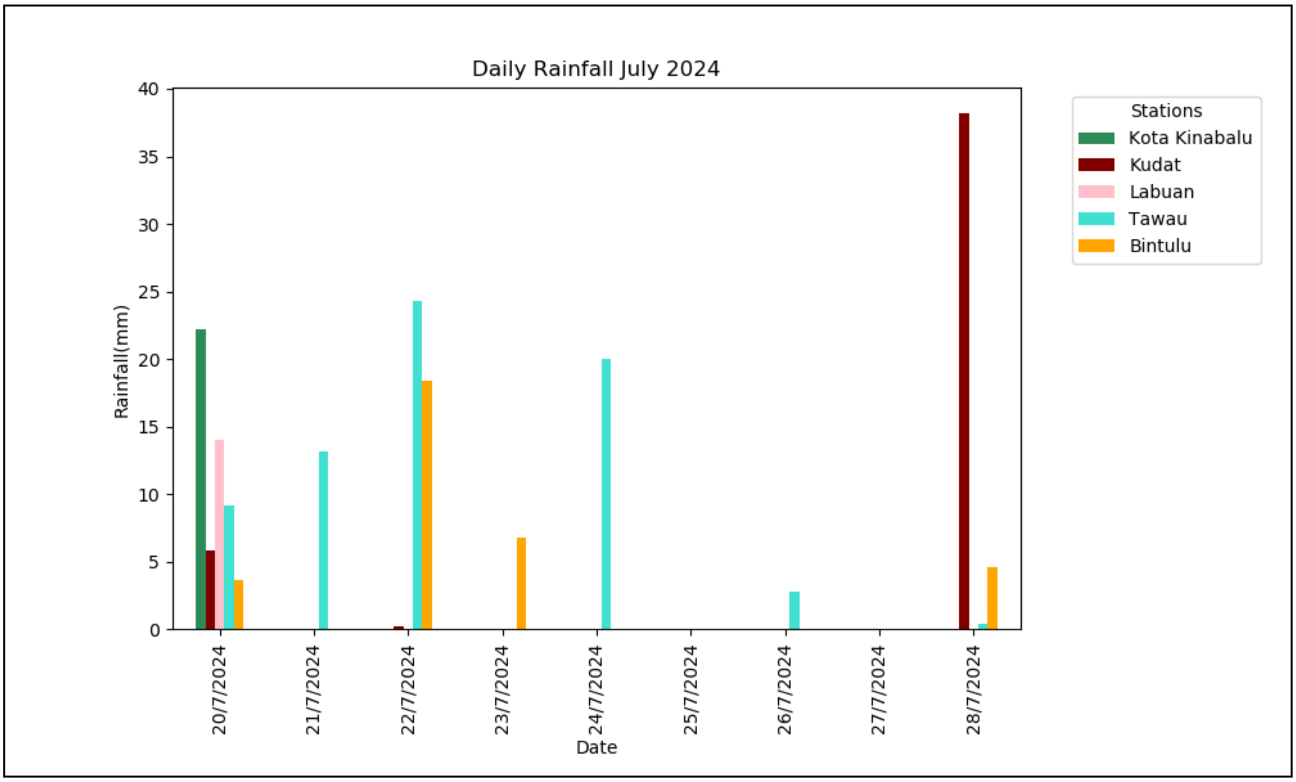


Figure 7: Daily rainfall during July 2024 for Ty Gaemi (20/7/2024 – 28/7/2024)

