ASMC BULLETIN

ASEAN SPECIALISED METEOROLOGICAL CENTRE

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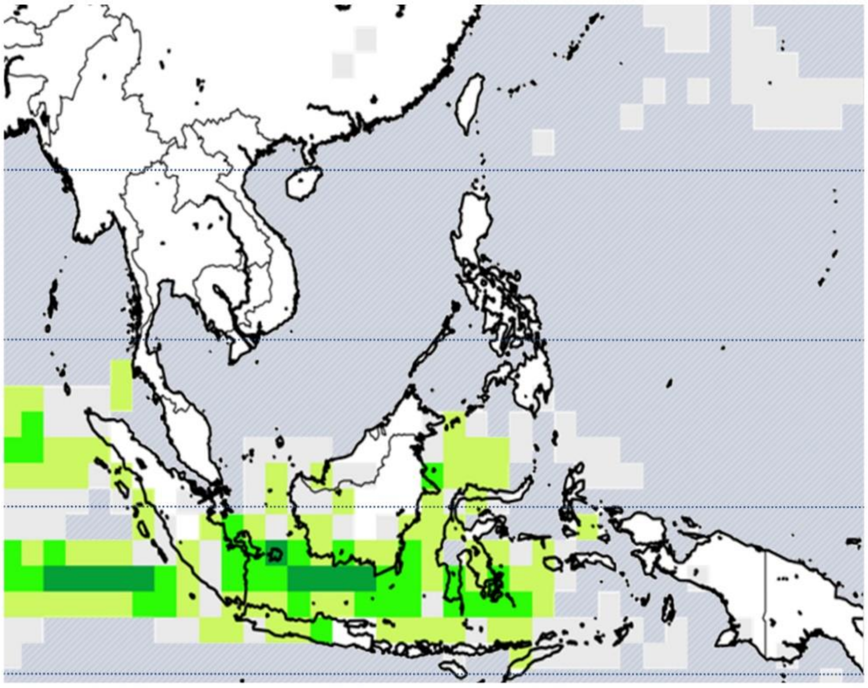

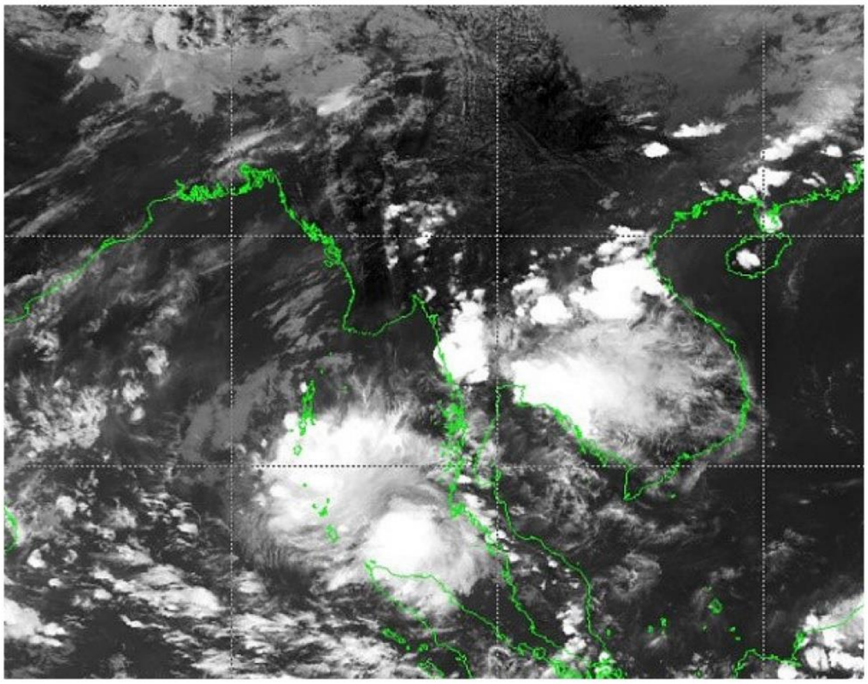

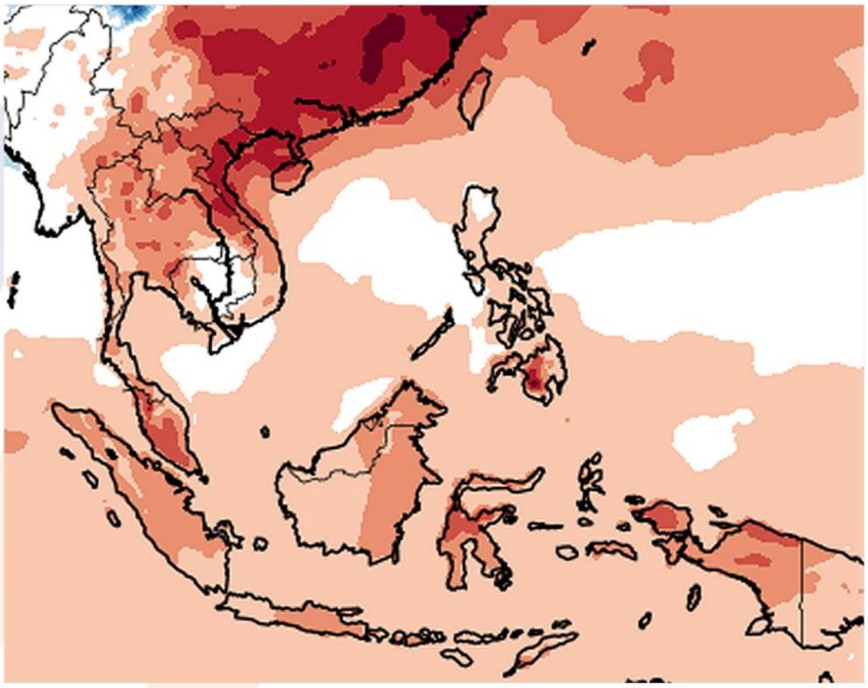

Highlights

- **In the first half of 2020,**
  - The Indian Ocean Dipole (IOD) returned to the neutral phase after a strong, positive episode in the second half of 2019.
  - El Niño Southern Oscillation (ENSO) was also in a neutral state as predicted. Thus, neither a significant ENSO nor IOD event was present to influence the northern ASEAN region's fire hotspot count, which was similar to that of 2019.
  - In the absence of a significant ENSO or IOD event, the influence of climate change on sea-surface temperatures was more visible, while other sources of shorter-term variability drove weather patterns in the region. For example, the heavy rainfall events in East Java (Indonesia), central Myanmar, and northern Viet Nam.
  - On the other hand, Thailand experienced a prolonged dry period which extended into early 2020 despite a weakening IOD, and southern Philippines experienced drought which could be attributed partly to a less active tropical cyclone season.
- **For the period September 2020 to February 2021**,
  - Models predict a high likelihood of neutral IOD conditions but favoured the development of La Niña conditions by the last quarter of 2020.
  - In line with the possibility of a La Niña development, wetter conditions are predicted by models over parts of Southeast Asia, particularly over the equatorial region.

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CLIMATE REVIEW (JAN-JUN 2020)

Neutral ENSO, and return to neutral IOD

El Niño Southern Oscillation

The first half of 2020 saw *neutral El Niño Southern Oscillation (ENSO) conditions*. Observed sea-surface temperature (SST) values over the Nino3.4 region of the Tropical Pacific fell within the neutral range during this period (Figure 1). Key atmospheric indicators of ENSO (e.g. trade wind strength and cloudiness) also exhibited neutral ENSO conditions.

Figure 1: The Nino3.4 index (detrended) using 1-month SST anomalies. Warm anomalies (≥ +0.65; red) correspond to El Niño conditions while cold anomalies (≤ -0.65; blue) correspond to La Niña conditions, otherwise neutral (> -0.65 and < +0.65). Reference methodology: Turkington, Timbal, & Rahmat, 2018.

In December 2019, most models from the Copernicus Climate Change Service (C3S) multi-system predicted ENSO neutral conditions for the first half of 2020 (Figure 2). The models indicated that the SSTs would cool slightly, as numerous Nino3.4 forecasts are negative. For the forecasts issued in January and February 2020 (not shown), the models' spread was larger, ranging between El Niño and La Niña conditions. However, the subsequent forecasts indicated that conditions would be neutral with an enhanced chance of La Niña conditions towards the middle of 2020.

Indian Ocean Dipole

After the strong, positive Indian Ocean Dipole (IOD) event in the second half of 2019, the IOD quickly returned to neutral in January 2020 (Figure 3). IOD events typically decay to neutral with the start of the monsoon season in the Southern Hemisphere. The return to neutral IOD at the start of 2020 was no exception, although the return was later than usual. *Since mid-January, the IOD index has been neutral*. The positive values in June 2020 were not quite strong or long enough to indicate another positive IOD event.

