A S M C
B U L L E T I N

ASEAN SPECIALISED METEOROLOGICAL CENTRE

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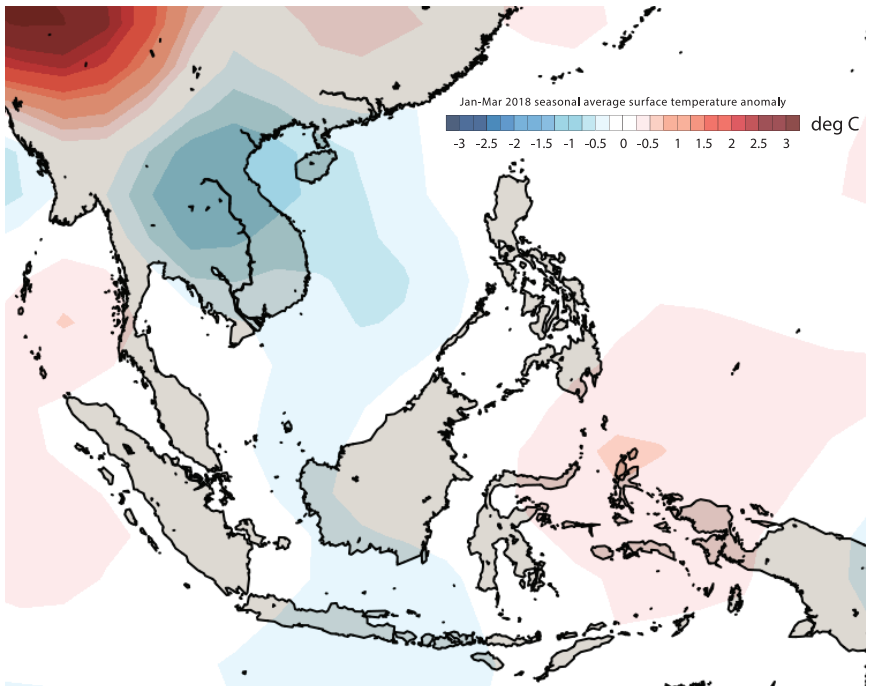

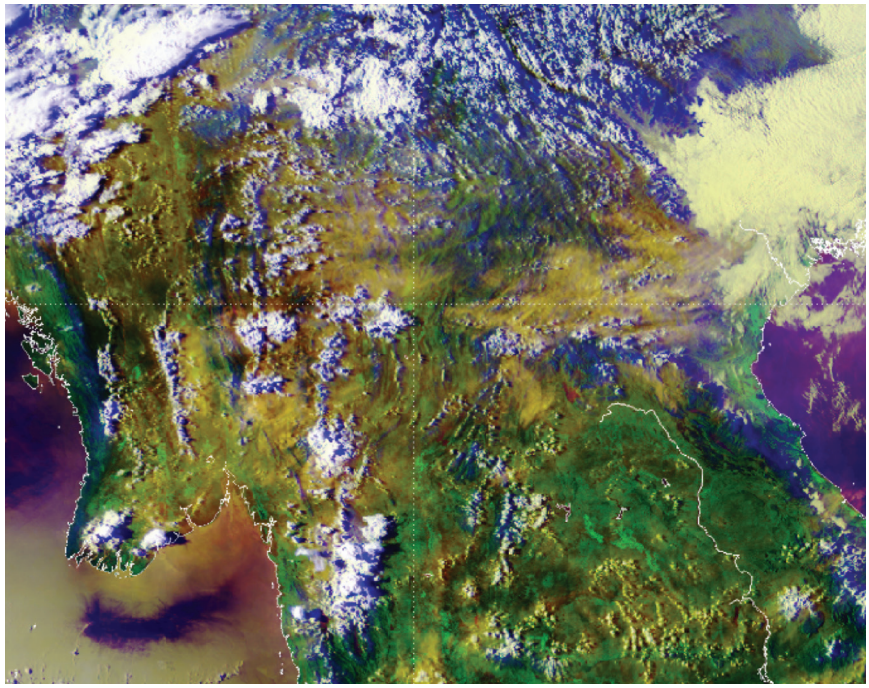

HIGHLIGHTS

- Weak to moderate La Niña conditions in the first quarter of 2018.
- Above-average rainfall over Southeast Asia during the first quarter of 2018.
- Weak El Niño favoured to develop by late 2018.
- Persistent hotspot activities over northern Southeast Asia in early-2018.
- Events: ASMC 25th Anniversary, Best Practice Workshop on Climate Change Projections, Second Subseasonal-to-Seasonal Predictions Workshop.

