Source: Berita Harian

Monitoring and Forecasting Severe Weather due to Monsoon Surges during Northeast Monsoon Season in Malaysia

Ambun Dindang
Malaysian Meteorological Department
(Met Malaysia)

Webinar Series on Climate Change Projection for Disaster Risk Reduction in Asia-Pacific Region Fourth Webinar with Malaysia

27 February 2025
15:00 - 17:00 [Japan Time, UTC+9]
14:00 - 16:00 [Malaysia Time, UTC+8]

OUTLINE

1. Northeast Monsoon in Malaysia
2. Monsoon surge during Northeast Monsoon
3. Early Warning System of MET Malaysia
4. Recent monsoon surges and related weather warnings
5. Conclusions

1. NORTHEAST MONSOON IN MALAYSIA

Seasons in Malaysia : The Monsoons

Nov - Mar

- Northeast Monsoon
- Rainy season /heavy rainfall
- Floods / land slides
- Rough Seas
- Storm surges/ coastal flooding

Apr/May

- Inter Monsoon
- Thunderstorm
- Flash Floods
- Heatwaves
- Haze

Jun - Sept

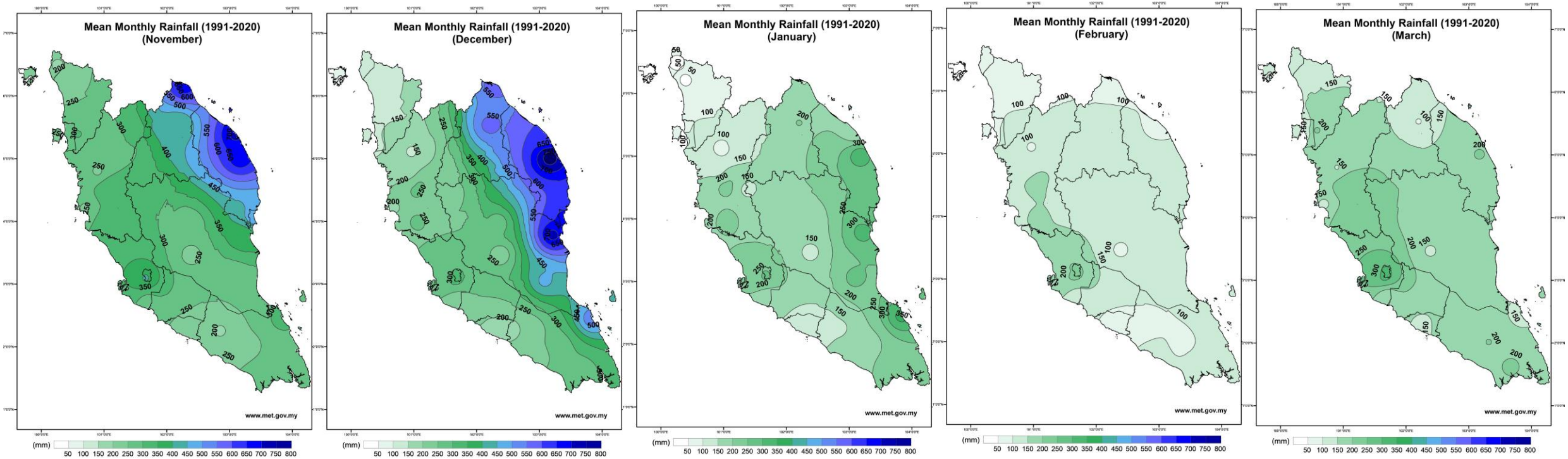
- Southwest Monsoon
- Haze
- Less rainfall
- Heatwaves
- Forest and Peatland fires
- Sumatras / Squall

Oct

- Inter Monsoon
- Thunderstorm/Hailstorm
- Flash Flood
- Heatwaves
- Forest and Peatland fires
- Mini tornado

1. NORTHEAST MONSOON IN MALAYSIA

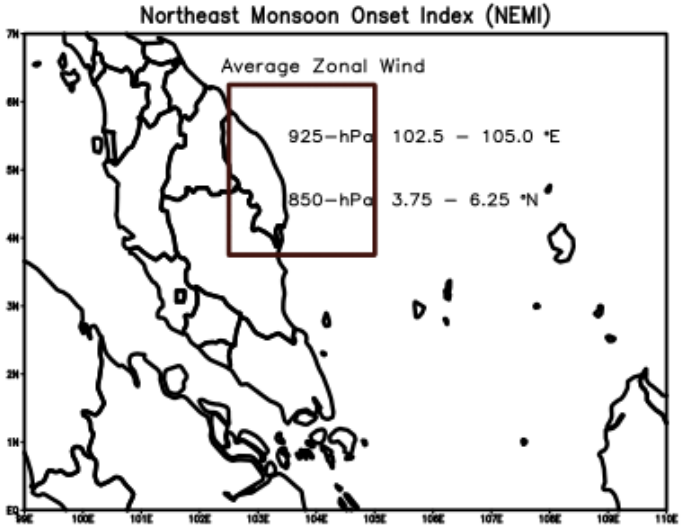
Mean Monthly Rainfall Pattern in Peninsular Malaysia (Nov-Mar)



- In the early phase of NEM, east coast states of peninsula receives more rainfall in Nov and Dec.
- Less rainfall recorded over northern peninsular during January and February, drier weather.
- Monsoon shifts towards Sarawak and Sabah during the second phase in January and February

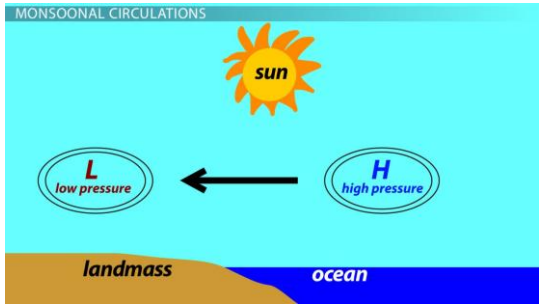
1. NORTHEAST MONSOON IN MALAYSIA

The Onset and withdrawal of Northeast Monsoon Season.



NEMI = U925,U850 (102.5-105.0E,3.75-6.25N)

- The northeast monsoon **begins** when Northeast Monsoon Index (NEMI) is negative for 7 consecutive days with 1 day wind speed is less than -2.5 m/s.
- The northeast monsoon **end** when NEMI is positive wind speed is more than -2.5 m/s for 7 consecutive days with westerly penetration over Malaysia



- A monsoon is a shift in winds that often causes a very rainy season or a very dry season. Although monsoons are usually associated with parts of Asia, they can happen in many tropical and subtropical regions – including several locations in the United States.

MetMalaysia: Northeast Monsoon Expected To Start Nov 5

01/11/2024 04:21 PM

- The onset date for NEM 2024/25 was on 5th Nov 2024, and press statement was issued on 1 Nov 2024

2. MONSOON SURGE DURING NORTHEAST MONSOON

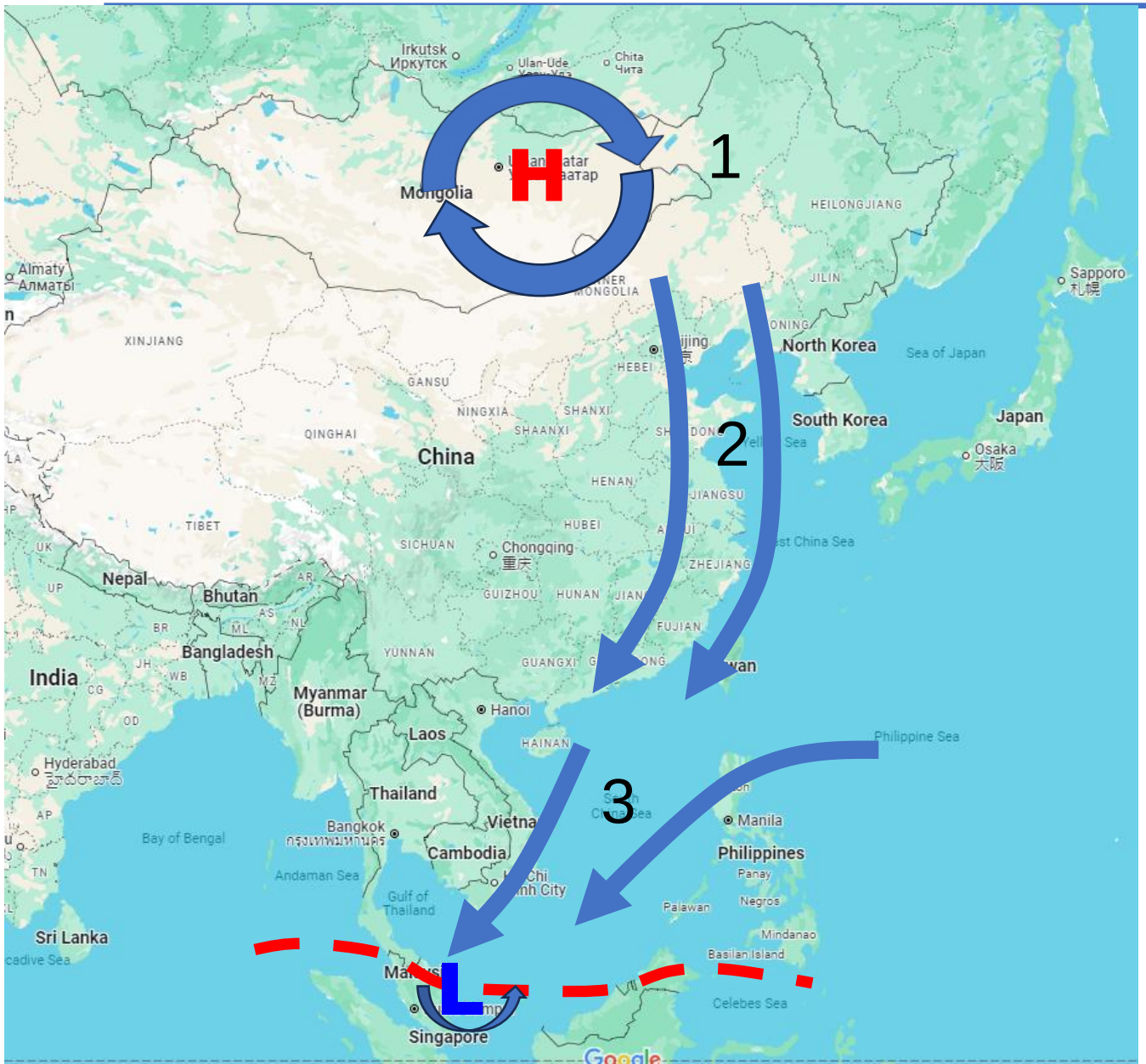
What is monsoon surge?