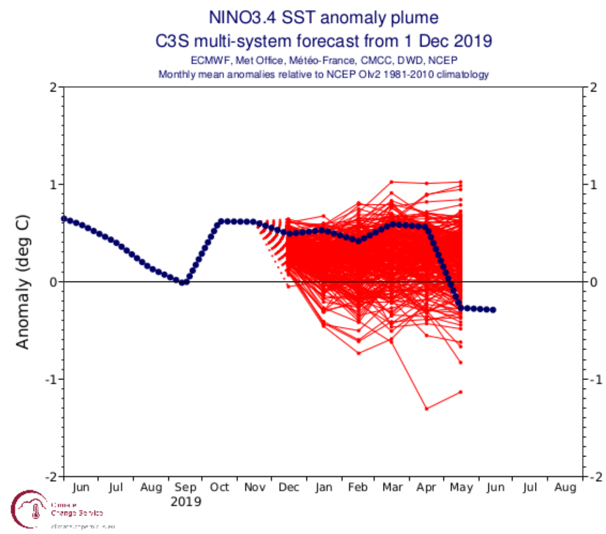


Figure 2: Forecasts of Nino3.4 index's strength (red lines) in December 2019 for the first half of 2020 from various seasonal prediction models of international climate centres. Observed values are in blue. Credit: Copernicus C3S.

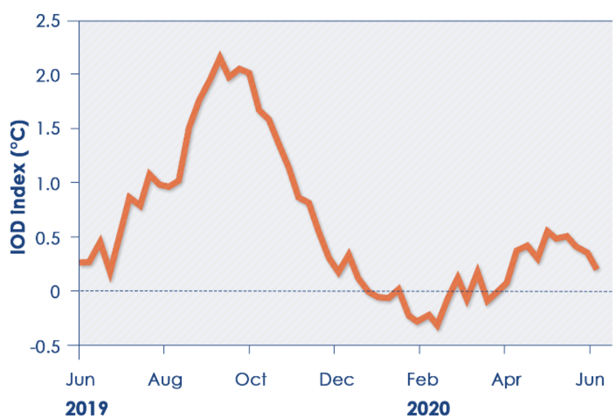


Figure 3: Indian Ocean Dipole (IOD) index showing smaller IOD values in the first half of 2020 compared to the strong positive IOD in the second half of 2019. Data: Bureau of Meteorology (BoM), Australia.

Temperature Conditions

The SST anomalies in and around Southeast Asia were warmer than average for the first half of 2020 (Figure 4; upper). Much of this warmth was likely linked to climate change, with temperatures closer to average once the long-term warming trend was removed (Figure 4; lower).

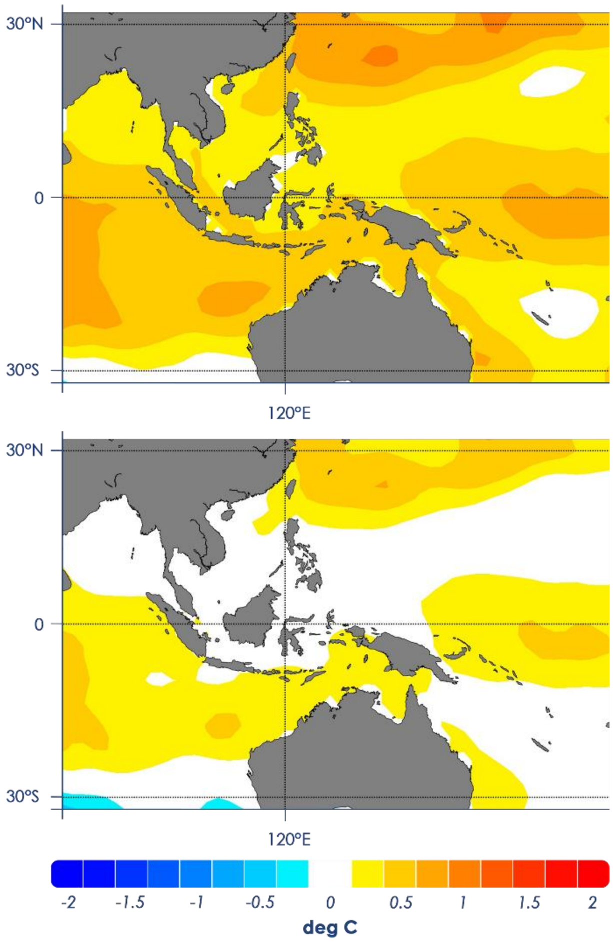


Figure 4: Average sea surface temperature anomalies (˚C) for January-June 2020 were warmer than average for much of the region (upper). The average sea surface temperatures around the region were closer to average after the climate change trend is removed (lower). Data: IRI Data Library.

The temperature was also warmer than average for Southeast Asia in the first half of 2020 (Figure 5). Myanmar is the exception, with temperatures close to average during the review period. The overall warmer temperatures can be partly attributed to the long-term warming trend. The strong IOD at the end of 2019 may have also had a lasting impact on the temperatures for the first quarter of 2020, with warmer anomalies for January-March (Figure 5; upper) compared to April-June (Figure 5; lower).

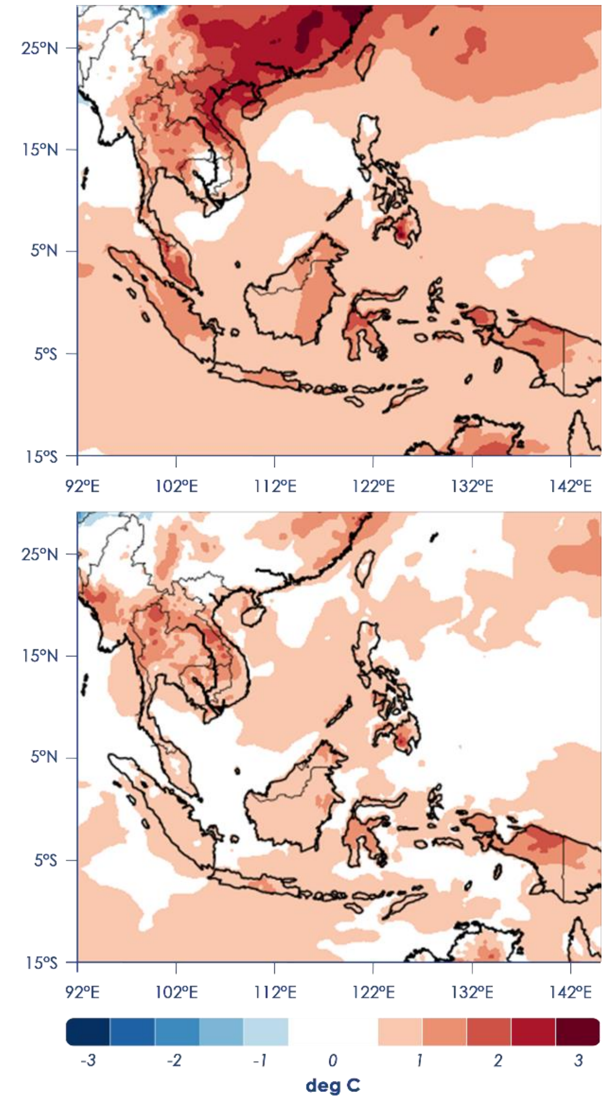


Figure 5: Average surface temperature anomalies (˚C) against 1981-2010 climatology for January-March (upper) and April-June (lower) show warmer conditions (red shades) over land for most parts of Southeast Asia. Data: ECMWF.

Rainfall Conditions

After the end of the Northeast Monsoon season and the decay of the IOD, Southeast Asia experienced positive rainfall anomalies (wetter) on average in the northern half of the region and negative rainfall anomalies (drier) in the southern half (Figure 6).

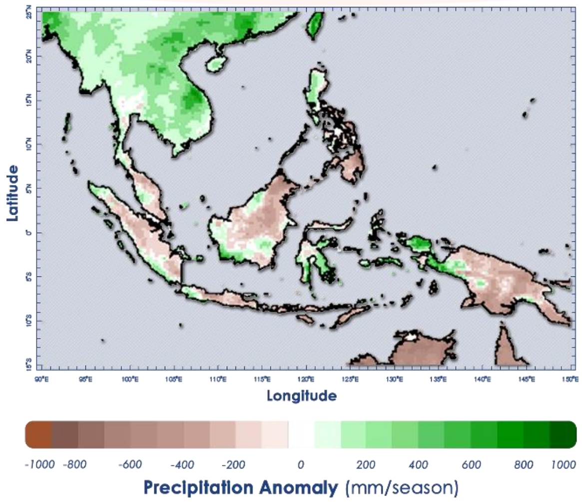


Figure 6: March-May 2020 seasonal rainfall anomaly (mm/season) against 1981-2010 climatology from CHIRPS dataset. Data: IRI Data Library.

This review demonstrates how significant rainfall anomalies can occur even without large-scale drivers like ENSO and IOD; although Southeast Asia-wide dry anomalies typically occur when an El Niño or positive IOD is present and wet anomalies typically occur during La Niña or negative IOD.

Madden-Julian Oscillation

At the sub-seasonal timescale, there was a series of Madden-Julian Oscillation (MJO) pulses during March-May 2020 (Figure 7). During March, an MJO developed over the Indian Ocean, reaching the western Maritime Continent before weakening and reappearing in the Indian Ocean again in the second half of March. This MJO circumnavigated the globe in April, before weakening at the start of May in the Maritime Continent. By the end of May, another MJO signal could be seen in the western Pacific. This signal continued moving eastwards before decaying in the Indian Ocean in mid-June. MJO phases 3 to 5 usually bring wetter conditions to the region, while phases 6 to 8 bring drier conditions. Due to the MJO being dominant in both phase groups during March-May, the wetter and drier effects are averaged and cannot be discerned from the multi-month rainfall anomalies (Figure 6). However, MJO can be linked to week-to-week variations in rainfall.

