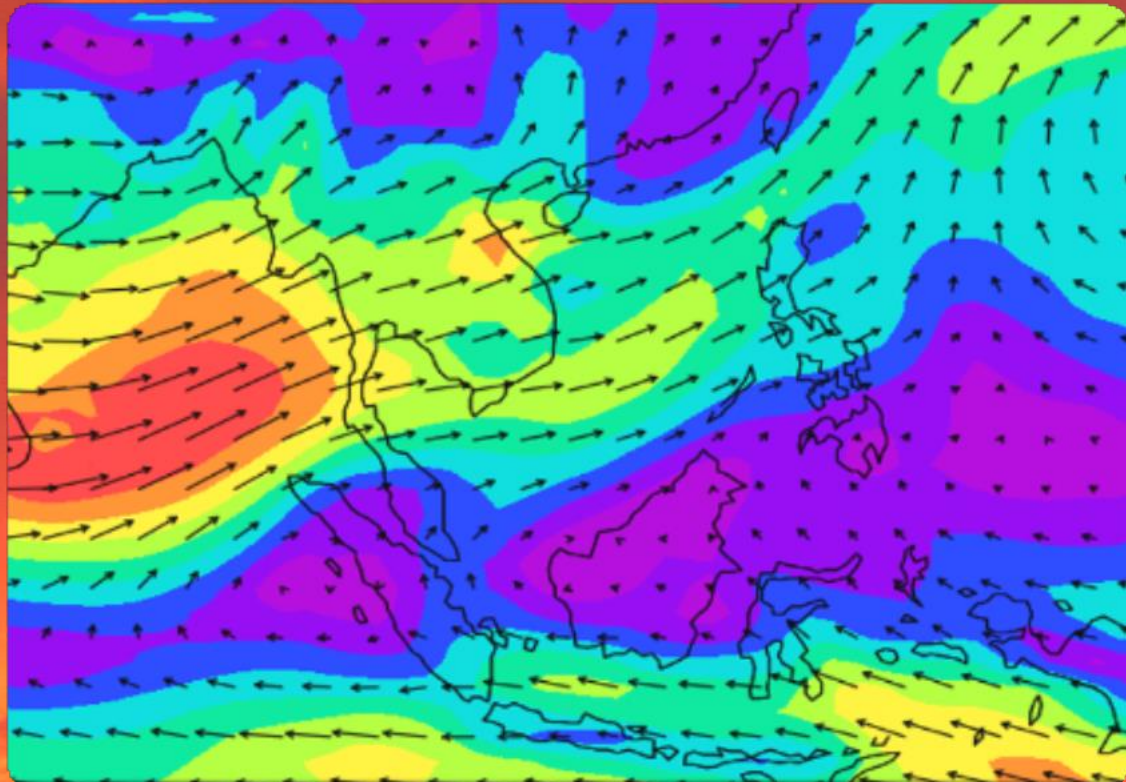




SOUTHWEST MONSOON REPORT KUALA LUMPUR MONSOON ACTIVITY CENTRE NOVEMBER 2023



**MINISTRY OF NATURAL RESOURCES,
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Introduction

The sea surface temperatures (SSTs) across the equatorial Pacific have been above average since August 2023. By September 2023, the tropical circulation anomalies in the Pacific basin were consistent with the circulation associated with El Niño. Low-level westerly anomalies and upper-level easterlies were observed over the east-central Pacific. From the International Date Line to the eastern Pacific, convection was slightly enhanced while in the Maritime Continent, convection was mostly suppressed. Overall, the coupled ocean-atmosphere system indicates the EL Niño condition. Multi models agree that El Niño is expected to continue through winter 2023/2024.

In the Indian Ocean basin, warmer than average SSTs have been observed over the central and western regions of the basin since September. At the same time, the SSTs in the eastern Indian Ocean have started to cool rapidly which will likely cause the positive Indian Ocean Dipole to strengthen. By late September the positive Indian Ocean Dipole (IOD) is underway. All models predict the positive IOD will continue at least through the end of the spring of 2024.