CLIMATE REVIEW (JAN – JUN 2018)

Weak to moderate La Niña conditions observed in early 2018

The sea-surface temperatures (SSTs) in the east-central Tropical Pacific Ocean were colder than average in the first quarter of 2018 and fell within weak to moderate La Niña range. Atmospheric conditions correspondingly showed patterns suggestive of La Niña in those months. Model outlook and experts' consensus from the Climate Prediction Centre/International Research Institute (CPC/IRI) predicted the SSTs to warm and return to neutral conditions by the second quarter of 2018 (Figure 1).

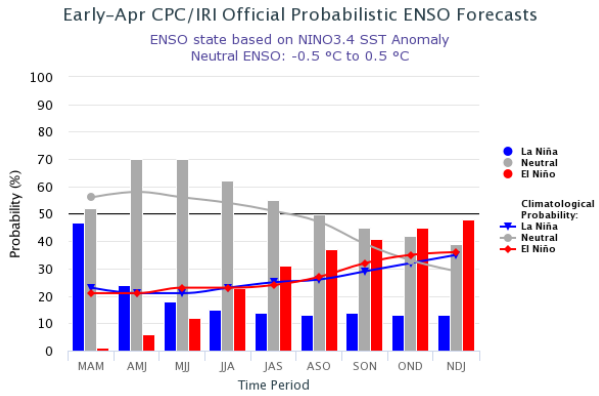

Figure 1: El Niño Southern Oscillation (ENSO) probabilistic forecast based on Nino3.4 index showed a higher likelihood of neutral conditions to return by April-June (AMJ) 2018 season. Credit: CPC/IRI.

In April 2018, the SST values returned to neutral as predicted. However, models predicted the SST warming tendencies to continue until the end of 2018. By June 2018, the monthly and 3-month average Nino3.4 index were close to zero (Figure 2).

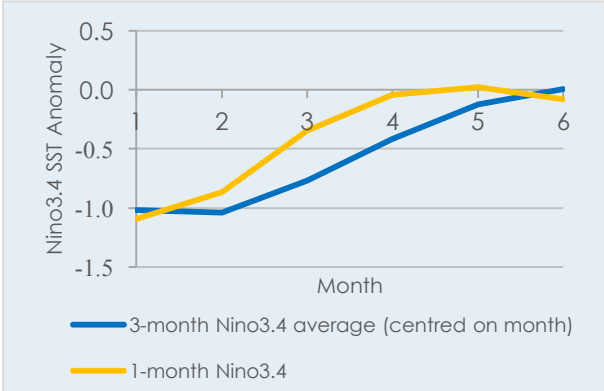

Figure 2: Nino3.4 index for 3-month average, centred on the month (dark blue) and 1-month average (yellow) values which were neutral by April 2018. Data: ERSST version 4.

Due to the weak to moderate La Niña conditions in the first three months of 2018, Southeast Asia experienced above-average rainfall (Figure 3a). In the second quarter, however, due to neutral ENSO conditions, the region did not experience any coherent large-scale rainfall anomalies (Figure 3b). Temperatures over the northern Southeast Asia region, in particular over Cambodia, Lao PDR, Thailand, and Vietnam, were colder than average over the first three months (Figure 4). The temperature anomaly may be explained by the higher mean sea level pressure, relative to climatology, during the season particularly for February 2018.