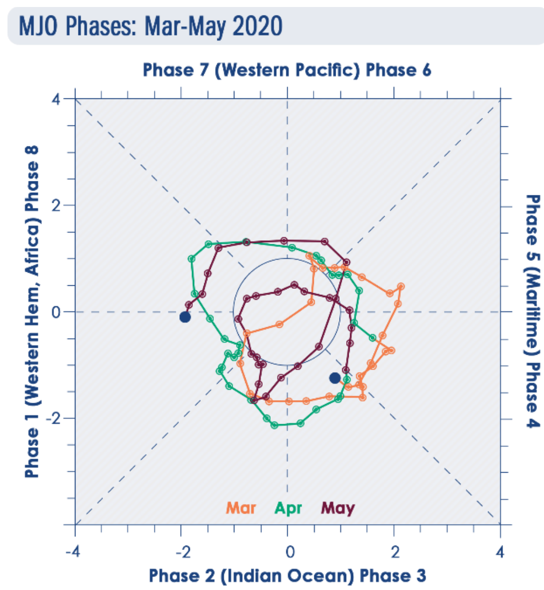


Figure 7: MJO strength and phases during March (orange), April (green), and May (purple) 2020. The two blue dots mark the start and end of the time series. Data: BoM, Australia.

REGIONAL FIRE AND HAZE SITUATION (JAN-JUN 2020)

Widespread smoke haze over the Mekong sub-region

The dry season of the northern ASEAN region started in December 2019 and extended into early-May 2020. Between January and February 2020, hotspot activities were detected mostly in Cambodia and parts of Thailand. The smoke haze that emanated from these hotspots affected parts of Cambodia and Thailand.

Between March and April 2020, there was an escalation in hotspot activities mainly in the northern parts of Mekong sub-region. Widespread smoke haze from these hotspots affected eastern Myanmar, northern parts of Thailand and Lao PDR (Figure 8 and Figure 9). Hazy conditions contributed to a deterioration in air quality levels in the affected areas, and "Unhealthy" to "Very Unhealthy" air quality readings were reported by stations in northern Thailand on many days.

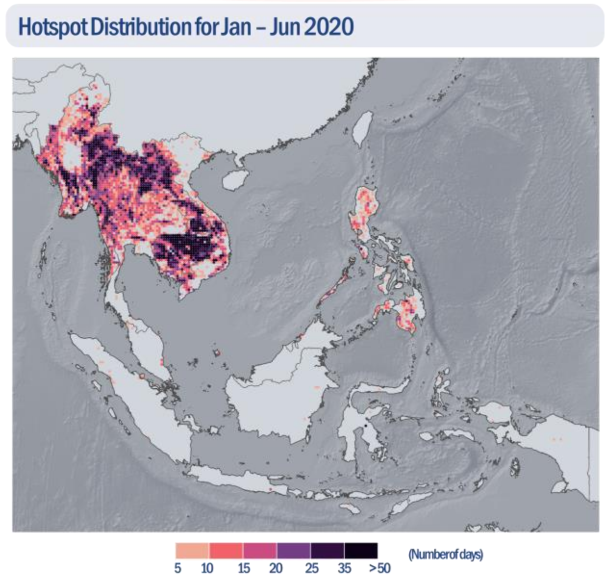


Figure 8: Distribution of NOAA-20 hotspots for January-June 2020. Persistent clusters of hotspots were detected mainly in northern Mekong sub-region, as well as in southern Lao PDR and Cambodia.

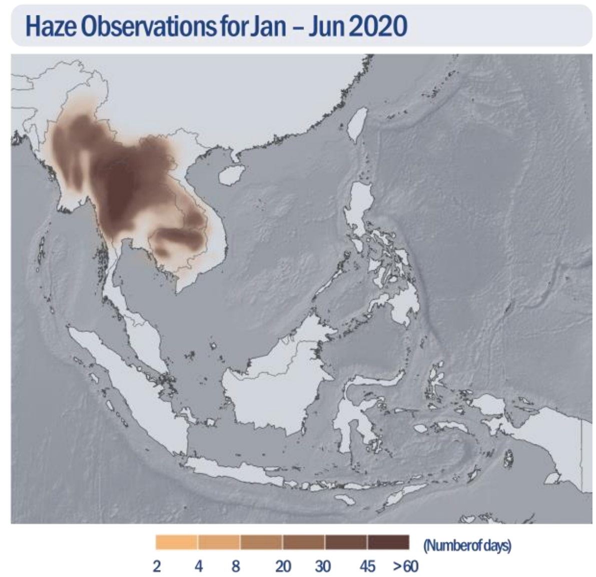


Figure 9: Haze observations for January-June 2020. Smoke haze from clusters of hotspots persisted in the northern Mekong sub-region, southern Lao PDR, and parts of Cambodia.

Some of the smoke haze from Lao PDR was also blown to northern Viet Nam by the prevailing winds on some days (Figure 10). By late-April and early-May 2020, an increase in showers over the northern ASEAN region helped to subdue hotspot activities and brought a gradual improvement to the haze situation. Overall, the number of hotspots detected in the first half of 2020 was comparable to that in 2019.

For the southern ASEAN region, there were occasional periods of dry weather in parts of Peninsular Malaysia and Sumatra. Isolated hotspots with localised smoke plumes were detected on a few days. However, these hotspots were short-lived and did not contribute to significant transboundary haze.

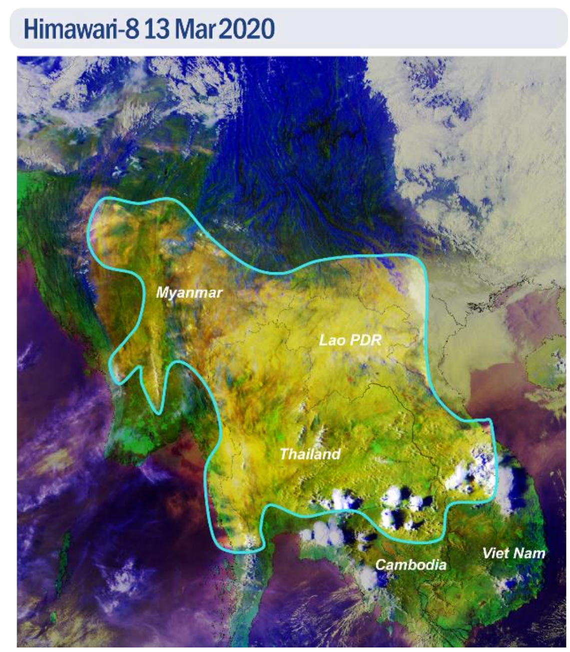


Figure 10: Himawari-8 satellite image on 13 March 2020 shows widespread smoke haze (highlighted areas) that affected large parts of the Mekong sub-region including Myanmar, Thailand, Lao PDR, and parts of Cambodia.

CLIMATE AND HAZE OUTLOOK (SEP 2020-FEB 2021)

Signs of La Niña development

ENSO Outlook

ENSO is currently neutral. Model outlooks from international centres (Copernicus C3S) indicate the neutral or cool anomalies to continue until the end of 2020 (Figure 11). From September onwards, most models predict La Niña conditions of varying strength based on the Nino3.4 index.

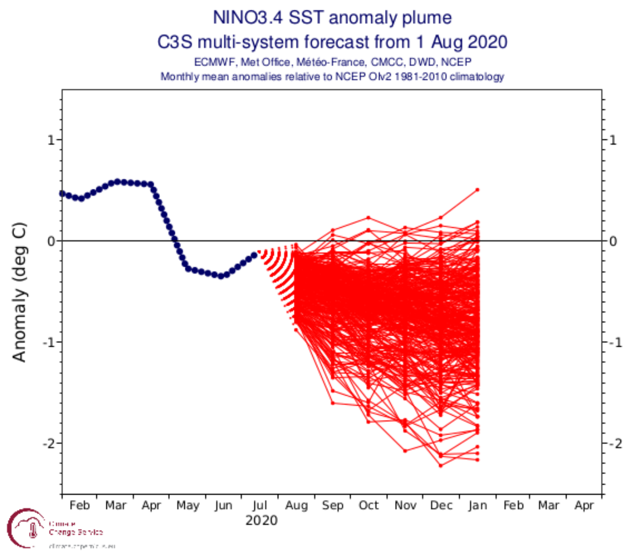


Figure 11: Nino3.4 SST anomaly predictions from C3S Copernicus models showing neutral or colder temperatures until the end of the year. Accounting for background warming, most models predict La Niña conditions from September onwards. Credit: Copernicus C3S.

In line with the Nino3.4 predictions, the ensemble-mean predictions of SST anomalies show La Niña-like conditions during September-November (SON) 2020 (Figure 12). Under La Niña conditions, colder SST anomalies are observed in the eastern Tropical Pacific Ocean (blue shades) and warmer anomalies in the western Tropical Pacific (red shades). La Niña conditions further require the SST pattern to remain for several months, as well as to couple with the atmosphere through stronger easterly winds in the eastern Pacific Ocean and more rainfall than average in the western Pacific Ocean.