A monsoon surge refers to a **strengthening of northeasterly winds** over the South China Sea (SCS), causing extensive rainclouds to form over a surrounding region and move inland causing **continuous heavy rain** in Malaysia.

Why monitoring and forecasting monsoon surge is important?

- ✓ Continuous heavy rain
- ✓ Monsoon floods
- ✓ Landslides
- ✓ Strong wind and rough seas
- ✓ Storm surge
- ✓ Coastal erosion
- ✓ Coastal flooding

2. MONSOON SURGE DURING NORTHEAST MONSOON



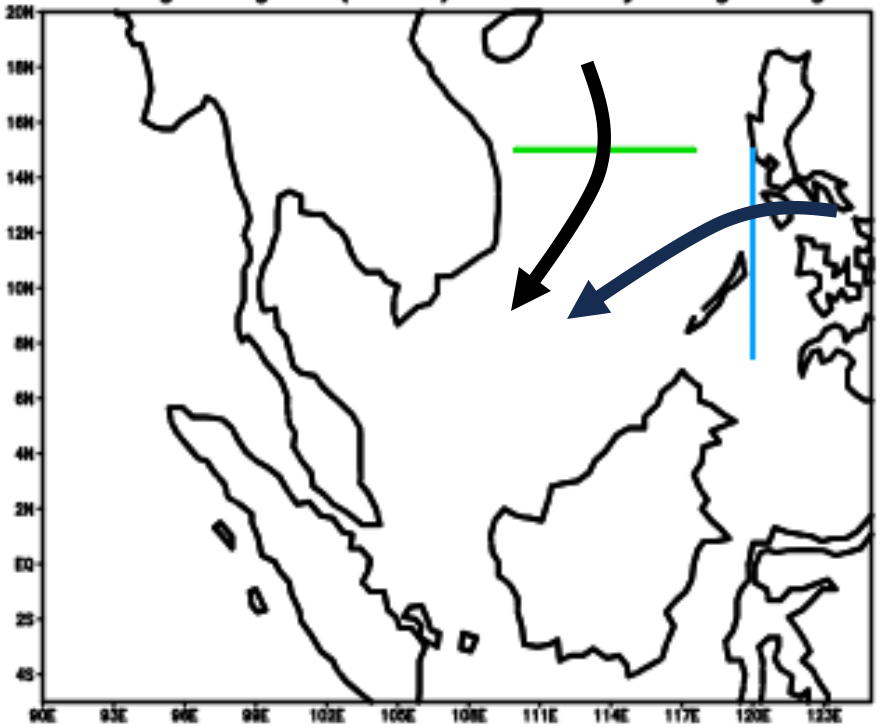
How does monsoon surge occur?

1. High Pressure area called Siberia High (H) develop during the Northern Hemisphere Winter (Nov-Mar). Air mass around the H circulates in clock wise manner (anticyclone)
2. When high pressure drops suddenly, cold air mass flow out from H towards tropics region (burst).
3. Cold & dry air mass from north and warm & moist air from east passes through ocean surface and collecting moisture evaporated from the South China Sea (SCS).
4. The meridional and easterly air mass called monsoon surge flow into a low pressure area (L) along the monsoon trough and caused heavy continuous rainfall over Malaysia.

2. MONSOON SURGE DURING NORTHEAST MONSOON

Monitoring and Forecasting NE Monsoon surges

Meridional Surge Region (Green) & Easterly Surge Region (Blue)



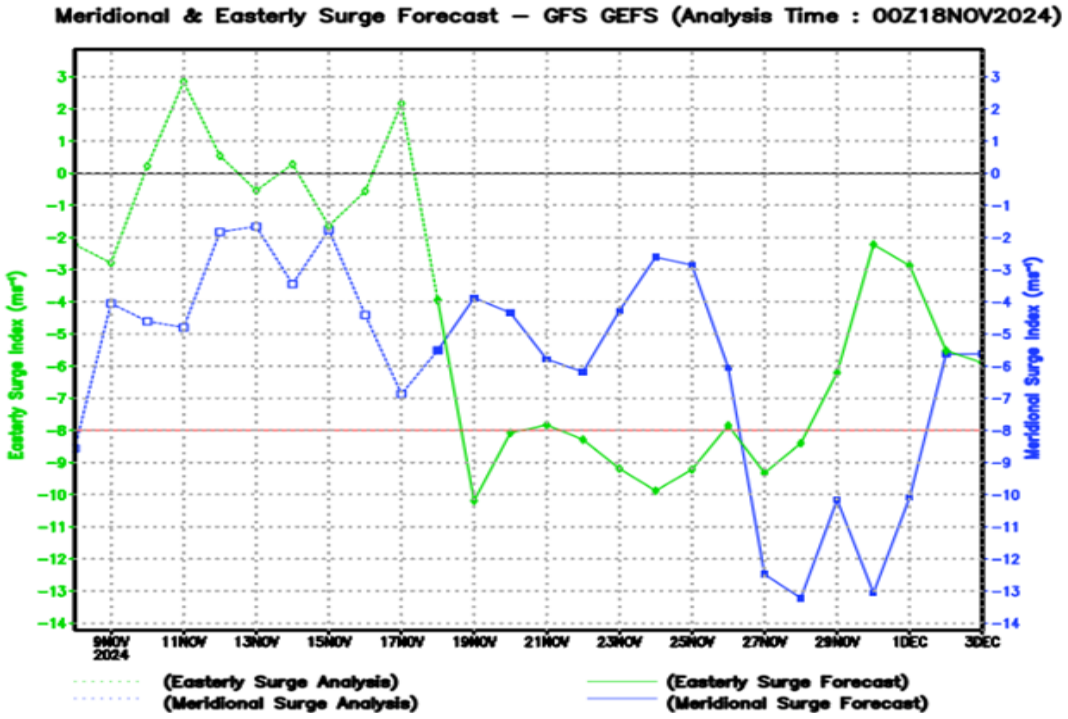
Meridional Surge = V925 (110.0-117.5E,15.0N)
Easterly Surge = U925 (120.0E,7.5-15.0N)

The **meridional surge index (MSI)** was adopted from C.P. Chang (2005). The MSI was defined as the average 925-hPa meridional wind bounded by **110 E to 117.5 E along 15 N.** The surge episode begins when the MSI is less than -8 m/s for 3 consecutive days and ends when the MSI is greater than -8 m/s for at least 3 consecutive days.

The **easterly surge index (ESI)** was adopted from Hai (2017). The ESI was defined as the average 925-hPa zonal wind between **7.5 N and 15 N along 120 E.** A surge episode is said to begin when the ESI is less than -8 m/s for 3 consecutive days and ends when the ESI goes above -8 m/s for at least 3 consecutive days.

2. MONSOON SURGE DURING NORTHEAST MONSOON

Monitoring and Forecasting NE Monsoon surges



KENYATAAN MEDIA

JABATAN METEOROLOGI MALAYSIA
KEMENTERIAN SUMBER ASLI DAN KELESTARIAN ALAM

19 NOVEMBER 2024

**JANGKAAN LURUAN MONSUN KUAT
PADA 27 NOVEMBER SEHINGGA 1 DISEMBER 2024**

Luruan monsun yang membawa hujan lebat berterusan sedang berlaku di timur dan selatan Semenanjung dijangka berlanjutan sehingga hujung November 2024. Analisis terhadap ramalan cuaca terkini menunjukkan kekuatan luruan monsun diramal meningkat pada **27 November hingga 1 Disember 2024**. Keadaan ini berpotensi menyebabkan hujan sangat lebat dan berterusan di timur Semenanjung dalam tempoh berkenaan.

MET Malaysia sentiasa memantau keadaan cuaca dari semasa ke semasa dan akan mengemas kini Amaran Hujan Berterusan sekiranya keadaan cuaca dijangka bertambah buruk.