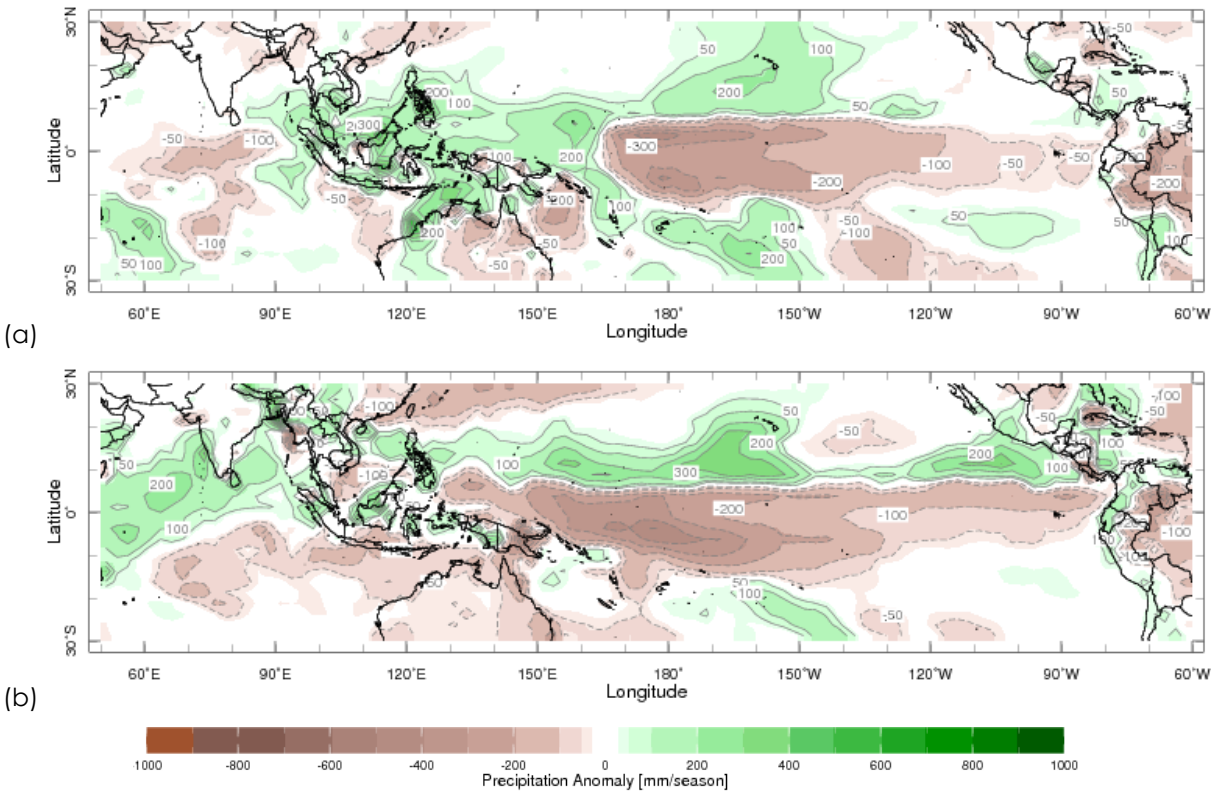

Figure 3: (a) January-March 2018 seasonal average rainfall anomaly (mm/season) over the Pacific and the Indian Ocean showing large-scale wet anomalies (green shades) over Southeast Asia during the weak to moderate La Niña episode, and (b) the corresponding plot for April-June 2018 showing less coherent large-scale anomalies over the region under neutral conditions. Credit: IRI Maproom.