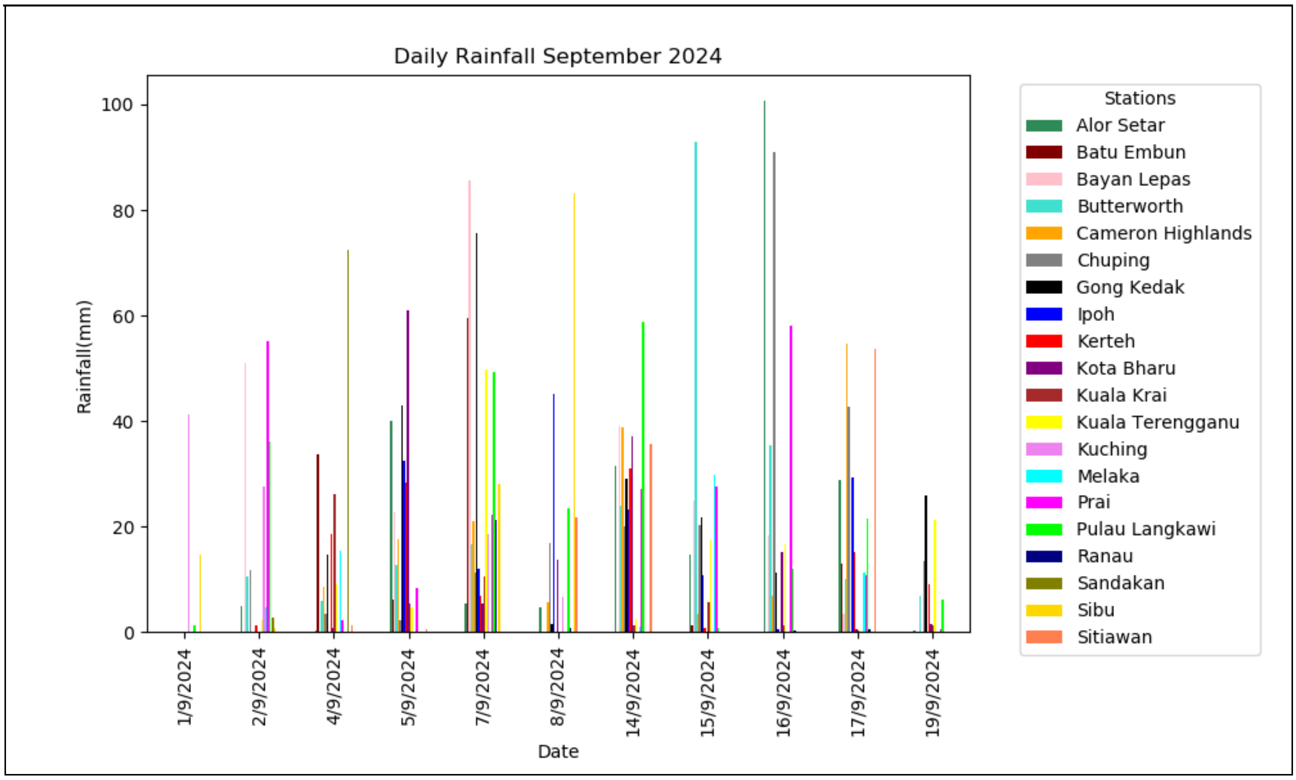


Figure 8: Daily rainfall during September 2024 for Ty Yagi (1/9/2024 - 8/9/2024), TS Pulasan (15/9/2024 - 17/9/2024) and TS Soulik (19/9/2024)

2. Hydrological Assessment

a) Flood Scenario in Malaysia

The 12 years trend shows the flood events increase significantly from 90 flood in 2001 to 783 in 2023. Details of the annual flood records since 2001 shown in **Figure 9**. From 1 January to 10 October, 2024, Malaysia has recorded 836 flood incidents. A significant flood is defined as a situation in which a flood event occurs during a period of rainfall exceeding 10 years and either the rainfall record is more than 60 mm/hour or the river water overflows. Analysis of the types of flood events shows that 59% are flash floods, while 34% are monsoon floods. Other types include flash floods (5%) and coastal floods (1%). The three main causes of flooding that have been identified are due to continuous heavy rain (39%), overflowing river water (28%), and internal drainage problems (13%). Typhoon and Tropical Storm can cause heavy rainfall. Among the areas of affected by TCs Jelawat, Gaemi, Prapiroon and Yagi are listed in **Table 2**.