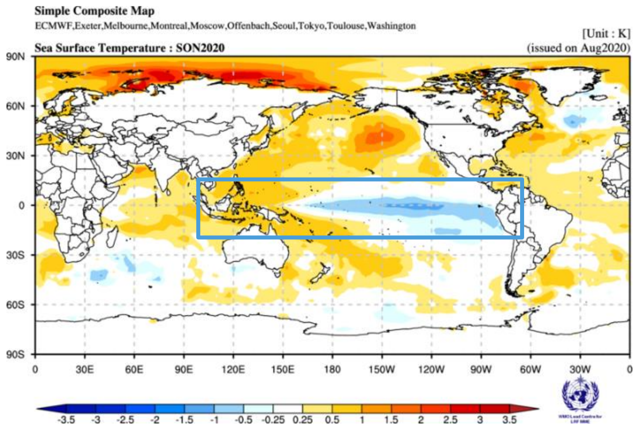


Figure 12: SST anomaly prediction for September-November (SON) 2020 from WMO showing La Niña like conditions in the Tropical Pacific Ocean (blue box). Credit: WMO Lead Centre for Long-Range Forecasting.

IOD Outlook

The IOD is likely to be neutral for September–November 2020. The IOD is currently positive but within the neutral range (see Figure 3). Most models are predicting the index to remain in the neutral range but become negative (Figure 13). While the models predict the IOD to remain neutral for the rest of 2020, models have limited skill in predicting IOD at longer lead times.

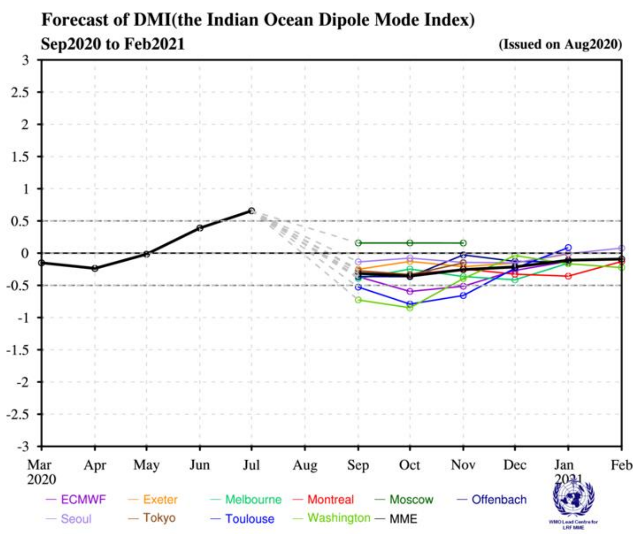


Figure 13: IOD index predictions, from models available on the WMO Lead Centre for Long-Range Forecasting, indicate negative IOD values, but mostly within the neutral range for the second half of 2020. Credit: WMO Lead Centre for Long-Range Forecasting.

Rainfall Outlook

In the upcoming September-November 2020 period, model predictions from selected C3S models (SEA RCC-Network Long-range Forecasting Node) indicate enhanced chances of above-normal (wetter) conditions predominantly over the eastern half of Southeast Asia (Figure 14). The areas of above-normal rainfall are as expected during a La Niña. For some parts of mainland Southeast Asia, Peninsular Malaysia, and Sumatra, the model predictions indicate no dominant tercile. These regions also correspond to regions where the model skill is low at this time of year.

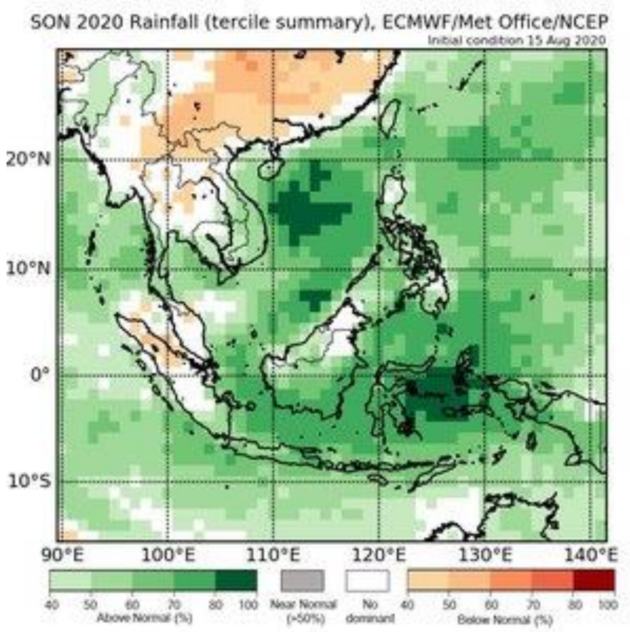


Figure 14: Rainfall tercile summary predictions of multi-model ensemble model for September-November (SON) 2020. Brown (green) shades show regions with a higher likelihood of drier (wetter) conditions (contains modified Copernicus C3S information).

If La Niña develops, wetter conditions are also likely for much of Southeast Asia for December 2020 - February 2021. Based on composites from previous La Niña events, wetter-than-average conditions occur over the Philippines, eastern Indonesia, northern Borneo, and Peninsular Malaysia.

Temperature Outlook

For temperature, most parts of the ASEAN region are predicted to continue experiencing above-normal conditions during September-November (SON) 2020 (Figure 15). The exceptions are eastern Thailand, Lao PDR and northern Viet Nam, where each of the terciles is equally likely based on model predictions.

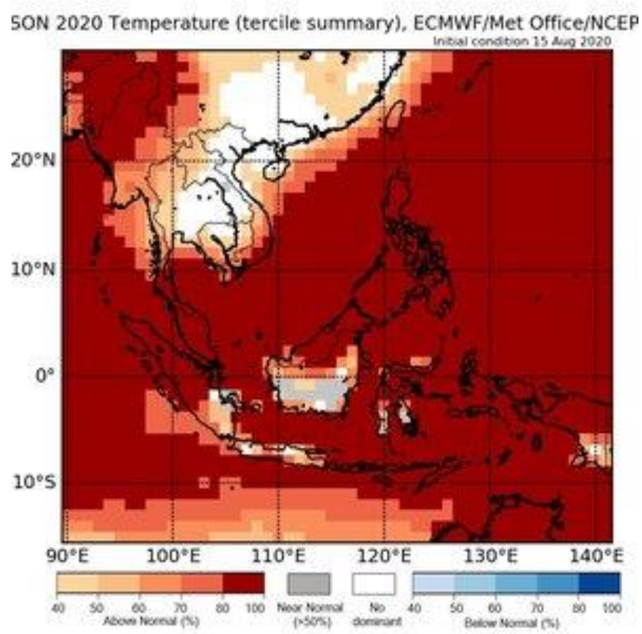


Figure 15: Temperature tercile summary predictions of multi-model ensemble model for September-November (SON) 2020. Red (blue) shades show regions with a higher likelihood of warmer (cooler) conditions (contains modified Copernicus C3S information).

Haze Outlook

With above-normal rainfall expected over the southern ASEAN region from September to November on average, the risk of widespread land and forest fires occurring in the region would likely be reduced considerably. However, there may still be occasional hotspot activities during brief periods of dry weather before the end of the dry season in early-October 2020. The risk of transboundary haze cannot be ruled out before then.

Wet conditions are typically expected to return to the southern ASEAN region gradually from mid-October 2020, which would help to subdue hotspot activities in Sumatra and Kalimantan. In contrast, the rainy season in the northern ASEAN region will gradually give way to the dry season, and an increase in hotspot activities can be expected in the Mekong sub-region towards the end of 2020.

SIGNIFICANT WEATHER EVENTS IN SOUTHEAST ASIA

Northwest Pacific tropical cyclone season synopsis (Jan-Jun 2020)

Contributed by Junie Ruiz and Rusy Abastillas (Weather Specialists, Climate and Agrometeorology Division)

Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

Two low-pressure areas in the Northwest Pacific Basin developed into tropical cyclones (TCs) inside the Philippine Area of Responsibility (PAR) from January to June 2020. These TCs named Typhoon (TY) Vongfong (10-17 May) and Tropical Storm (TS) Nuri (11-12 June) made landfall in the central Philippines and traversed towards the northern part of the country (Figure 16).

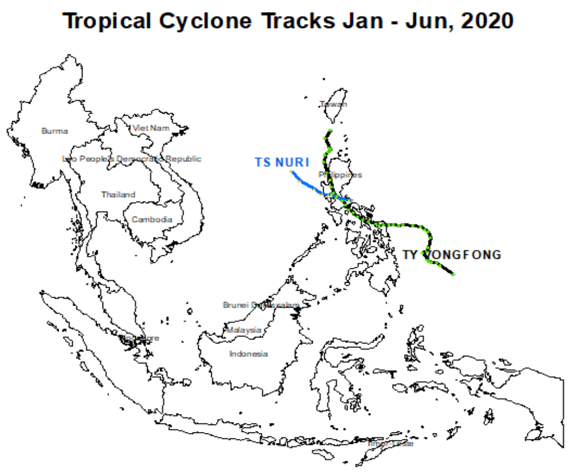


Figure 16: Tracks of tropical cyclones that affected the region from January to June 2020: Typhoon Vongfong (10-17 May) and Tropical Storm Nuri (11-12 June).