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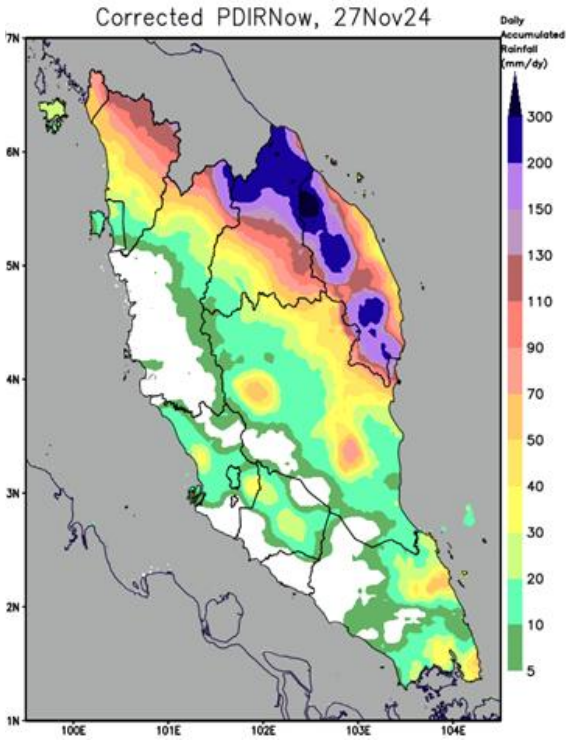
Sumber:
DR. MOHD HISHAM BIN MOHD ANIP

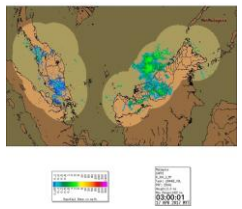


- Weather model run at 8am 18 Nov 2024 forecast that strong MS expected to occur from 26 Nov until 1 Dec 2024.
- Press statement issued on the 19 Nov 2025 mentioned that east coast states of peninsula will be affected.
- Alert stage warning (Yellow) effective from 26-29 Nov 2024 issued on 23 Nov 2024.

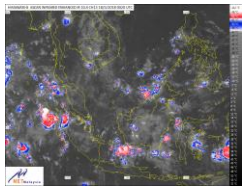
3. EARLY WARNING SYSTEM (EWS) of MET MALAYSIA

OBSERVATION & DATA ACQUISITION


424 Surface Observation Stations
8 Upper Air Stations

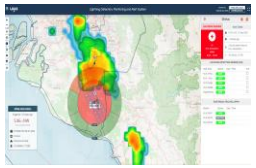



19 Weather Radars &
6 Wind Shear Detection Systems

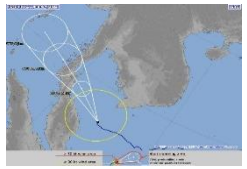
3 Geostationary Satellite Ground Stations

LDAS
LIGHTNING DETECTION, MONITORING AND ALERT SYSTEM



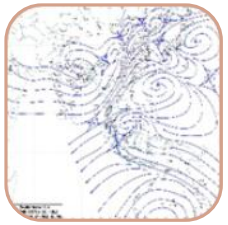
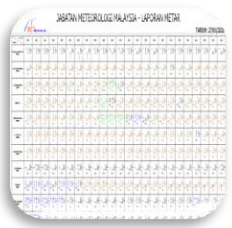
16 Lighting Detection Sensor (LDS)
6 LDS + EFM (Electric Field Mill

GTS, AFTN, WIS, WAFCs, FTP

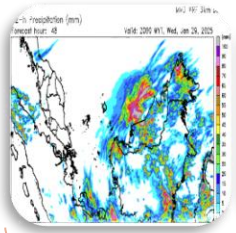
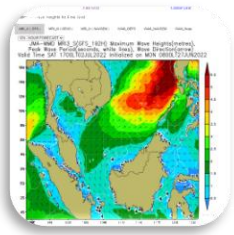


International Data Sharing

PROCESSING & ANALYSIS

Latest Weather Charts

Numerical Weather Prediction Models

Weather Forecast

Weather Warning

- Thunderstorm Warning
- Weather Advisory/Warning (Alert, Severe, Danger)
- Strong Wind & Rough Seas Warning
- Low Visibility Warning

DISSEMINATION


Website
Mobile App myCuaca

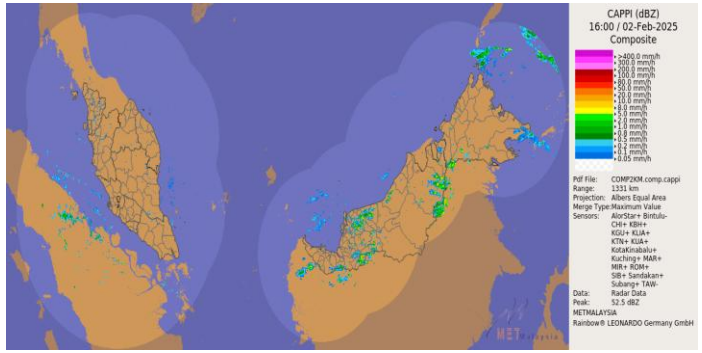
Social Media
TV Weather Report


SMS
Whatsapp
E-mail
Facsimile

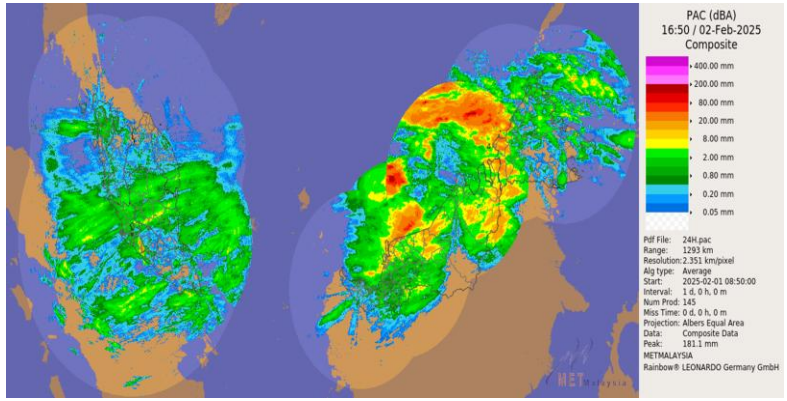

Mass Media

3. EARLY WARNING SYSTEM of MET MALAYSIA – Observation & Data Acquisition

a). Radar Observation Stations (19 + 6).

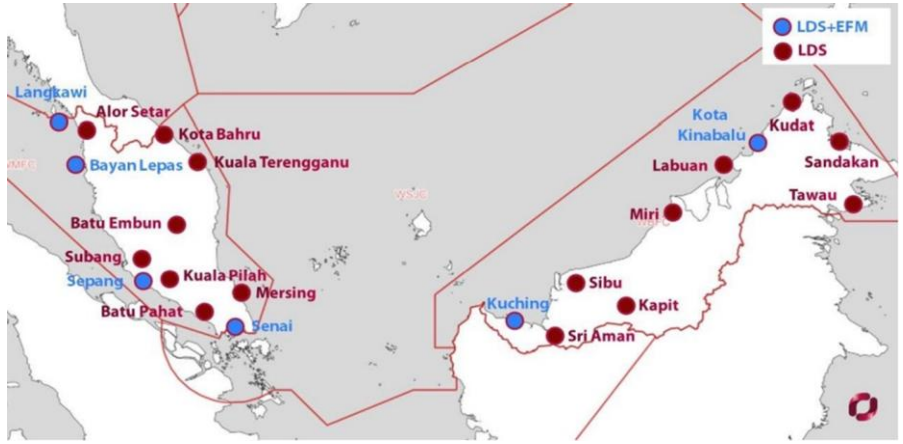


CAPPI Composite Radar

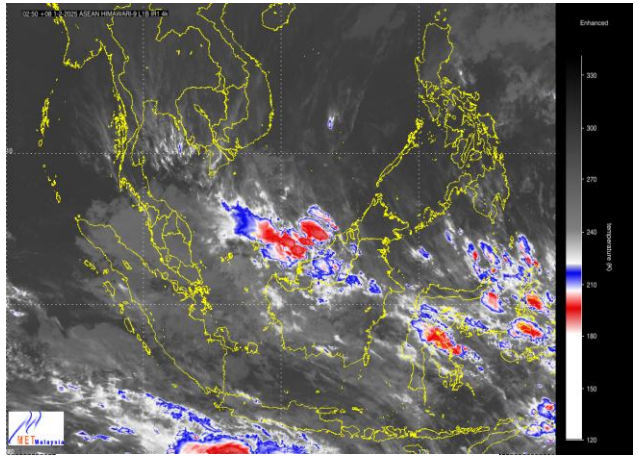


24 hours Accumulated Rainfall

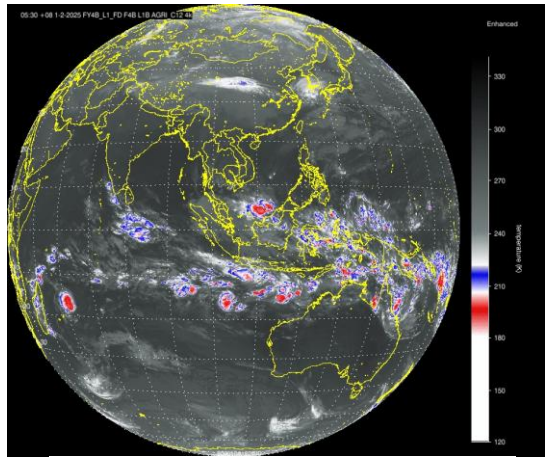
c). Lightning Detection and Alert System(16+6).