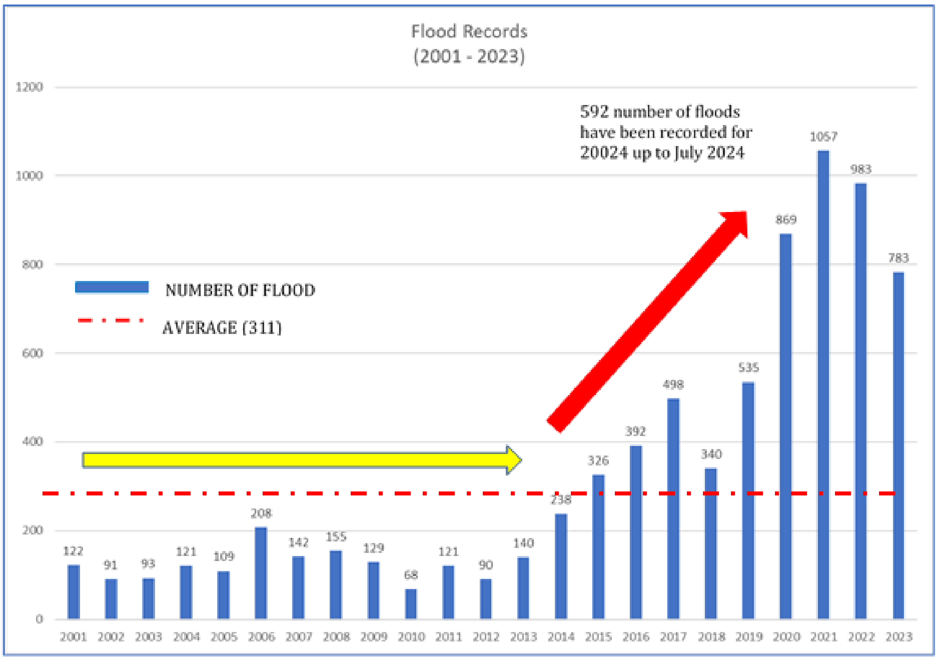


Figure 9: Annual flood records

Table 2: Areas Affected in Malaysia due to TCs Jelawat, Gaemi, Prapiroon and Yagi

No.	Tropical Cyclone (TC)	Classification	Date		Flood area affected
			Birth	Dissipation	
1	Jelawat	Tropical Storm	17/12/2023	18/12/2023	There was flood reported on the east coast of Peninsular Malaysia mostly in Terengganu (4 case) and Pahang (1 case). While East Malaysia occurred in Sandakan, Sabah (2 case) and Kota Samarahan, Sarawak (3 case).
2	Gaemi	Typhoon	20/7/2024	28/7/2024	No flood recorded
3	Prapiroon	Tropical Storm	21/7/2024	24/7/2024	No flood recorded
4	Yagi	Typhoon	1/9/2024	8/9/2024	There has been reported flood occurred in the northern Peninsular of Malaysia. The states are Pulau Pinang (6 case), Kedah (9 case)

An event on 7 September 2024, in Kulim, Kedah, the Malaysian Meteorological Department has issued four (4) Thunderstorms Warning on the same day (7 September 2024) at 12.15pm, 2.30pm, 3.50pm and 5.40pm as shown on **Figure 10**.