The months of September and October are the climatological peak period of the western North Pacific typhoon season. From May up to September 2023, there are twenty-two (22) low pressure systems detected in the western North Pacific basin of which thirteen (13) of them evolved into tropical storms or greater intensity. The number of formations for tropical cyclones (TCs) of tropical storm intensity of higher was lower than the average of about seventeen calculated from the 1981-2021 data. Out of these thirteen, three (3) intensified into severe tropical storms, while two (2) intensified into typhoons, five (5) intensified into very strong typhoons and (two) 2 intensified into violent typhoons. Many countries in Southeast Asia, except for the Philippines and Vietnam are not in the direct path of the Pacific typhoons. Nonetheless, these countries may experience drier or wetter weather due to the tail effect and pathway of the typhoons. In the summer of the 2023 Pacific typhoon season, many systems tracked more zonally paths.

1. Weather Conditions from May to September 2023

Generally, from May to September, the southwest monsoon is associated with dry weather and lesser rainfall over the South China Sea (SCS)-Malaysian region. In May 2023, westerly low-level flow (850hPa) prevailed throughout the Bay of Bengal (BOB) and penetrated Indochina until southern China (refer Figure 1). The subtropical ridge was well established over the Western Pacific. In this period, rainfall was observed in the eastern Indian Ocean with less rainfall observed in the Maritime Continent (MC) and South China Sea (SCS). By June, the subtropical ridge had fully retreated into the western Pacific. This allows the intrusion of westerlies from the equatorial Indian Ocean (IO) all the way to the northern SCS and northwest Pacific. This shows that the southwest monsoon had fully established over the MC. The trough was clearly visible in northern Indochina – southern China. In June, there was an increase in rainfall amount in BOB, Indochina, and the Philippines while parts of western Peninsular Malaysia received slightly less rainfall. During this period, westerly winds strengthened and broadened over the equatorial IO and SCS. The low-level wind flow in July resembled June, characterized by a slightly stronger westerly zonal wind component compared to the previous month, stretching from the equatorial Indian Ocean towards the SCS until the western Pacific. The monsoon rainband expanded covering most of the BOB and extended into the western Pacific during July. In the western Pacific region, the easterly trades began to weaken considerably as the SSTs in the eastern Pacific continued to warm. This led to a decrease in

the rainfall in the western Pacific region. By September, the monsoon trough had migrated from the north and located in the Indochina region. This indicates the beginning of the gradual withdrawal of southwest monsoon.