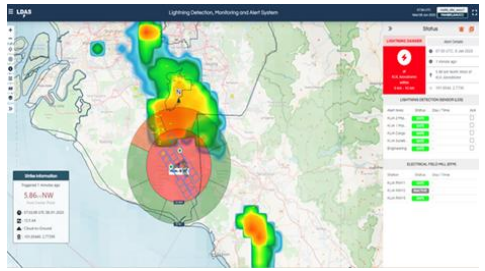
b). Satellite Ground Receiving stations (3).



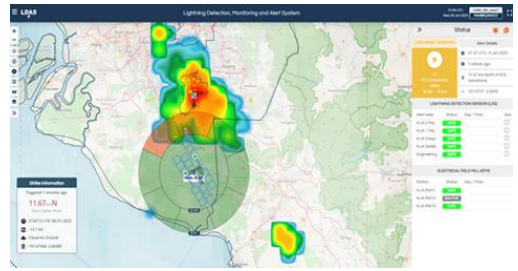
Infrared Enhanced



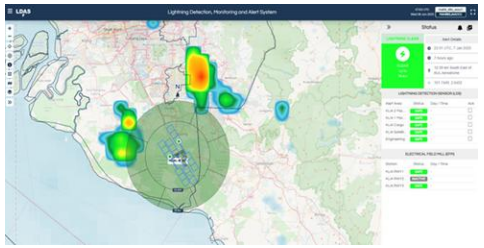
Infrared Enhanced



Lightning Danger (red)



Lightning warning (amber)

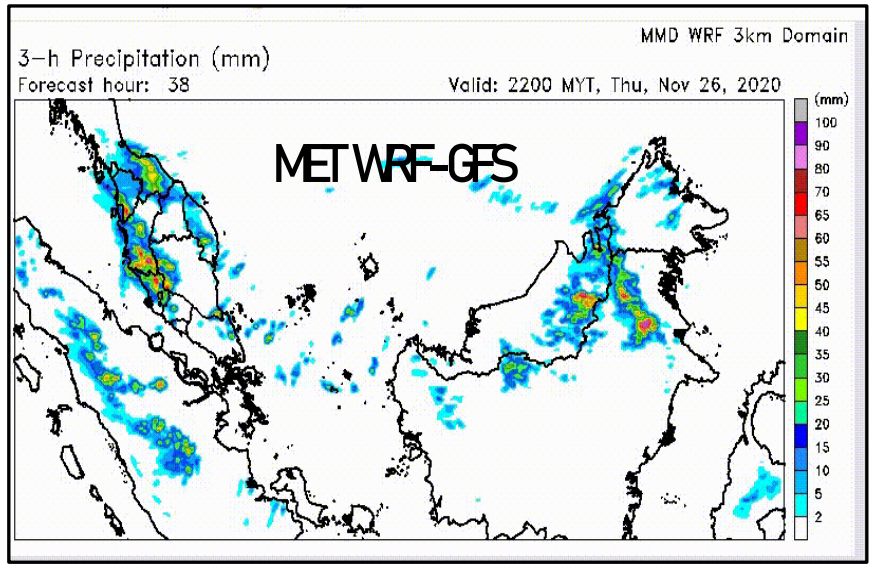


Lightning clear (green)

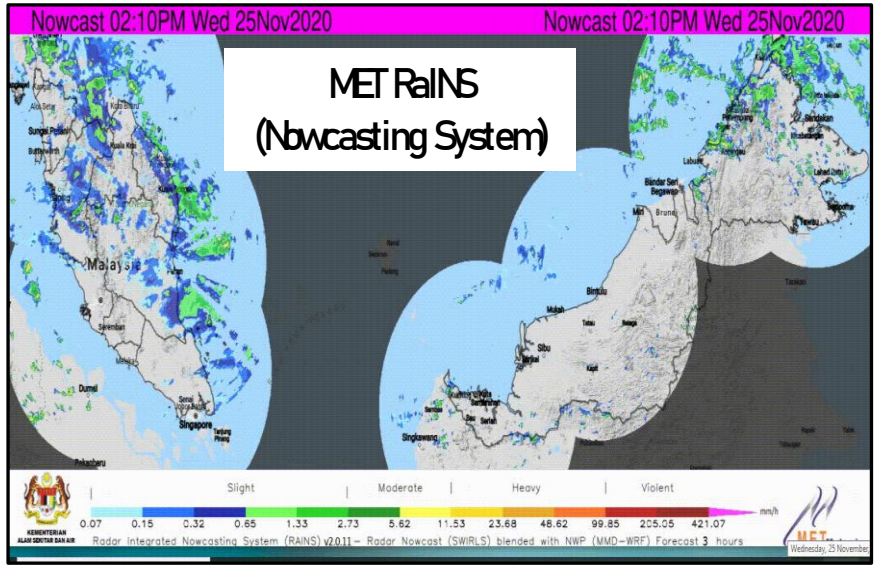
3. EARLY WARNING SYSTEM of MET MALAYSIA – Data Processing & Analysis

a). Weather models output produced by High Performance Computing (HPC).

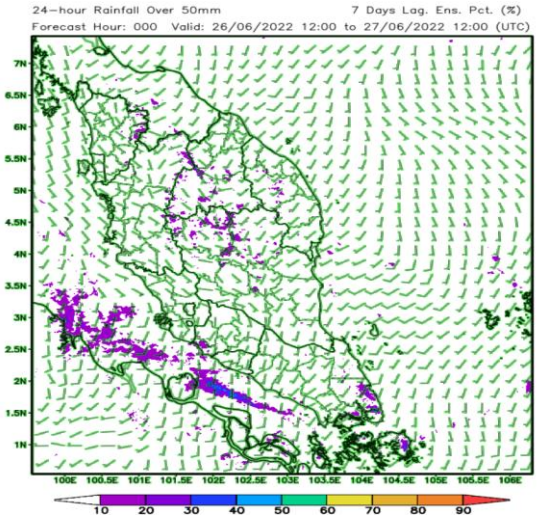
MET Kuala Lumpur City Hall Multi Hazard Platform