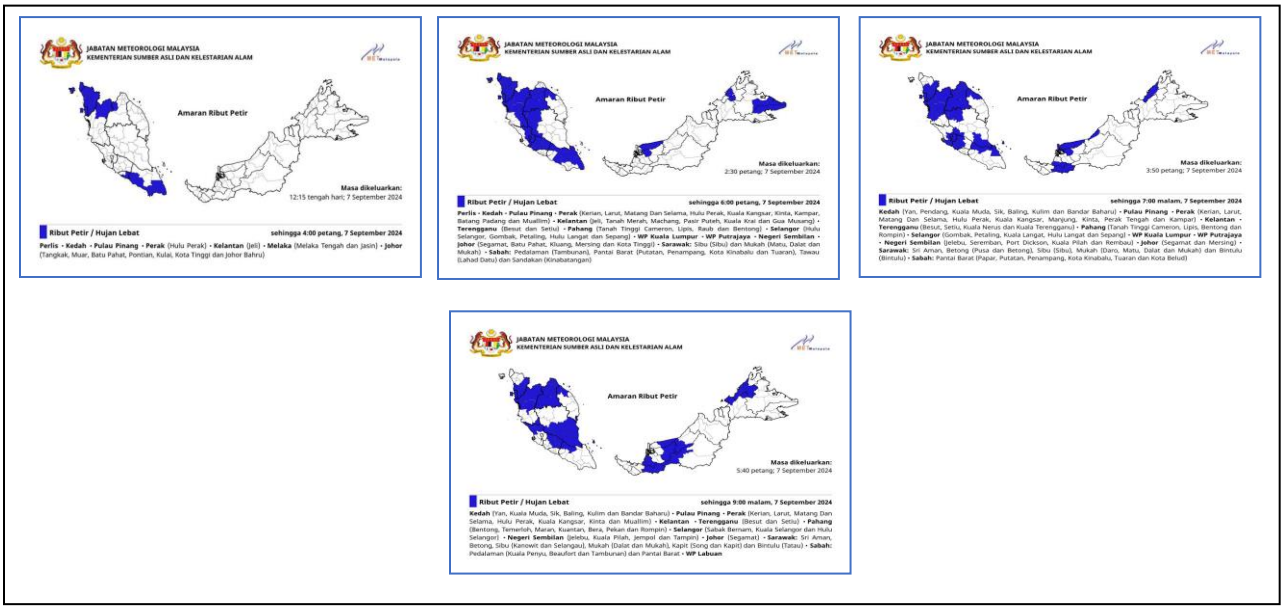


Figure 10: Warning issued by the Malaysian Meteorological Department

The flash flood that occurred on 07 September 2024 in Kampung Paya, Kulim Kedah was due to continuous heavy rain and causing Sungai Mahang could not accommodate the abundant rainwater runoff from the village. The flood that occurred involved 9 families. However, there was no temporary evacuation centre opened. The average depth of the area involved in flooding is 0.1m-0.5m. **Table 3** show the rainfall depth at two (2) rainfall station on the 7 September 2024 and the annual recurrence interval (ARI). **Figure 11** show the picture of the affected areas.

Rainfall Station	Maksimum Rainfall (mm)				ARI (Year)	
	14.00 – 15.00	15.00 – 16.00	16.00 – 17.00	17.00 – 18.00	1 hour	3 hour
Sg. Kerian di Mahang	0.5	2.5	2.0	2.5	0	0
Ldg. Bagan Sena di Kedah	24.5	16.0	3.5	2.5	0	0

Table 3: Rainfall recorded for two stations near the flood area on 7 September 2024

The district Department of Irrigation and Drainage proposed a short term to reduce the flood as follows:

i. Internal drainage system maintenance;
ii. Upgrading the existing drainage system;
iii. Maintenance of urban drainage system;
iv. Dredging and deepening Sungai Mahang periodically.

Figure 11: Picture of affected areas during the flood event at Kampung Paya

b) Hydrological Standardization

Hydrological Procedure (HP) was first published by the Department of Irrigation and Drainage, Malaysia (JPS) in the year 1973. There were three (3) HP that was published during that year which was:

i. Estimation of the Design Rainstorm in Peninsular Malaysia (HP1);
ii. Water Quality Sampling for Surface Water (HP2);
iii. A General Purpose Event Water Level Recorder (HP3).