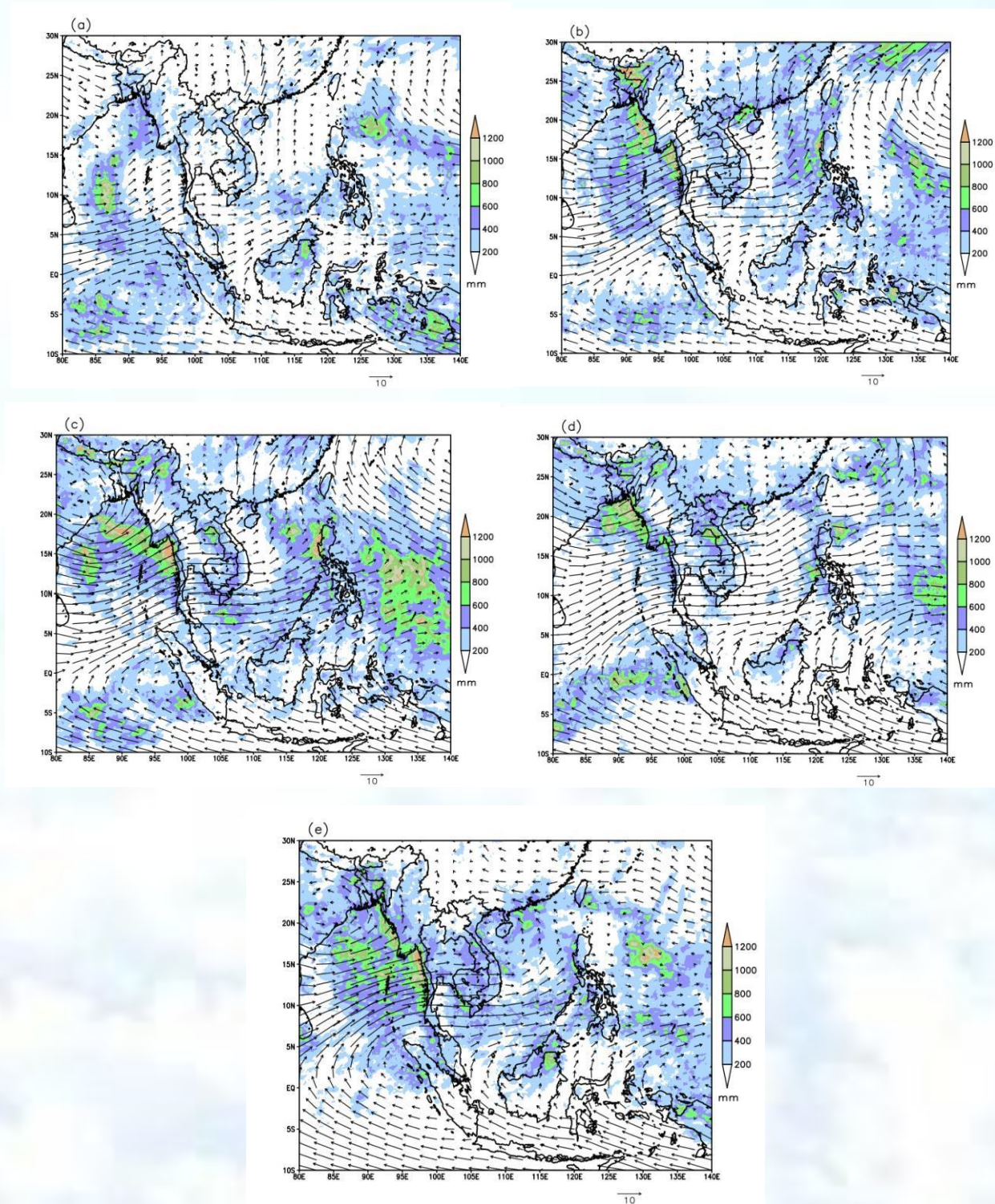


Figure 1. The monthly mean wind at 850-hPa (vector, ms^{-1}) and monthly mean rainfall (shaded, mm) for (a) May 2023, (b) June 2023, (c) July 2023, (d) August 2023 and (e) September 2023

The time-longitude anomalous zonal wind at 850hPa from May to September 2023 averaged between the equator and 15 °N is depicted in Figure 2. The westerly wind anomalies are indicated by warm colour shading, while the easterly wind anomalies are indicated by cold colour shading. The westerly winds in the SCS region (110 to 120 °E) were generally strong. It is observed that the westerly wind anomalies have generally dominated the SCS since the beginning of the period. Throughout the season, intermittent easterly winds were observed in the SCS.

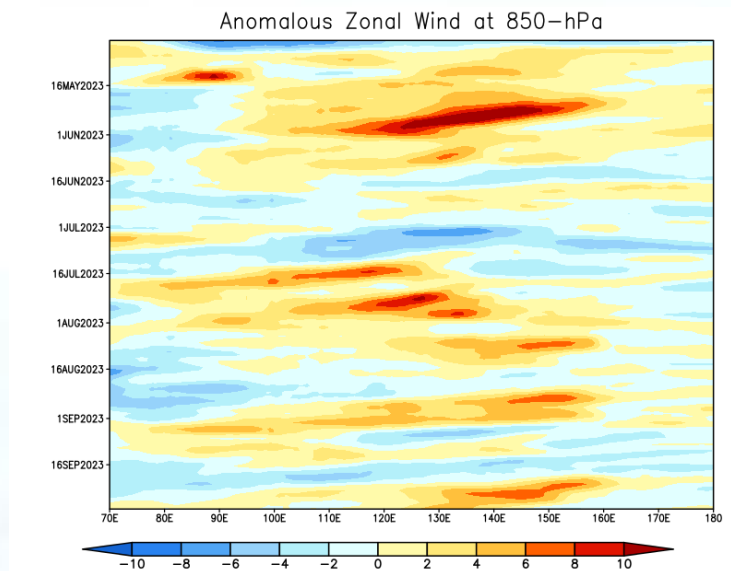


Figure 2. The time-longitude of anomalous zonal wind (ms^{-1}) at 850-hPa averaged between the equator and 15°N. All anomalies represented departures from 1979 to 2020 monthly means.

2. Outgoing Longwave Radiation (OLR)

The monthly distributions of anomalous outgoing longwave radiation (OLR) from May to September 2023 are depicted in Figure 3. Enhanced convection is denoted by cold colour, while suppressed convection is denoted by warm colour. The anomalous OLR field shows a clear east-west dipole in the early part of the monsoon season with enhanced convection observed in the western Pacific while suppressed convection observed in the western Maritime Continent. However, with the development of El Niño, the enhanced convection in the western Pacific weakened beginning in August. In the eastern Indian Ocean, strong suppression began to appear in August and intensified in September which was associated with rapid cooling of SSTs and emerging positive IOD mode.