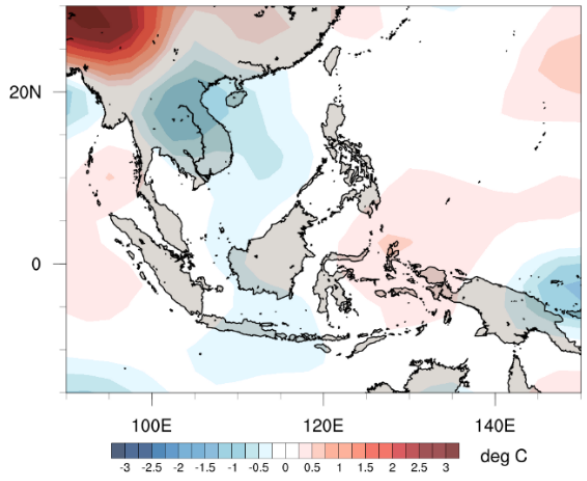

Figure 4: January-March 2018 seasonal average surface temperature anomaly (˚C) showing colder conditions (blue shades) over northern Southeast Asia (Cambodia, Laos, Thailand, and Vietnam) with respect to the 1981-2010 climatology. Data: NCEP Reanalysis

The Indian Ocean Dipole (IOD) was neutral for the first half of 2018, and there was no impact on rainfall in this region. However, the Madden-Julian Oscillation (MJO) was very active during the first half of 2018, mainly from mid-January to mid-February in Phases 6, 7, and 8 (Figure 5). These MJO phases typically bring westerly wind bursts over the western tropical Pacific and large-scale suppressed rainfall over the Maritime Continent. The MJO did not significantly affect the net positive rainfall anomaly conditions brought by La Niña during that period.

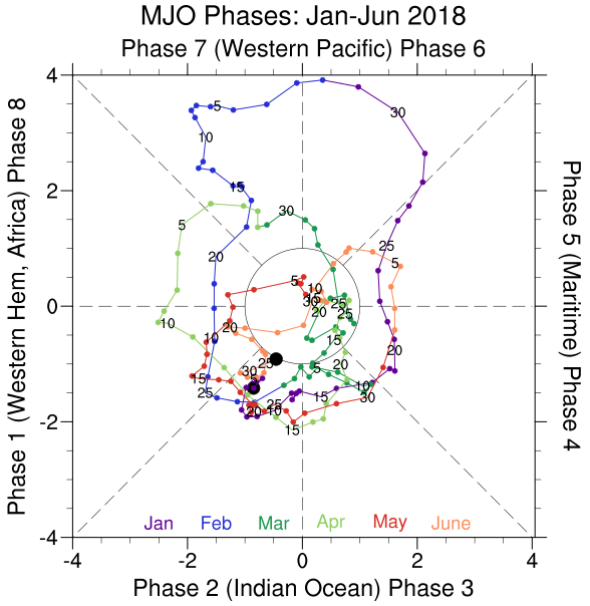

Figure 5: MJO phases from January to June 2018. The MJO was very strong and active from around mid-January to mid-February 2018. Data: BoM, Australia.

REGIONAL FIRE AND HAZE SITUATION (JAN – JUN 2018)

Dry season led to persistent hotspot activities in northern Southeast Asia

The traditional dry season of northern Southeast Asia set in around late 2017 and extended to early May 2018. During the season, extended periods of drier weather, in particular between February and April 2018 contributed to increased hotspot activities over northern Southeast Asia. Persistent hotspot activities were detected in several areas (Figure 6 and Figure 7), including areas along the border between Myanmar (Shan, Kayah, and Kayin provinces) and Thailand (Mae Hong Son, Chiang Mai, and Tak provinces), and in the northern parts of Cambodia.

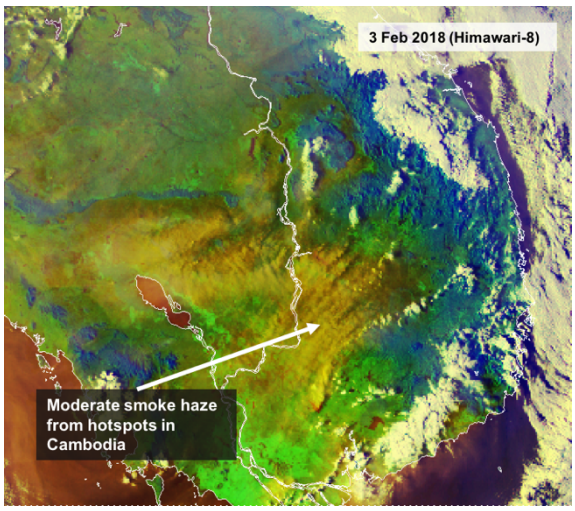

Figure 6: Himawari-8 satellite image on 3 February 2018 shows moderate smoke haze emanating from clusters of hotspots detected in northern Cambodia.