JPS have been reviewing, updating current HP and publishing new HP for the purpose use of various government agencies and private sectors in the field of water resources. The updating and reviewing of HP, is in line with more hydrological data have been accumulated in recent years, to incorporate new methods, technologies and "best practices" in hydrometric development, monitoring and hydrological analysis. To date, JPS have published 31 hydrological procedures that include various hydrological disciplines. In general, HP can be categorised into 3 main applications:

i. Procedures that consist of various hydrological design methods and analysis (i.e. HP1, HP4, HP5, HP11, HP12, HP13, HP16, HP17, HP18, HP20, HP26 and HP27);
ii. Procedures that describe various hydrological data collection methods, data management and data quality control (i.e. HP2, HP6, HP7, HP10, HP15, HP19, HP22 and HP28);
iii. Procedures related to hydrometric instrument standards (i.e. HP3, HP8, HP9, HP14, HP21, HP23, HP24, HP25, HP32, HP33 and HP35).

The latest HP that has been publish is Hydrological No. 32: Hydrological Standard for Rainfall Station Instrumentation and Hydrological Procedure No. 33: Hydrological Standard for Water Level Station Instrumentation.

i. Hydrological No. 32: Hydrological Standard for Rainfall Station Instrumentation

   This procedure is used as the standard instrumentation, installation and maintenance for rainfall stations in Malaysia. Changes in instrumentation over the years have improved in time resolution and rainfall depth over the recording history in many sites. Improvements in resolution however come at a cost of maintaining stationarity. Also, the time interval pertaining to data collected has significantly changed over time.

ii. Hydrological No. 33: Hydrological Standard for Water Level Station Instrumentation

   Since decades JPS as the national hydrological agency has been developing hydrological stations throughout Malaysia to collect and obtain data for water resource assessment, planning, development, early flood warning and river monitoring purposes. JPS has several water quality stations especially in Kuala Lumpur and Selangor. This procedure is made as the standard for water quality station instrumentation, installation and maintenance at hydrological stations in Malaysia.

c) National Flood Forecasting and Warning Programme (PRAB)

Since 2015, Malaysia is developing a Flood Forecasting and Warning System under the Program Ramalan dan Amaran Banjir (PRAB) throughout the country. The 15 years project (2015-2030) aims to provide monsoon flood forecast 7 days in advance and early warning flood forecast up to 2 days in advance to the flood related agencies and public. PRAB consists of four main components (detection, forecast, integrated forecast operation system & warning and dissemination) plans to develop flood forecast modelling system for 74 main river basins throughout the country and currently (year 2024) 28 river basins have been completed and operational as shown in **Table 4**.

PRAB is now developing another 11 river basins has been initiated for Selangor, Johor and Sabah since 2022 as shown on **Table 5**. Besides, PRAB also involved in the construction of hydrological telemetry stations which includes parameter of rainfall, water level, streamflow, soil moisture and evaporation. A number of siren and camera systems will be installed at selected locations of the flood prone area. Non-structure elements that related to public awareness also have been carried out to provide basic knowledge on flood forecast and warning. The awareness programme involved many parties such as flood related agencies, student (school and higher education), villagers, local leaders, non-governmental organizations and others.

Table 4 : List of operational river basins under National Flood Forecasting and Warning System (NAFFWS)

No.	State	River basin
1	Perlis	Sungai Perlis
2	Kedah	Sungai Kedah
3	Kedah	Sungai Muda
4	Kedah	Sungai Melaka at Langkawi
5	Pulau Pinang	Sungai Juru
6	Pulau Pinang	Sungai Perai
7	Pulau Pinang	Sungai Jawi
8	Pulau Pinang	Sungai Pinang
9	Perak	Sungai Kerian
10	Perak	Sungai Kurau
11	Perak	Sungai Perak
12	Johor	Sungai Johor
13	Johor	Sungai Mersing
14	Johor	Sungai Endau
15	Pahang	Sunga Rompin

16	Pahang	Sungai Pahang
17	Pahang	Sungai Kuantan
18	Terengganu	Sungai Kemaman
19	Terengganu	Sungai Dungun
20	Terengganu	Sungai Paka
21	Terengganu	Sungai Terengganu
22	Terengganu	Sungai Setiu
23	Terengganu	Sungai Besut
24	Kelantan	Sungai Kelantan
25	Kelantan	Sungai Golok
26	Negeri Sembilan	Sungai Linggi
27	Melaka	Sungai Kesang
28	Melaka	Sungai Melaka