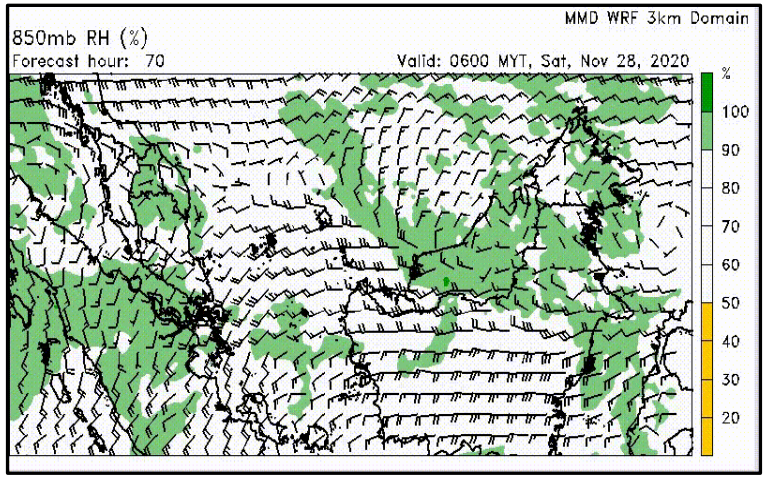
Precipitation Forecast



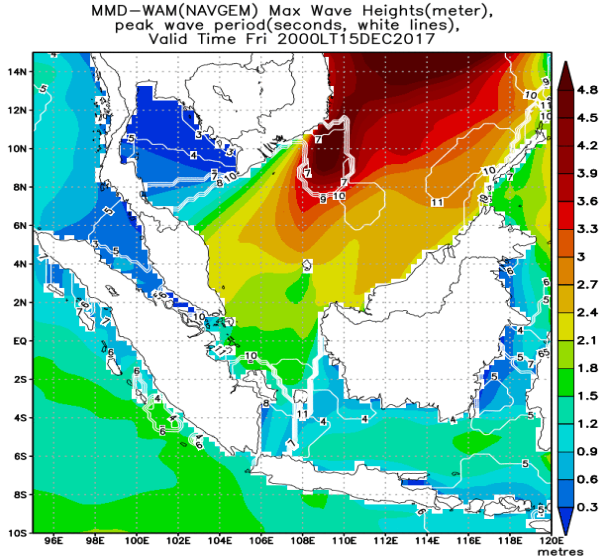
Nowcasting



Ensemble Forecast



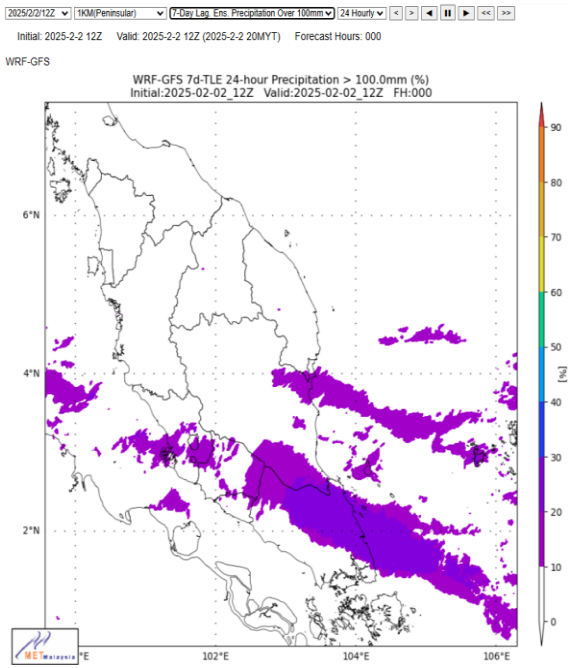
Relative Humidity Forecast

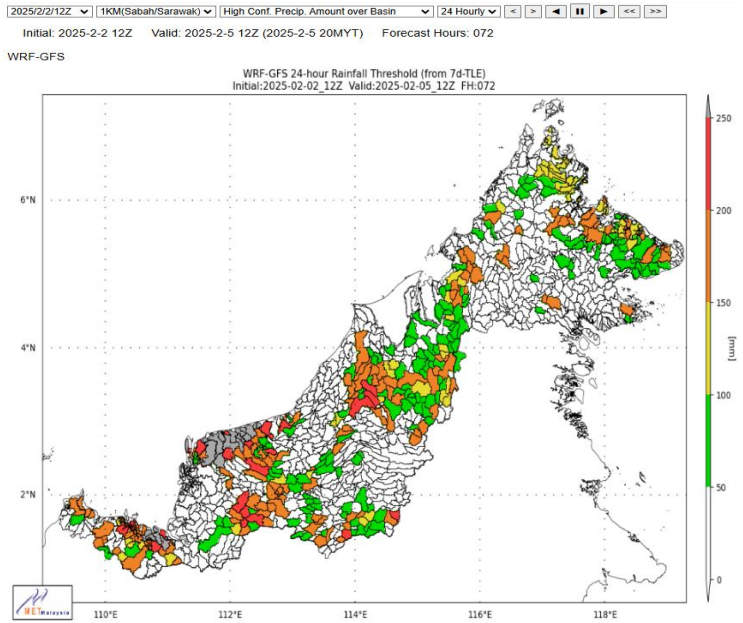


Marine Forecast

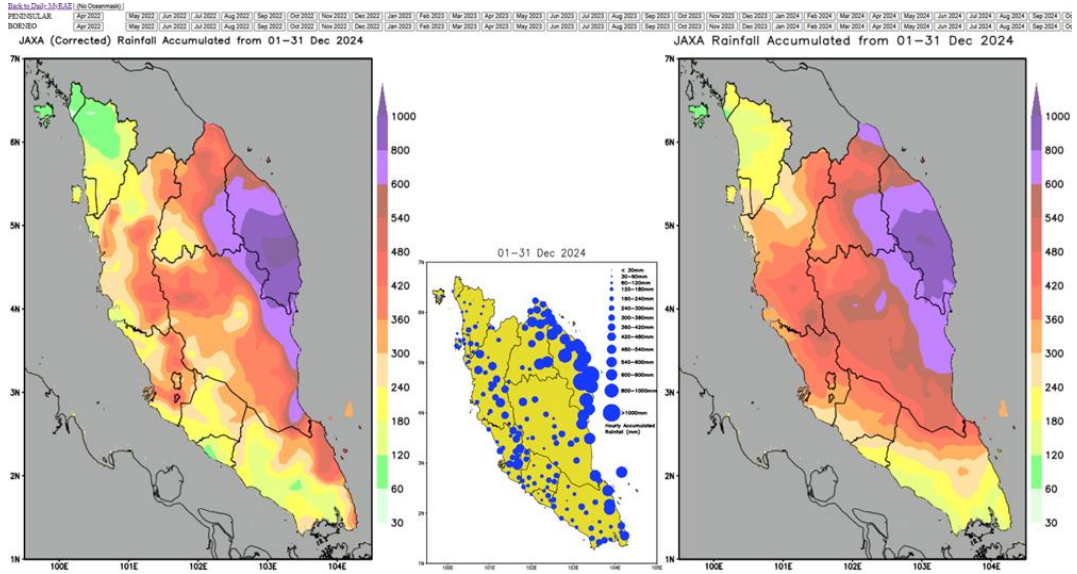
3. EARLY WARNING SYSTEM of MET MALAYSIA – Data Processing & Analysis

b). Time lag ensemble & River Basin forecasts





c). Malaysian Rainfall Analysis and Estimation (MyRAE)

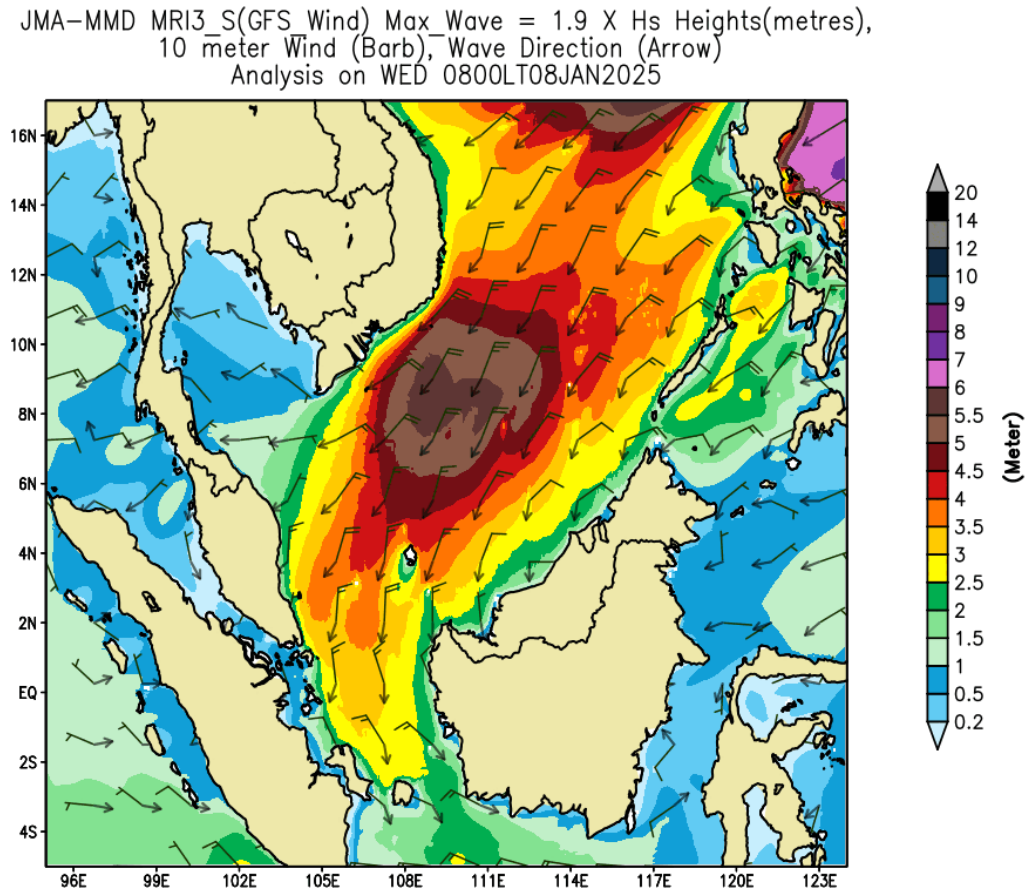


Corrected with satellite data | Station observation | Uncorrected

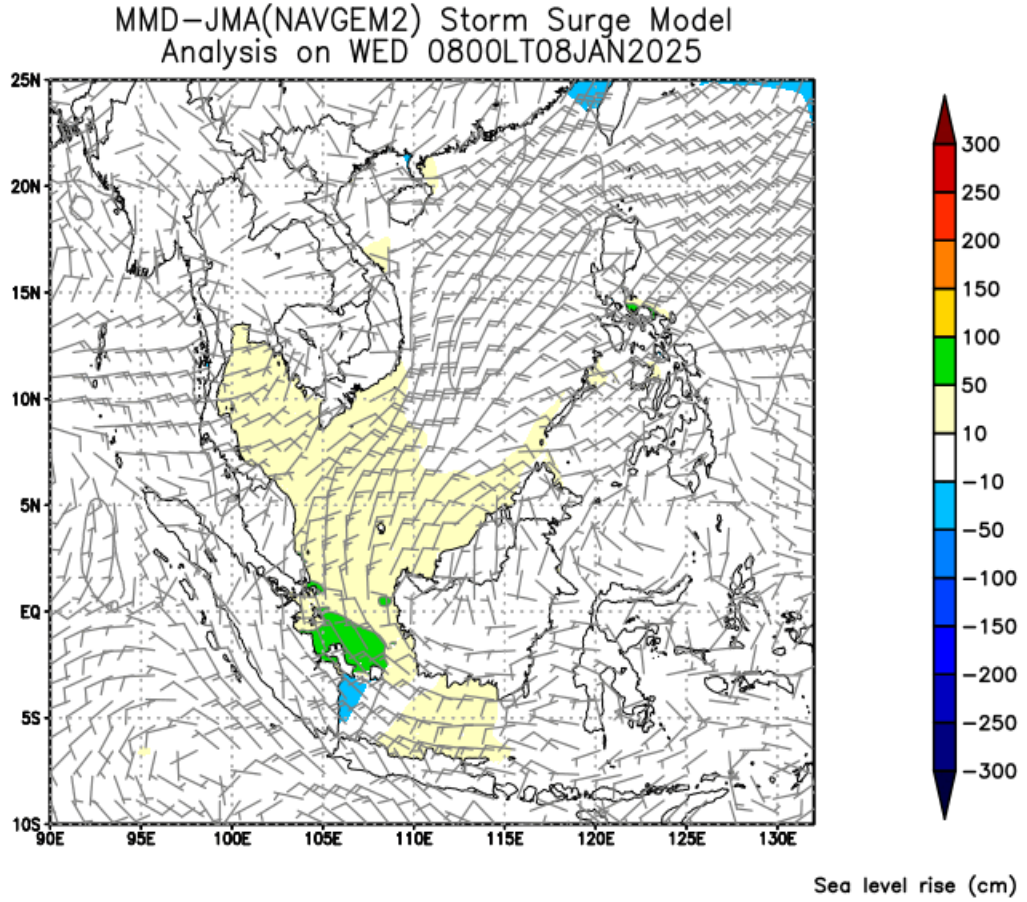
24 Hours Accumulated Rainfall Estimation using MyRAE