Fewer Tropical Cyclones

The number of TCs during this period was considered below average in the basin. Moreover, both TCs were formed only in the second quarter of 2020. TY Vongfong brought moderate to heavy rains which caused floods and landslides in some areas in the northern and central Philippines (Figure 17). Meanwhile, TS Nuri did not significantly impact the Philippines but triggered the onset of the rainy season in the western sections of the country.

Due to the fewer occurrence of TCs and the prevalence of neutral to borderline El Niño conditions, most areas in the southern part of the Philippines (Mindanao) experienced up to 20-60% rainfall reduction for three consecutive months or more.

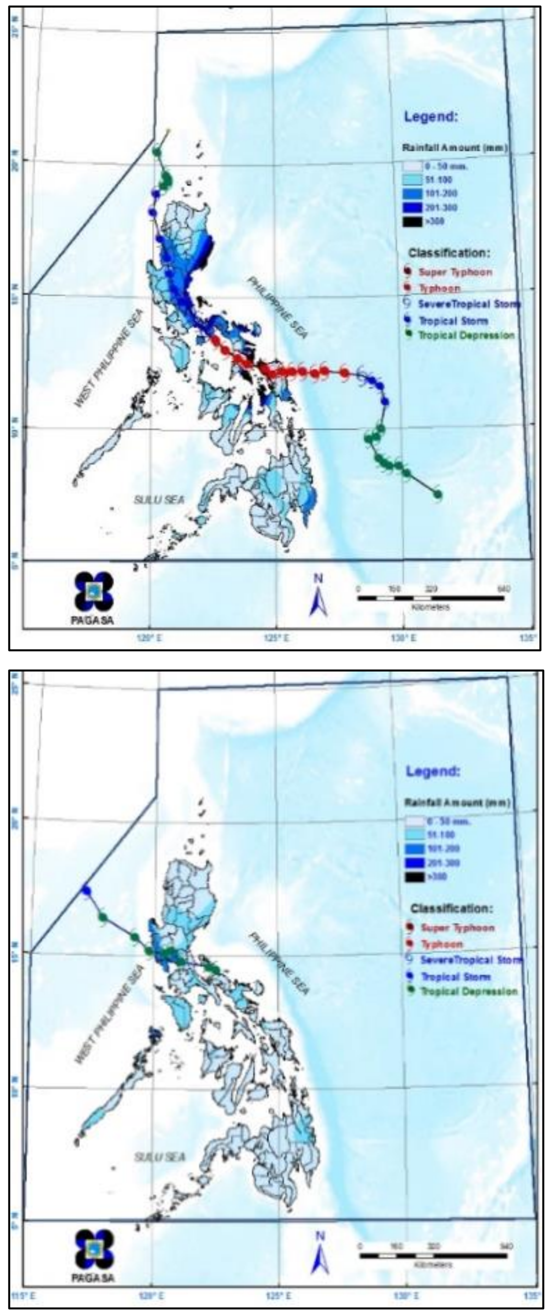


Figure 17: Track of TY Vongfong from 10 to 17 May (upper) and TS Nuri from 11 to 12 June (lower) and the events' cumulative rainfall over the PAR.

Meteorological Drought

The rainfall deficit led to meteorological drought conditions over the affected areas. PAGASA's post rainfall assessment showed that the lack of rainfall, especially in the northern and western parts of Mindanao from November 2019 to March 2020, had hindered farming activities related to rice and corn. The severity of drought in these areas led to heat stress on crops and inadequate soil moisture during its vegetative stage, which decreased the yield in return.

For this, the PAGASA Regional Services Division (PRSD)-Mindanao coordinated closely with various stakeholders from the government, private, and non-government organisations, especially those in the agriculture and water resources management sectors. PRSD-Mindanao also issued Climate Advisories to the region to prepare for and mitigate the possible impacts during the drought.

The late onset of the dry season in East Java

Contributed by Novi Fitrianti and Marlin Denata (Staff of Sub Division for Climate Analysis and Information)

Agency for Meteorology, Climatology and Geophysics of the Republic of Indonesia (BMKG)

The typical dry season over the East Java Province spans from the first half of March to the last *dekad* (10-day period) of July each year. Usually, much of the Province would already be in the dry season by the last dekad of April.

Dry Season Late Onset

In 2020, the onset of the dry season started in the second dekad of March 2020, but overall the onset of the 2020 dry season in East Java was later than normal. The onset dates for most parts of East Java were late by more than three dekads (Figure 18). Furthermore, normally 95% "Zona Musim" or ZOM (areas that have clear distinctions between the wet and dry seasons) of the East Java Province would have experienced the "Awal Musim Kemarau" or AMK (onset of the dry season) by the end of May. However, in 2020 this spatial extent was achieved much later in early- to mid-June (Figure 19).

MJO's Influence

The MJO was in Phase 3 (over the Indian Ocean) and Phase 4 (Maritime Continent) during the third dekad of April and until early May 2020.

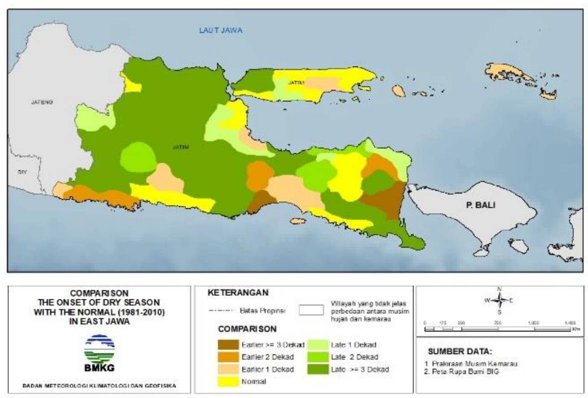


Figure 18: The difference in the onset of 2020 dry season compared to the normal onset. Brown (green) shades indicate earlier (later) onset dates.

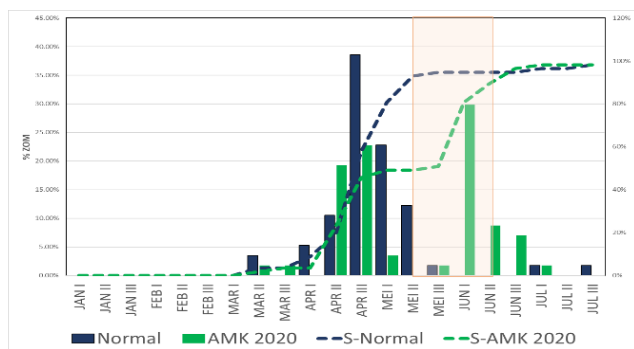


Figure 19: The percentages of "Zona Musim" or ZOM (areas that have clear distinctions between the wet and dry seasons) for the "Awal Musim Kemarau" or AMK 2020 (onset of the dry season) represented by green bars, compared to normal represented by dark blue bars. The corresponding accumulated percentages (right-axis) of AMK 2020 are shown by the green dotted lines, compared to the normal shown by the blue dotted lines.

The MJO then developed again over the Indian Ocean (Phase 2 and Phase 3) and propagated towards the Maritime Continent (Phase 4 and Phase 5) during the second half of May (Figure 20). The MJO phases during this period corresponded well with the cloud cover, reflected by the negative outgoing longwave radiation (OLR) anomaly over the region (not shown). The MJO convective phases and the associated negative OLR anomaly (more cloud cover) implied MJO-related wet episode during this period contributed to the late onset of the dry season. During this time, several significant flooding events were recorded, particularly on 28 May 2020. For example, online media Kompas (https://tinyurl.com/kompasbanjirMay2020) reported several regions in the East Java Province, such as Sidoarjo District and Surabaya City, were severely affected by the floods.

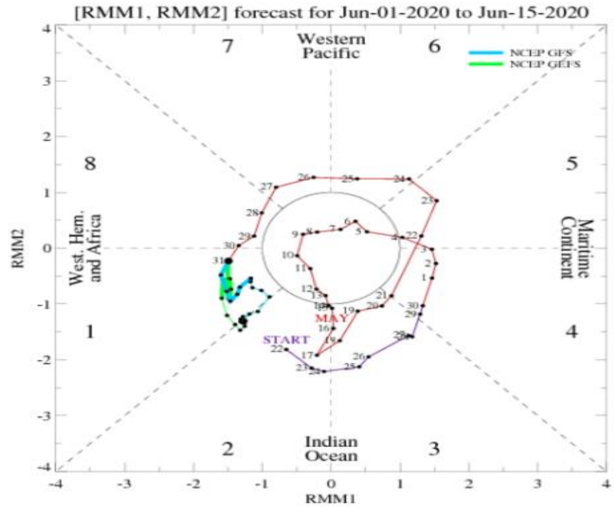


Figure 20: The MJO phases from 22 April to 31 May 2020. Credit: NCEP-NOAA.

The Indian Ocean Dipole in 2019 and the severe drought during 2019-20

Contributed by Chalump Oonariya (Meteorologist, Climate Centre)

Thai Meteorological Department (TMD)

An unusually strong, positive Indian Ocean Dipole (IOD) event occurred in the second half of 2019. It led to severe climate impacts around the Indian Ocean Basin, including the long-term rainfall deficit over mainland Southeast Asia. The IOD was behind the anomalous zonal winds at 850 hPa, which in turn contributed to low rainfall between September 2019 to March 2020.