Table 5 : List of initiated river basins under National Flood Forecasting and Warning System (NAFFWS)

No.	State	River basin
1	Selangor	Sungai Klang
2	Selangor	Sungai Bernam
3	Selangor	Sungai Selangor
4	Selangor	Sungai Langat
5	Selangor	Sungai Buloh
6	Johor	Sungai Muar
7	Johor	Sungai Batu Pahat
8	Johor	Sungai Skudai
9	Sabah	Sungai Kinabatangan
10	Sabah	Sungai Padas
11	Sabah	Sungai Abai

3. <u>Socio-Economic Assessment</u>

Malaysia recorded 783 flood incidents in 2023. Study carried out by Department of Statistics Malaysia found that in year 2023, overall losses due to floods were RM755.4 million (2022: RM1,026.5 million) which equivalent 0.04 per cent (2022: 0.06 per cent) as against nominal Gross Domestic Product. Living quarters losses amounted to RM168.3 million (2022: RM157.4 million), vehicles RM22.3 million (2022: RM18.8 million), business premises RM53.2 million (2022: RM50.3 million), manufacturing RM10.3 million (2022: RM8.7 million), agriculture RM120.6 million (2022: RM154.5 million), and public assets & infrastructure RM380.7 million (2022: RM636.8 million) as shown in **Figure 12**.

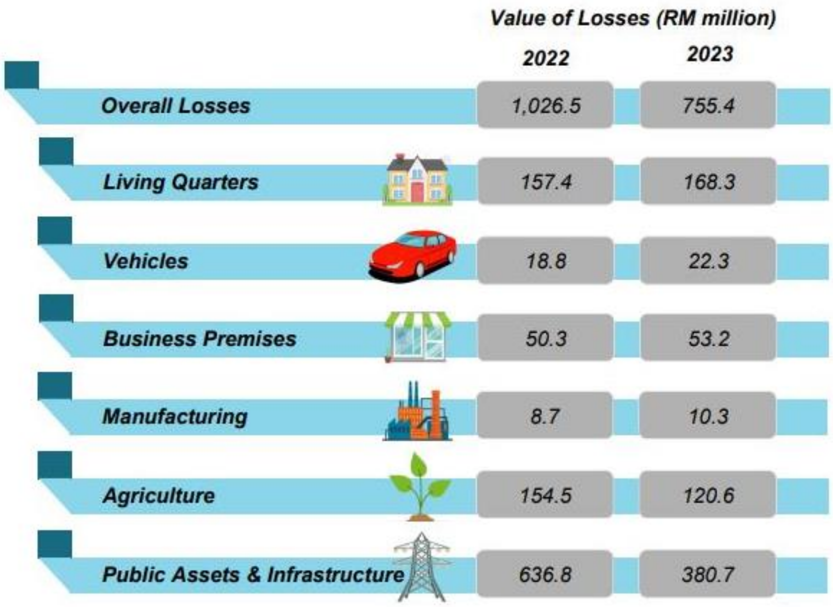


Figure 12: Category of flood losses in year 2022 and 2023

II. Summary of Progress in Priorities supporting Key Result Areas

1. Addition of One Radar Observation Sites in Malaysia for Monitoring Severe Weather

MET Malaysia has enhanced its radar observation network with the addition of one new radar in Tawau to improve coverage of severe weather monitoring. The new S-Band radar with Doppler capability is strategically located to overcome terrain blockage.