- MyRAE uses the method of Barnes Successive Correction (BSC) to fine-tune satellite gridded rainfall data with respect to rain gauge data.
- BCS is used because it is simple to understand and explain, while powerful enough to reduce the difference between satellites and rain gauge.

d). Marine models of MET Malaysia



Maximum wave forecast model



Storm surge forecast model

3. EARLY WARNING SYSTEM of MET MALAYSIA – Information Dissemination

SMS & WhatsApp

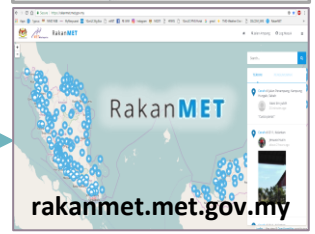
Mass Media

Tsunami Siren

E-mail & Fax

myCuaca mobile app

Website



Social Media

@malaysiamet @malaysianmet /metmalaysia

mymet.tv

Hotline

Hotline: 1-300-22-1638 / (03-79678116)

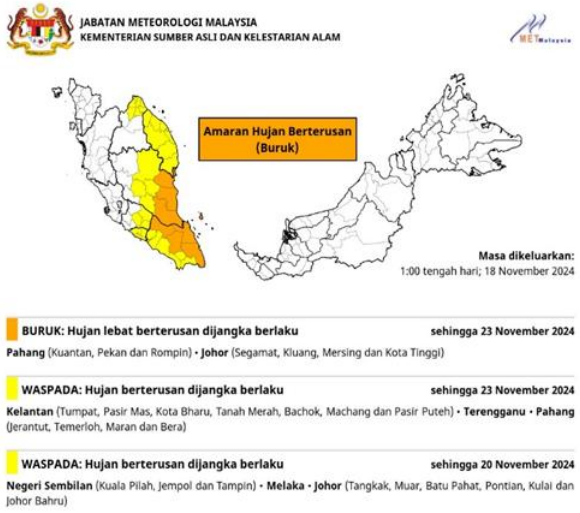
Radio

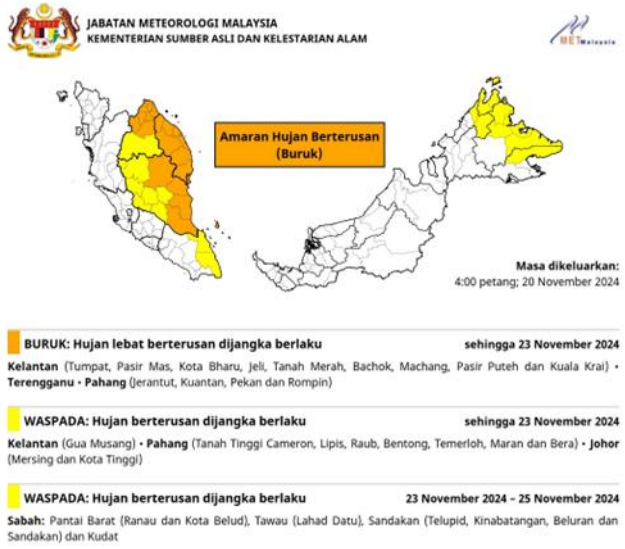
TV Crawler

Weather broadcaster (TV1)

4. RECENT MONSOON SURGES AND RELATED WEATHER WARNING

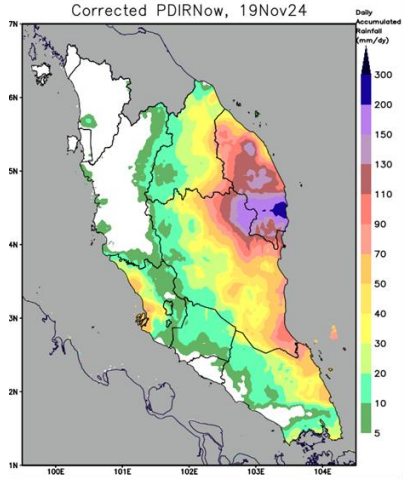
a) 1st monsoon surge on 19 – 22 November 2024



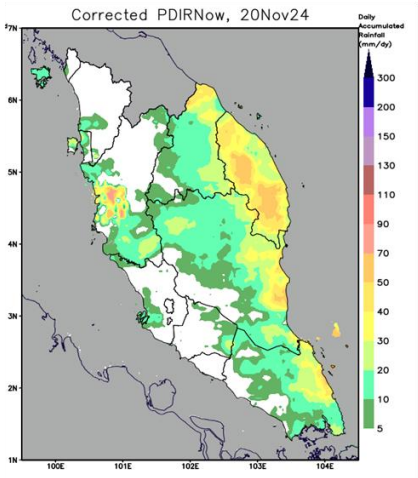


Alert warning issued on 15 Nov 2024

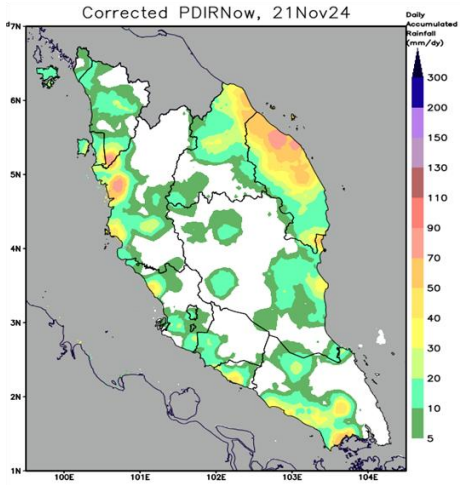
Warning was updated to amber stage on 18 Nov 2024 and 20 Nov 2024



19 Nov 2024



20 Nov 2024



21 Nov 2024

- Heavy rain was recorded mainly in the state of Terengganu on 19 Nov 2024
- Moderate rain was recorded in Kelantan, Pahang and east of Johor.

4. RECENT MONSOON SURGES AND RELATED WEATHER WARNING

b) 2nd monsoon surge on 26 – 30 November 2024

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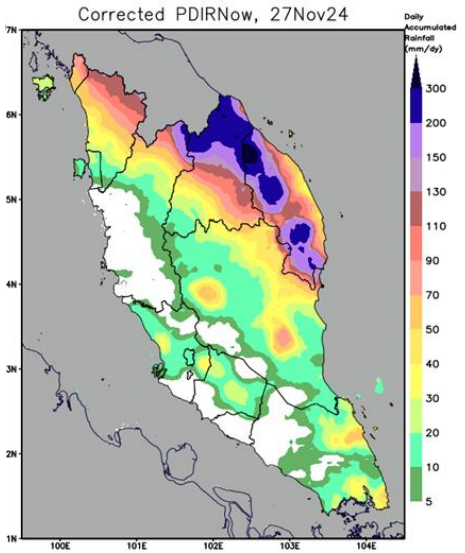
Sumber:
DR. MOHD HISHAM BIN MOHD ANIP
Ketua Pengarah
Jabatan Meteorologi Malaysia (MET Malaysia)
Kementerian Sumber Asli dan Kelestarian Alam
19 November 2024, 2:00 petang

Press Statement was issued on 19 Nov 2024

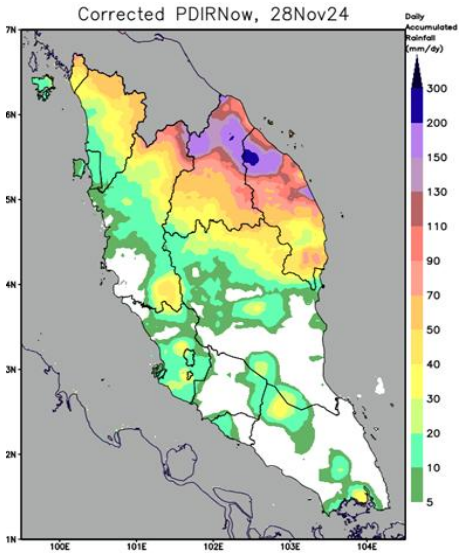
Alert stage warning (Yellow) was issued on 23 Nov 2024