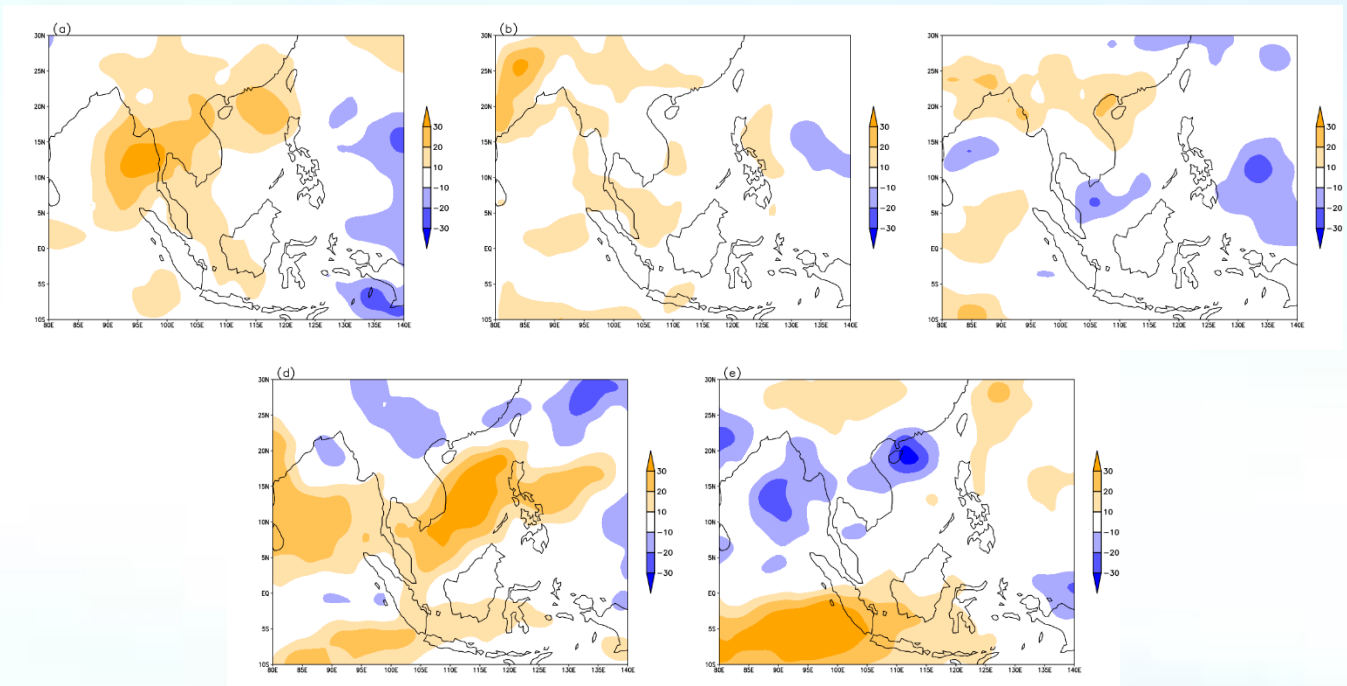


Figure 3. The monthly anomalous OLR (Wm^{-2}) for (a) May 2023, (b) June 2023, (c) July 2023, (d) August 2023 and (e) September 2023. All anomalies represented departures from 1991 to 2020 monthly means.

The time-longitude of anomalous OLR from May to September 2023 averaged between the equator and 15°N is shown in Figure 4. Enhanced convection is denoted by green shading, while suppressed convection is denoted by orange shading. From the beginning of the period to early July 2023, the WNPO region was generally dominated by enhanced convection. Meanwhile, suppressed convection was observed in the MC region ($90^{\circ}\text{E}-140^{\circ}\text{E}$).