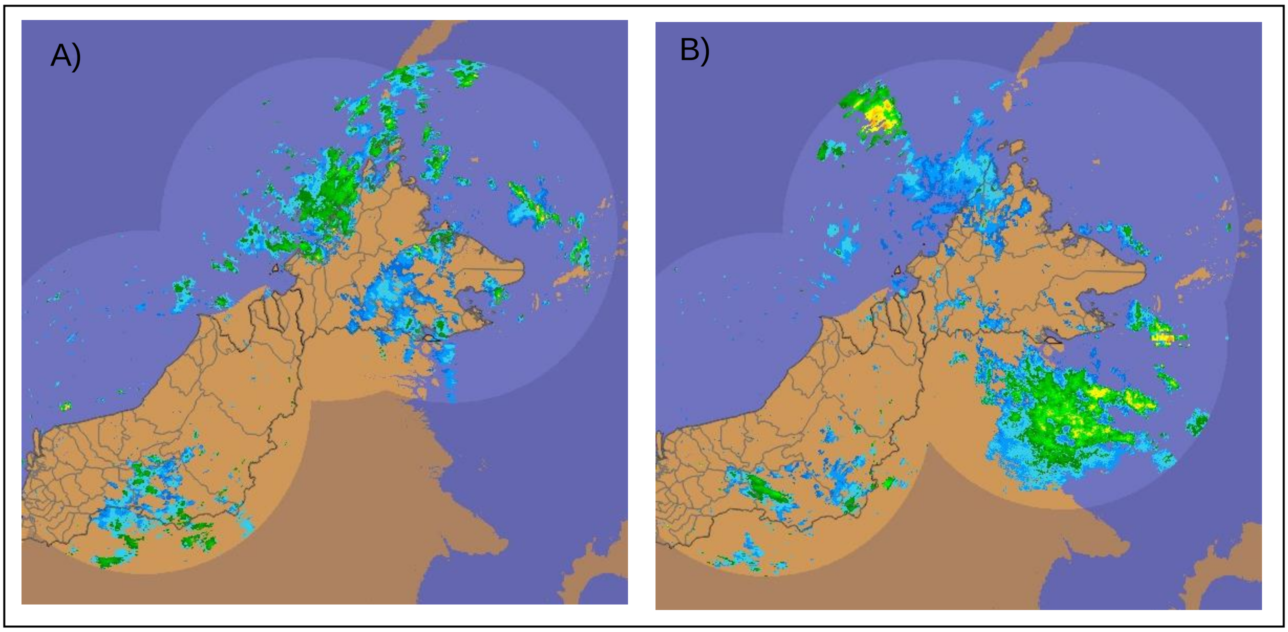


Figure 13: The figure A) denotes radar observation before inclusion of new radar, and figure B) denotes radar observation after inclusion of new radar. Note improved radar observation in the mountainous region.

2. The 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.

Figure 14: The National Disaster Risk Reduction Policy 2030

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

a) Opportunity and challenges in coordination multiple stakeholder
Effective coordination among multiple stakeholders, across various levels, including the Federal Government, State Governments, Local Authorities (PBT), the private sector, Government Link Company (GLC), Government Link Investment Company (GLIC), volunteer bodies, non-governmental organizations, and the community is crucial in reducing disaster risks, to shape Malaysia into a safe and disaster-resilient nation.

b) Priority Areas Addressed:
Warning systems and information delivery to target groups, especially vulnerable populations.

c) Disaster Risk Reduction

Promote international cooperation of DDR implementation project:

i. Enhance collaboration, sharing of expertise, best practices, and knowledge transfer.

Reducing the number of people affected by disasters by 2030:

i. Empowering Policies, Legislation, and Mechanisms Related to Disaster Risk Reduction
ii. Ensure mitigation actions are carried out in disaster-prone areas to prevent recurrence, reduce impact and shorten the duration of disasters
iii. Enhance community-based disaster risk reduction programs by incorporating the concept of localization.

3. 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 NADMA. It was executed by National Disaster Command Centre (NDCC) which is one of the units under NADMA. NDCC operate 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.