The time-longitude plot of sea surface temperature (SST) anomaly (Figure 21) shows the strong, positive IOD evolution in 2020.

Evolution of the IOD

By mid-May 2019, the east-west contrast in the Indian Ocean (i.e. colder-than-normal SST in the southeastern Indian Ocean and warmer-than-normal SST in the northwestern Indian Ocean) had initiated the positive IOD event. It rapidly intensified a few months later to peak in October 2019 before weakening rapidly in December. The positive IOD forced strong low-level (850 hPa) zonal wind anomalies during October-December 2019 over mainland Southeast Asia (Figure 22).

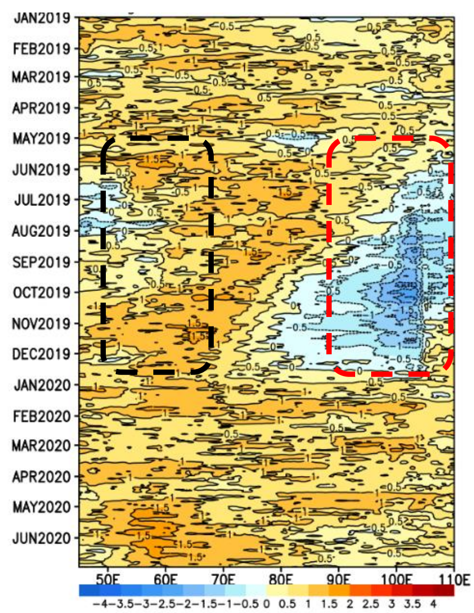


Figure 21: Time-longitude plot of sea surface temperature (SST) anomalies (1981-2010 climatology) showing the evolution of the positive IOD event from May to December 2019. The black (red) box demarcates the western (eastern) Indian Ocean longitude regions used to calculate the Dipole Mode Index. Credit: OISSTv2.

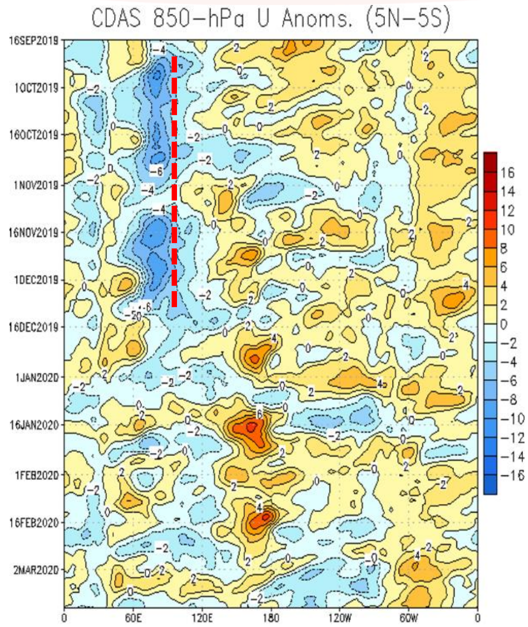


Figure 22: The 850 hPa zonal wind anomaly with respect to 1981-2010 climatology depicting the persistent, rainfall-inhibiting low-level divergence (blue shaded areas) over the mainland Southeast Asia and the surrounding region (centred around 100°E; red line). Credit: NCEP/NCAR CDAS.

Impact on Rainfall

The zonal wind anomalies induced high-pressure subsidence, which inhibited rainfall and triggered severe drought conditions. Most parts of Thailand had already started experiencing long-term precipitation deficit since February 2019. The low-rainfall condition, which extended to March 2020 (Figure 23), was exacerbated by the strong positive IOD in between.

Water Crisis

Although there were wet breaks from tropical cyclone (TC) activities in July 2019 (TC Wipha) and August 2019 (TC Podul) (Figure 23), these were short-lived and the effects were dominated by the IOD-induced dry conditions over Thailand. Many provinces in Thailand that faced the drought reported water crises. The drought not only impacted the water supply in agricultural areas but also drinking water supply in the urban areas. The water crisis became a national agenda in January 2020.

In that month, due to low rainfall (Figure 24) and depleted rivers, southern Thailand faced a saltwater intrusion crisis. Northern Thailand, on the other hand, was affected by severe forest fires and most areas in the central and northeastern parts of Thailand experienced freshwater shortages.

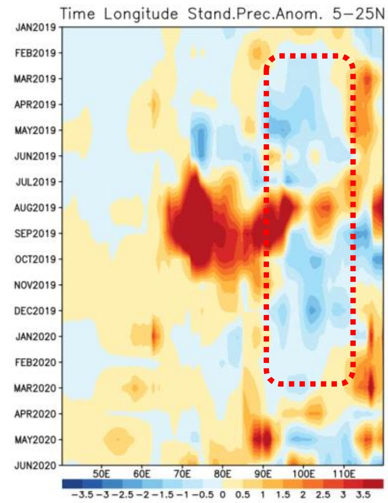


Figure 23: Time-longitude of standardised precipitation anomaly with respect to 1981-2010 showing the long-term rainfall deficit (blue shaded regions) extending from February 2019 to March 2020 over mainland Southeast Asia (90°E-110°E; red box). Credit: NCEP/CPC-UNIFIED.

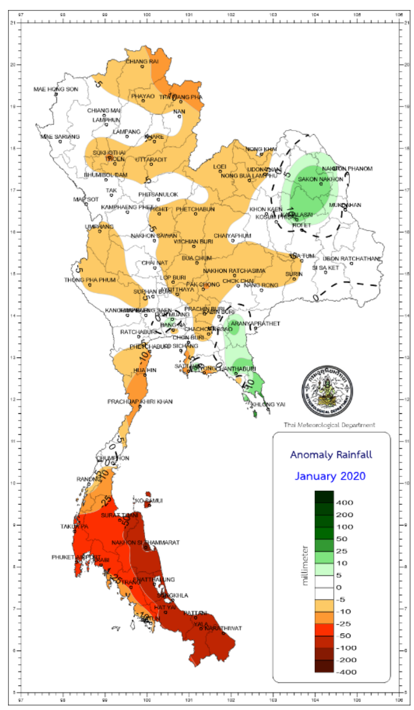


Figure 24: The spatial pattern of rainfall anomalies (mm) in January 2020 with respect to 1981-2010 climatological mean. Data: TMD's 75 rain-gauge stations.

Heavy rain event over Meiktila Township on 11 May 2020

Contributed by Sabai Lwin (Assistant Director)

Department of Meteorology and Hydrology (DMH), Myanmar

On the afternoon of 11 May 2020, Myanmar experienced a hailstorm that was accompanied by heavy rainfall and strong winds, which caused some damage in Meiktila Township, Mandalay (Figure 25). The strong winds damaged houses, schools, religious buildings, and government property.

Figure 25: Strong winds severely affected several areas in Myanmar, one of which was Meiktila Township. Credit: Eleven Media.

Synoptic Situation

At the time of the event, Myanmar was in the midst of the Pre-Monsoon Season. During this season, the country typically experiences steeply rising daytime temperatures and severe thunderstorms. The wind-chart analysis on that day showed conditions that were conducive for rain activities over Meiktila Township. The event was also observable from the radar image (Figure 26). The corresponding surface weather chart (Figure 27) showed a low-pressure system over Central Myanmar. The combination of these synoptic anomalies, enhanced convection, and the formation of heavy-rain clouds (Figure 28) were factors in the build-up to the adverse weather event.

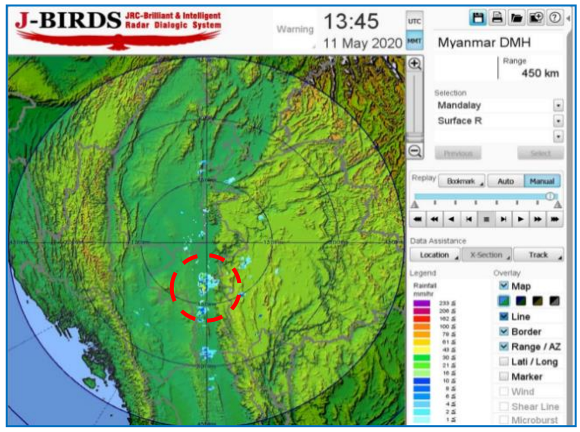


Figure 26: Radar analysis on 11 May 2020 at 0715 UTC (1:45 pm local time) from Mandalay Radar. The thunderstorm that affected Meiktila is in the red circle.

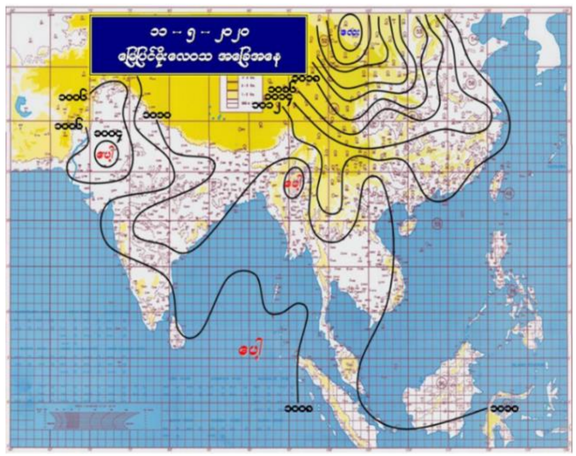


Figure 27: Surface weather chart by the DMH on 11 May 2020 (00 UTC) showing a low-pressure area over the Mandalay Region.