Warning was updated to severe (Orange) and danger stage (Red) on 27 Nov 2024

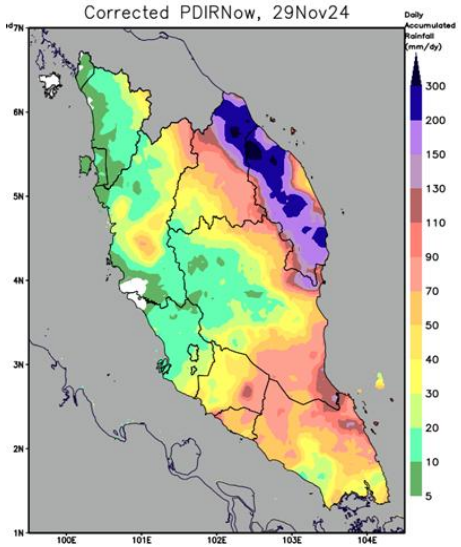
Source: Utusan Malaysia



27 Nov 2024



28 Nov 2024



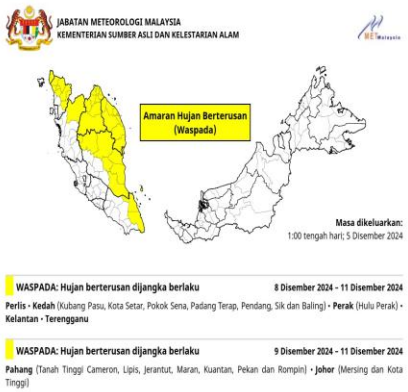
29 Nov 2024

Source: ASTRO

Source: Berita Harian

4. RECENT MONSOON SURGES AND RELATED WEATHER WARNING

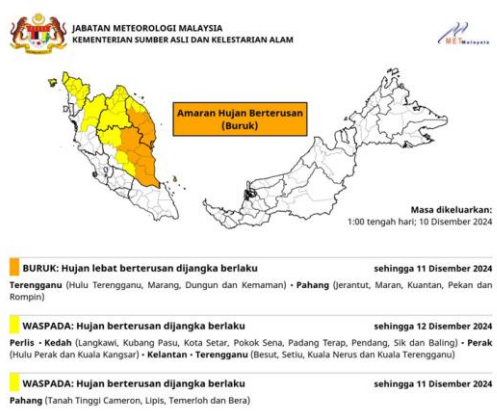
c) 3rd monsoon surge on 9 – 12 December 2024



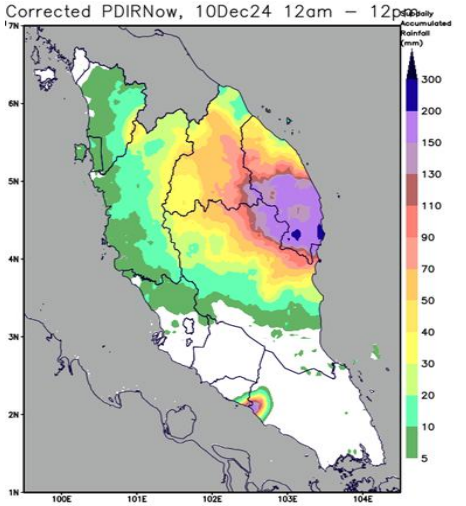
Alert warning issued on 5 Dec 2024

Upgrade to severe stage (Orange) on 9 Dec 2024, 9 am

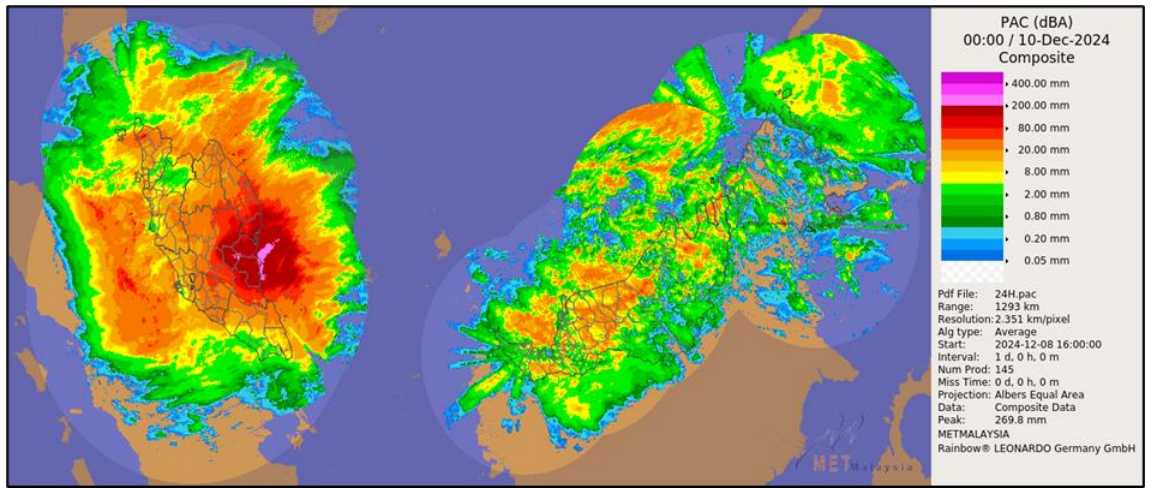
Upgrade to danger stage (Red) on 9 Dec 2024, 730pm



Downgrade to severe stage (Orange) on 9 Dec 2024, 730pm



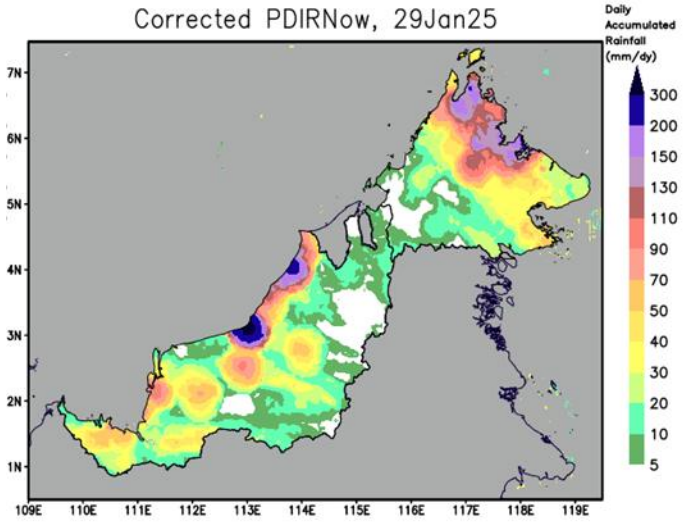
9 Dec 2024

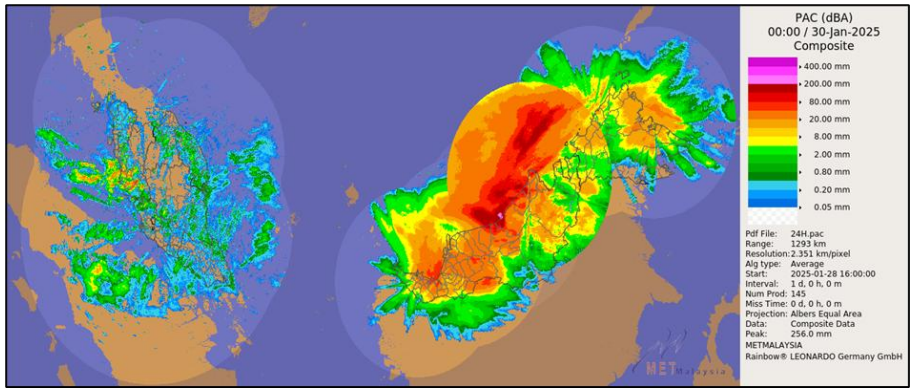


24 hours accumulated rainfall based on radar echo on 10 Dec 2024

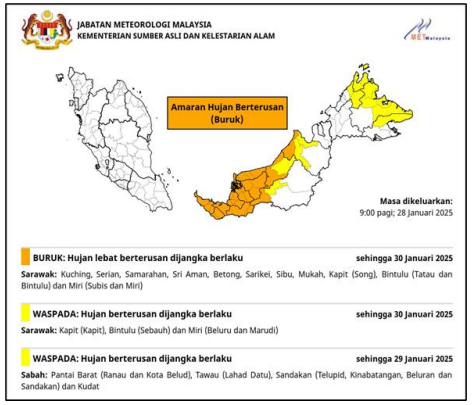
4. RECENT MONSOON SURGES AND RELATED WEATHER WARNING

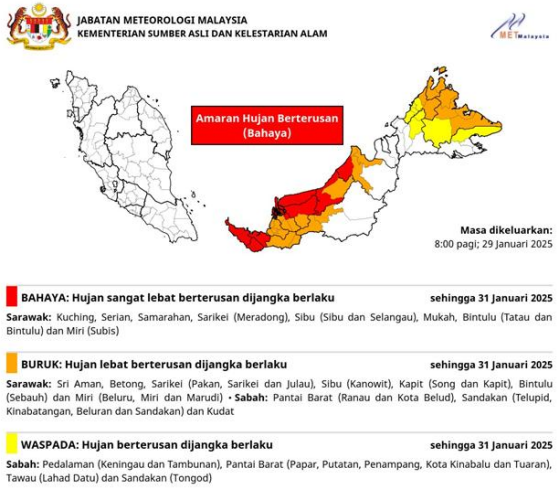
d) 7th monsoon surge on 28 – 31 January 2025





24 Hours Accumulated rainfall on 29 JANUARI 2025





Alert warning (Yellow) issued on 24 Jan 2025, updated to severe (Orange) 28 Jan 2025 and danger stage (Red) on 29 Jan 2025