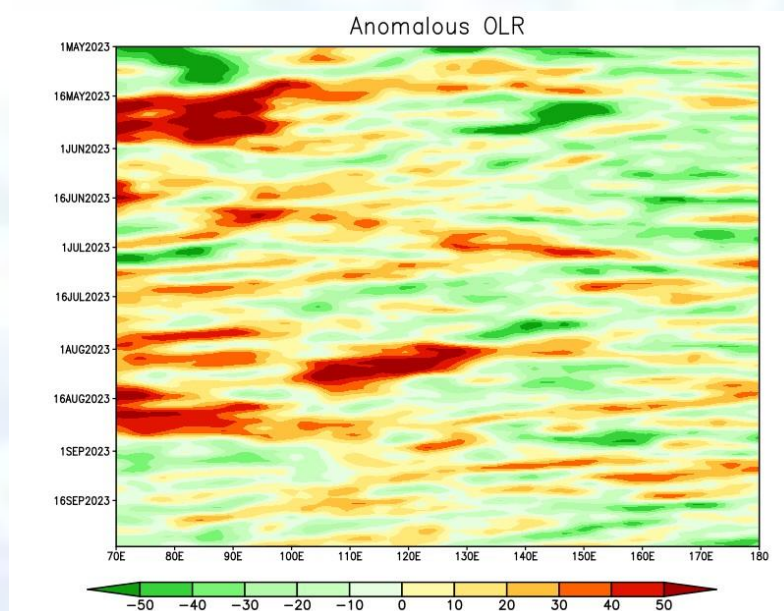


Figure 4. The time-longitude of anomalous OLR (Wm^{-2}) averaged between the equator and 15°N . All anomalies represented departures from 1991 to 2020 monthly means.

3. Weather Outlook from Nov 2023 to Jan 2024

In general, the upcoming northeast monsoon is associated with heavy rainfall over southern Thailand, eastern Peninsular Malaysia, east Malaysia, and Indonesia due to the convergence between cold surges linked to the Asian winter monsoon and Pacific easterlies.

The seasonal outlook over the Maritime Continent is based on the outlook provided by the ASEAN Specialized Meteorological Centre (ASMC) updated on 31st October 2023. Based on the outlook, regions over the southern and eastern Maritime Continent are expected to receive below-normal rainfall, while regions over the northwestern Maritime Continent are expected to receive above-normal rainfall from November 2023 to January 2024. Currently, a positive Indian Ocean Dipole (IOD) is present and predicted to end by January-February 2024, while the El Niño conditions are predicted to persist until at least middle of 2024. Much of the region will experience drier conditions because of both El Niño and positive IOD. Above-normal temperature is predicted for most of the ASEAN region for NDJ 2023/2024.

Based on the seasonal outlook from MET Malaysia updated on 1st November 2023, normal rainfalls are expected in most parts of the country except for certain parts of Johor, while rainfalls over Sarawak and Sabah are expected to be slightly below normal in November 2023. In December 2023 parts of Sabah are expected to receive slightly below rainfall while everywhere the rainfall is expected to be normal. In January 2024, most parts of Peninsular will receive normal rainfall. Slightly above normal rainfall is expected in the divisions of Kuching, Samarahan, Sri Aman and Betong in the state of Sarawak. Meanwhile whole parts of Sabah and Labuan are expected to receive slightly below normal rainfall. This long-term weather outlook is based on consensus from meteorologists through analysis of several selected climate forecast models such as NCEP Coupled Forecast System Model Version 2 (CFSv2), JMA Ensemble Prediction System (Tokyo Climate Centre), European Center for Medium Range Weather Forecast (ECMWF) and Seasonal Climate Forecast, International Research Institute for Climate Society (IRI). Global phenomena that are changing the country's current weather, such as the El-Niño Southern Oscillation (ENSO), the Madden-Julian Oscillation (MJO) and the Indian Ocean Dipole (IOD) are also discussed.

Acknowledgements: The wind charts were analysed using ECMWF ERA5 reanalysis dataset. The OLR charts were generated using NOAA daily uninterpolated dataset, while the rainfall data were obtained from the Global Precipitation Measurement (GPM) dataset produced by the National Aeronautics and Space Administration (NASA). In this report, wind anomalies were taken with respect to 1979–2020 base period, while OLR anomalies were taken with respect to 1991–2020, which was provided by NOAA. Seasonal outlook for Southeast Asia was obtained from ASMC (updated 31st October 2023) meanwhile for Malaysia was produced by MET Malaysia (updated 1st November 2023). The records and climatology of tropical cyclones developed in WNPO were from the Regional Specialised Meteorological Centre (RSMC) Tokyo.