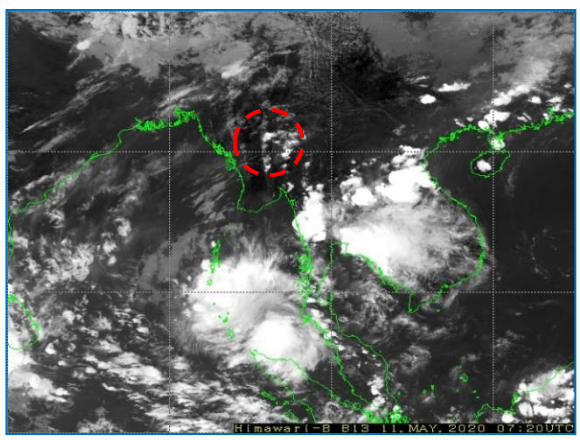


Figure 28: Himawari-8 Satellite image on 11 May 2020 at 0720 UTC showing heavy-rain clouds over Central Myanmar (red circle). Credit: Japan Meteorological Agency.

Observations and Forecasting

Essential products which the meteorological forecasters at DMH use daily are the rainfall and wind forecast products from the US National Centres for Environmental Prediction Global Forecast System (NCEP GFS). Based on the GFS model output (not shown), the weather event over Central Myanmar was well-predicted. The daily rainfall amount recorded at Meiktila Station on that day was 60 mm, which is considered very heavy for the Dry Zone area (Central Myanmar), where 38 mm is the threshold for heavy rainfall. Strong winds blew at speeds of 35-40 mph (~50-65 km/h), which contributed to the damages.

The DMH had issued strong wind advisories ahead of the Pre-Monsoon Season, which typically spans from April to before the onset of Southwest Monsoon over Myanmar (usually in early to mid-May). The public was warned of possible strong winds accompanied by hail, thunder, lightning, and isolated rain or thundershowers. The public was reminded that these events were likely to occur in the afternoon or evening, over the whole country due to unstable air conditions and convective clouds formed by gradually rising daytime temperatures. The reminders included warnings of strong surface wind speeds that could reach up to 35-40 mph. With such warnings, the public had been advised in advance to take the necessary precautions for weather events expected during the Pre-Monsoon Season.

A one-day extreme rainfall event in Ha Giang Province on 21 July 2020

Contributed by Nguyen Thi Diem Huong and Chinh Ta Huu (Forecasters)

National Center for Hydro-Meteorological Forecasting (NCHMF), Viet Nam

On 21 July 2020, an extreme one-day rainfall event occurred in Ha Giang Province with a total amount of 347 mm observed within just 12 hours, causing severe floods, landslides, and significant damage to local properties, as well as the loss of life. The highly extreme event was unprecedented.

Observations

Notably, most of the nearby stations observed rainfall amounts under 100 mm/day, so Ha Giang's station one-day rainfall was much higher (Figure 29; left). Figure 29 (right) also indicates that the second-highest daily rainfall recorded over 60 years (1961-2020) in July at Ha Giang station is only around 250 mm/day (1983), much lower than the record this year. Figure 30 shows that the 24-hour rainfall of 250 mm in 1983 is already considered a rare event, with a return period of 30 years. In contrast, the approximately 350 mm/day of rainfall on 21 July has a return period of 100 years.

Climatologically, July is a rainy period in the north of Viet Nam due to the monsoon trough, which is normally active over the 25°N latitude. The monsoon trough will be more intense if there is a moving cold air mass in the north strengthening the northeast wind (or the easterly wind originating from a subtropical high-pressure system) and coupled with the intensification of southwest wind to the south of the trough. The rain patterns this year was similar to climatology as there was a monsoon trough close to the Viet Nam-China border, therefore impacting nearby provinces like Ha Giang. Thus, the cause of this extreme rainfall event itself was not unusual.

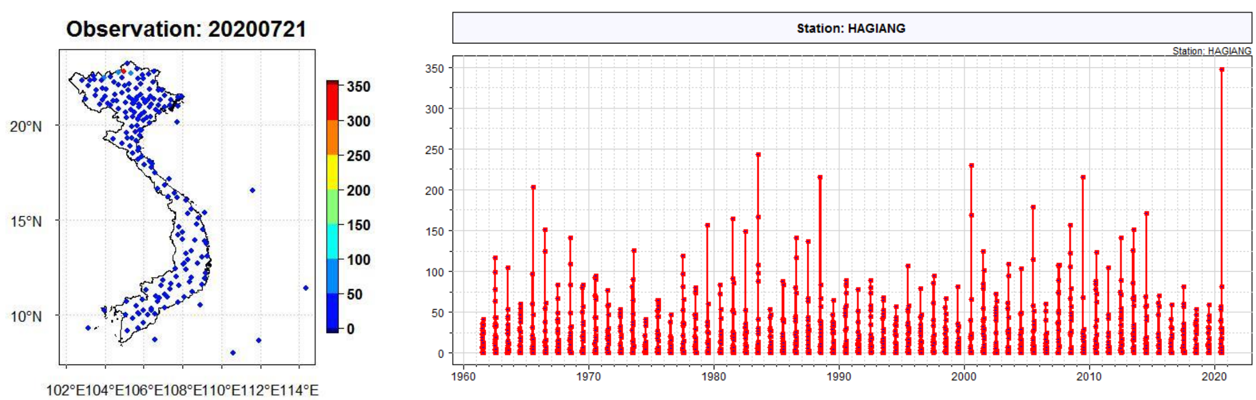


Figure 29: Observed one-day rainfall (mm) over Viet Nam on 21 July 2020 (left) and recorded annual maximum daily rainfall (mm) at Ha Giang province in July (1961-2020) (right).

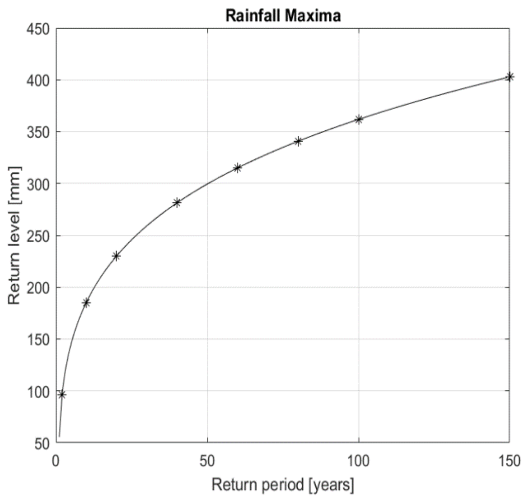


Figure 30: Rainfall return period of July's annual daily maximum rainfall over Ha Giang Province for the period 1961-2020.

Synoptic Patterns

However, there was an additional factor that contributed to the unusual amount of rainfall. During that period, there was a westward movement of a subtropical high-pressure system (SH), which brought more moisture and created disturbance (wind convergence) over the region (Figure 31). In July, the SH dominates the rain patterns because it can either influence the track of tropical cyclones or bring easterly wave disturbances towards the north of Viet Nam. Due to the extreme rainfall amount, climatologists suggested that climate change could have also played a role in this outlier event.

Model Forecasts

Figure 32 shows the 48-hour accumulated rainfall amount forecasted for this event by the 3-km Weather Research and Forecasting Model (WRF) driven by the ECMWF Integrated Forecasting System (IFS) ("WRF3km-IFS"). The WRF3km-IFS forecasted an intense rainfall (red) area close to Ha Giang province with over 300 mm of rain, while the IFS forecasts only around 100 mm of rain (not shown). Therefore, the regional model, with higher spatial resolution, produced better forecast than IFS, in this case. Presumably, WRF3km-IFS can be a good source of reference for forecasters in predicting extreme events in the future.

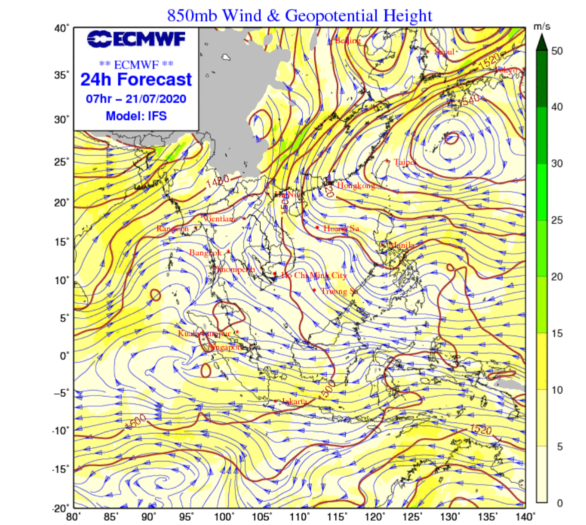


Figure 31: Forecasted synoptic patterns of 850 mb wind (blue streamlines) and geopotential height (red contours) on 21 July 2020.