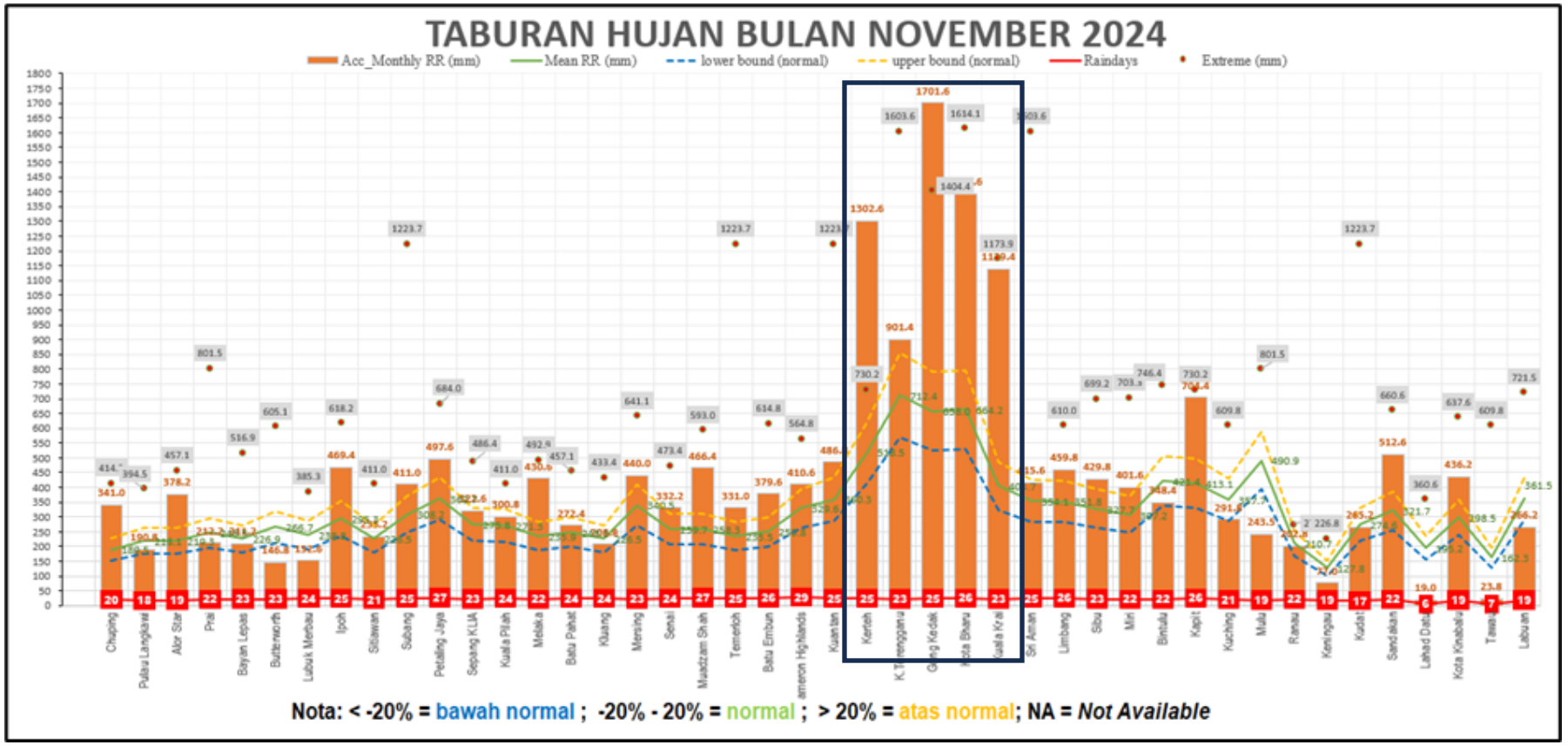
Bintulu, Sarawak
Source: Berita Harian

Bintulu, Sarawak
Source: Utusan

Sabah
Source: Nabalu News

STATISTICS ON THE HEAVY RAINFALL EPISODS DUE TO MONSOON SURGES

Monthly Rainfall for November 2024



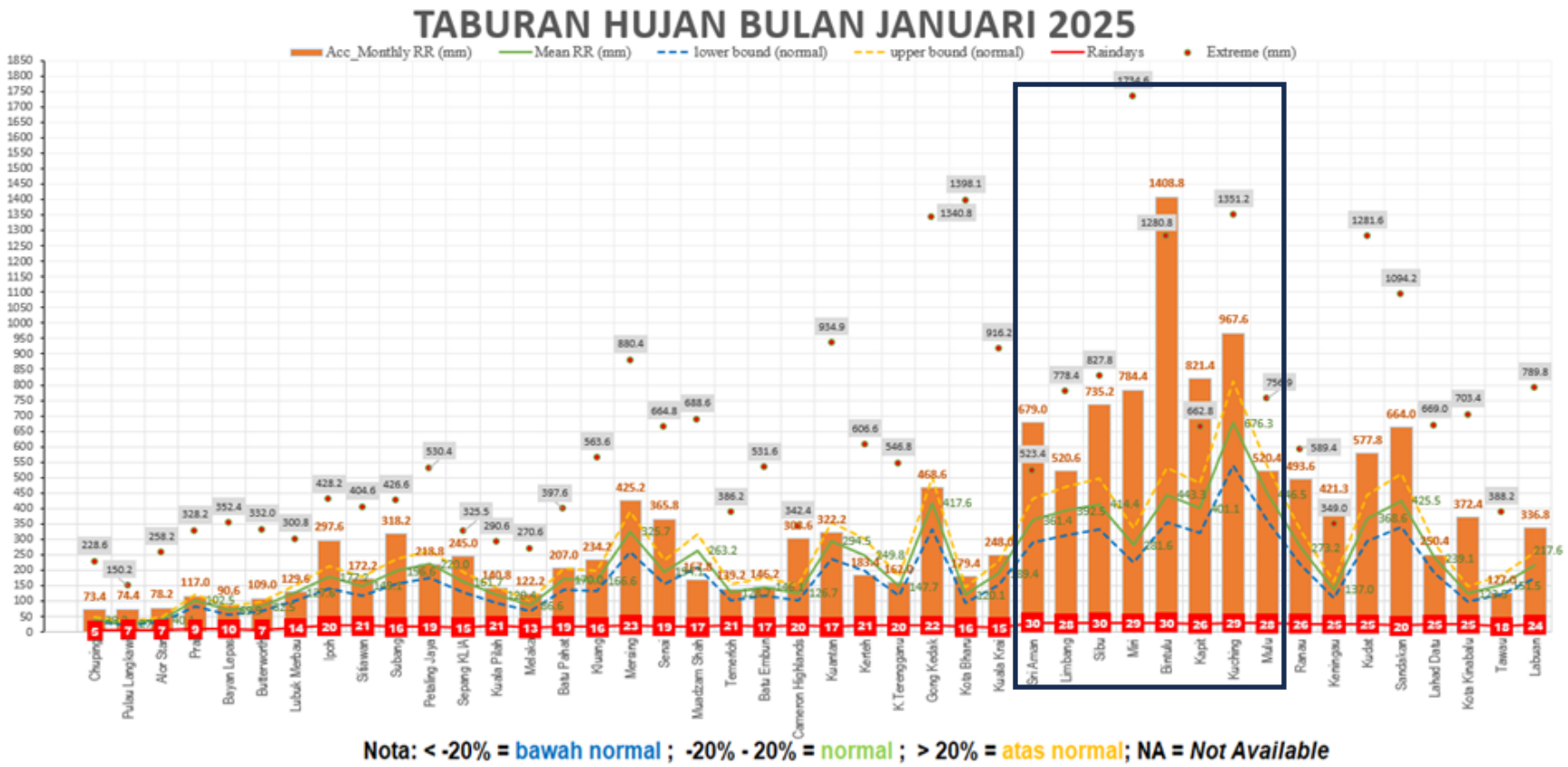
Five stations located at east coast states (Kertih, Kuala Terengganu, Gong Kedak, Kota Bharu and Kuala Krai) recorded monthly rainfall amount very much higher that its monthly mean values for Nov 2024.

Two new records were created in Nov 2024;

1. Kerteh recorded 1302.6 mm superseded previous record, 730.2 mm.
2. Gong Kedak recorded 1701.6mm compared to previous record, 1404.4 mm.
3. Kuala Krai almost equal with previous record, 1173.9mm

STATISTICS ON THE HEAVY RAINFALL EPISODS DUE TO MONSOON SURGES

Monthly Rainfall for January 2025



All principal stations in states of Sarawak recorded higher than normal rainfall for the month of January 2025.

Three new records were created in Jan 2025;

1. Sri Aman recorded 679.0 mm superseded previous record, 523.4 mm.
2. Bintulu recorded 1408.8 mm compared to previous record, 180.8 mm.
3. Kapit recorded 821.4 mm as compared with previous record, 662.8 mm

5. CONCLUSIONS

1. MET Malaysia is able to provide early warnings on the occurrences of heavy rainfall due to monsoon surges.
2. Weather models are performed well throughout the Northeast Monsoon season.
3. Continuous monitoring the weather is important to warn in advance the occurrences of monsoon surges.
4. Some new records were made during the recent heavy rainfall associated with monsoon surges in Malaysia


Terima Kasih
Thank you for your attention