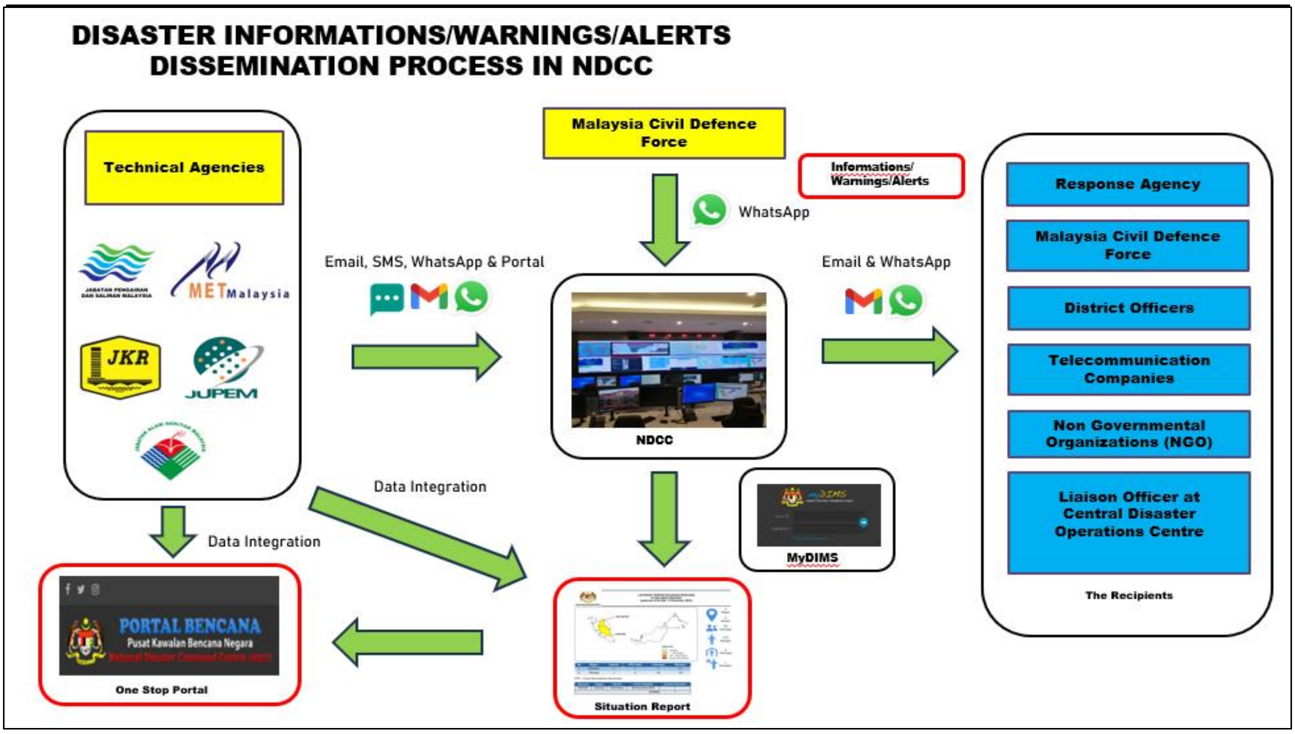


Figure 15: The dissemination of early disaster alerts or warnings

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

a) Data sharing across agencies
Opportunity for collaborative platforms: Develop and promote a shared digital platform where multiple agencies can contribute and access data. This could foster inter-agency partnerships and improve response times.

b) Two-Way Communication
To enhance communication between the state and district disaster operations rooms, it's crucial to establish a framework that facilitates both one-way and two-way communication effectively.

c) System maintenance and update
Establish joint maintenance and upgrade initiatives among agencies to pool resources, share best practices, and reduce costs associated with system upkeep.

d) Lack of skilled personnel

Work with educational institutions to develop specialized training programs and workshops focused on disaster management skills, ensuring a steady pipeline of qualified personnel.

Priority Areas Addressed:

a) Meteorology

Enhancing accuracy of weather forecast involving continuous heavy rain and tsunami.

b) Hydrology

Enhancing availability and access to flood and river water level alert.

c) Disaster Risk Reduction

Increase level of preparedness and awareness on disaster risk reduction as well as disaster management among vulnerable group involving urban dan rural areas.

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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