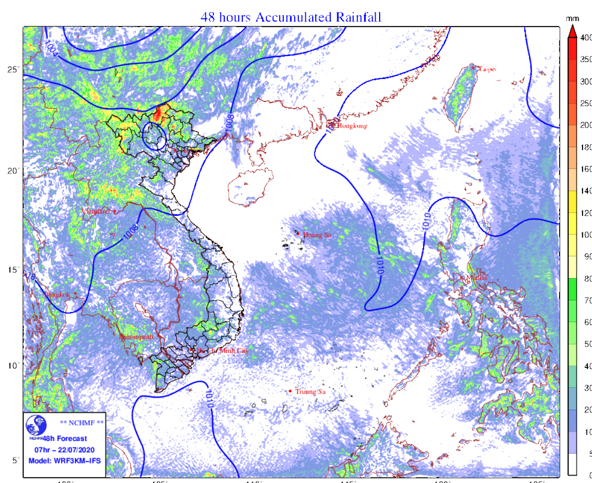


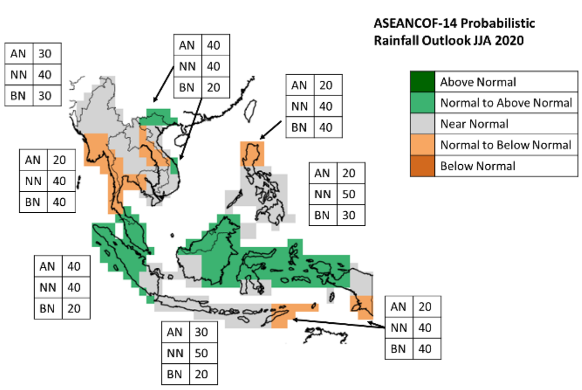
Figure 32: 48-hour accumulated rainfall forecast of the Weather Research and Forecasting Model driven by the ECMWF Integrated Forecasting System (WRF-IFS).

ASMC EVENTS

Fourteenth Session of the ASEAN Climate Outlook Forum (ASEANCOF-14), online, 21 May 2020

The Fourteenth Session of the ASEAN Climate Outlook Forum (ASEANCOF-14) took place online on 21 May 2020 coordinated by the ASMC. Representatives from the ASEAN National Meteorological and Hydrological Services (NMHSs: Brunei, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam), along with experts from the World Meteorological Organization (WMO) and Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES), joined together online to discuss the outlook for June-August 2020.

ASEANCOF sessions for the June-August period are usually held online, which conveniently meant that participants were already prepared for the various safe-distancing measures put in place for COVID-19. Prior to the meeting, the NMHSs filled out a detailed questionnaire which included questions on the upcoming boreal summer monsoon season’s outlook for rainfall and temperature, the outlook for important climate drivers (e.g. ENSO and IOD), and a review of the previous December 2019 – February 2020 outlook. During the online meeting, the participants discussed the responses before coming to a consensus for Southeast Asia as a whole.



The new format of the seasonal rainfall outlook for ASEANCOF. The gridded format allows for easier incorporation of model data as well as verification of the outlooks afterwards.

This session also had a focus on developing objective seasonal outlooks. The WMO Guidance on Operational Practices for Seasonal Forecasting highlights the need for climate outlook forums to have forecasts that are producible, and in a digital format so that they are accessible to different applications and easily verifiable. During the session, Dr Wilfran Moufouma-Okia, WMO, and Dr G. Srinivasan, RIMES, presented the steps recommended to generate objective outlooks and the progress of various international climate outlook forums on this aspect.

Participants of the Fourteenth Session of the ASEAN Climate Outlook Forum. Many participants joined from their own homes, while some NMHSs were able to participate from the office.

ASEANCOF-14 also took two steps closer to objective seasonal outlooks. Firstly, a gridded multi-model ensemble from the WMO Lead Centre for Long-Range Forecasting was used as the basis for the seasonal outlooks. This first step is reproducible, and it also ensures that the consensus discussions are founded on science. The new gridded digital format also allows for easier verification of the seasonal outlooks – the second step closer towards objective outlooks. Subsequent ASEANCOFs will continue to move closer to objective seasonal outlooks.

The meeting concluded with a group photo of the participants. As evident from the photo, some NMHSs were able to join in from their office, while other participants were working from home. While the participants agreed that the discussions were fruitful, many were looking forward to the next physical meeting, which may now have to wait until 2021. On a positive note, a longer time before the next physical meeting gives those involved in ASEANCOF more time to experiment on and develop objective seasonal outlooks.

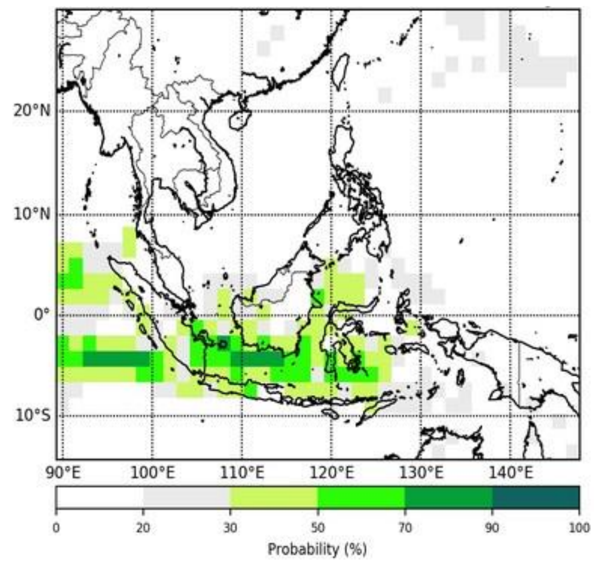
Subseasonal-to-Seasonal Predictions Southeast Asia (S2S-SEA) Real Time Pilot Project

The Pilot Project is testing in real-time S2S products developed as part of the S2S-SEA Capability Building Programme.

The ASEAN Specialised Meteorological Centre (ASMC) kicked off a series of training workshops under the S2S-SEA Capability Building Programme in 2017. Three training workshops (S2S-SEA I to III) have been held since then. The workshops aim to build capabilities in S2S prediction in the National Meteorological and Hydrological Services (NMHSs) of Southeast Asia. S2S also targets collaboration with end-users to develop tailored products for specific applications.

Leveraging on the World Meteorological Organization's (WMO) S2S Prediction Project Real-Time Pilot Initiative, the ASMC launched the S2S-SEA Real Time Pilot Project (RTP) in the first quarter of 2020. The RTP focuses on developing tailored subseasonal products for disaster risk reduction related to extreme weather events, by engaging selected national users and NMHSs alongside a regional user – the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre). To strengthen the links with the applications community, ASMC also partners with the UN Economic and Social Commission for Asia and the Pacific (ESCAP) and the Regional Integrated Multi-Hazard Early Warning System (RIMES).

The proposed workflow involved taking information from the S2S Real-Time Pilot initiative and translate it for the end-users. ASMC would generate products, derived from model output provided by the S2S Real-Time Pilot Initiative, including anomaly and probabilistic predictions of temperature and rainfall at various thresholds. To assist the NMHSs and regional users in product-interpretation, ASMC would include a regional assessment for the upcoming three weeks. The NMHSs would then translate this regional assessment for the national end-users, specific to their areas of interest.



A sample product for the likelihood of intense rainfall (90th percentile) for the week 31 August to 6 September 2020 initialised on 20 August (two weeks' lead time).

The Covid-19 situation had restricted regional activities in general, but it did not hamper the progress of the S2S-SEA RTP. ASMC continued to issue the regional assessments to AHA Centre biweekly as it did before the Covid-19 restrictions were effected in the earlier part of 2020. ASMC and AHA Centre also continued to meet online, at least monthly, to enhance the products available further.

The next stage of development involves engaging the NMHSs and the related National Disaster Management Agencies (NDMAs). Initial plans to hold a physical meeting with the national participants have been put on hold. However, this engagement will continue online to fully leverage on online collaborative technologies in light of the Covid-19 situation. There is still a considerable amount of work to be done before the participants can fully reap the benefits of the RTP products in an operational setting. For example, it remains challenging to identify the appropriate temperature or rainfall thresholds that would constitute an extreme value and translate an event into a disaster – other non-meteorological factors notwithstanding. Furthermore, the model predictions need to be assessed if they are skilful enough to forecast such extreme events.

Until such challenges are overcome, the ASMC and its RTP partners will continue working hard towards achieving the goals of the S2S Prediction Project which is, firstly, to improve forecast skill and understanding in the subseasonal timescale with special emphasis on high-impact weather events. Secondly, it is to promote the uptake of subseasonal products by operational forecasting centres and exploitation of the products by the applications community.

Upcoming Event

Fifteenth Session of the ASEAN Climate Outlook Forum (ASEANCOF-15), online, November 2020

The upcoming 15th Session of the ASEANCOF will be coordinated by ASMC and conducted online given the Covid-19 situation. The ASEANCOF-15 aims to generate consensus rainfall and temperature outlooks for the December 2020 - February 2021 boreal winter monsoon season. The consensus will be provided alongside related information on weather and climate drivers in the Southeast Asia region such as the El Niño/La Niña, Indian Ocean Dipole, and monsoon circulations.

In collaboration with international and regional partners, ASMC aims to develop further ASEANCOF's framework for objective seasonal outlook through this session.

This bulletin is a biannual publication of ASMC and is published annually in March and September. The bulletin provides a review and outlook of weather and climate phenomena of importance to the region (e.g. ENSO, MJO, and monsoon) and their influence on the region's temperature and rainfall conditions.

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