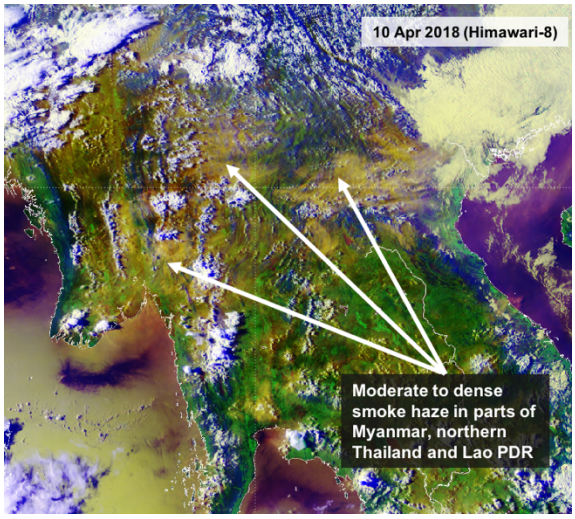

Figure 7: Himawari-8 satellite image on 10 April 2018 shows widespread moderate to dense smoke haze from land and forest fires over the north of northern Southeast Asia.

The smoke haze that emanated from these hotspots resulted in the deterioration of air quality in some parts of the region. For example, Lampang in northern Thailand reported moderate to unhealthy air quality on several days. The return of shower activities with the onset of the inter-monsoon season in mid-April brought relief to the haze situation. Since May 2018, hotspot activities in the northern Southeast Asia have been generally subdued.

In the first half of 2018, the number of hotspots detected compared to the same period in 2017 is slightly lower for northern Southeast Asia. Figure 8 shows the hotspot density map from January to June 2018. During this period, most of the hotspots were detected in central and eastern Myanmar, northern Thailand, northern Cambodia and parts of Lao PDR and Vietnam.

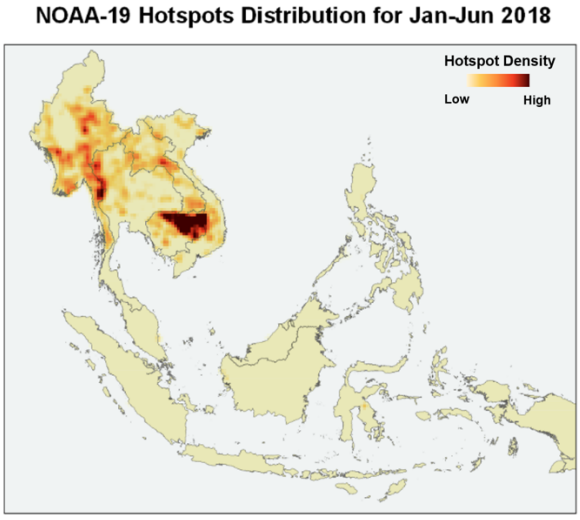

Figure 8: Hotspot density map based on NOAA-19 satellite from January to June 2018.

For the southern Southeast Asia region (Brunei, Indonesia, Malaysia, and Singapore), there were occasional hotspots with localised smoke plumes observed in parts of Peninsular Malaysia and Sumatra during brief periods of dry weather. However, these hotspots were short-lived and did not contribute to significant transboundary haze.

CLIMATE AND HAZE OUTLOOK (SEP 2018 – FEB 2019)

Weak El Niño development favoured in late 2018

Model outlook and experts' consensus from the CPC/IRI predict around 70% chance for weak El Niño conditions to emerge by September-November 2018 season (Figure 9), aligned with the warm SST anomalies that are forecast to develop over the east-central tropical Pacific Ocean during the September–November 2018 season onwards (Figure 10).

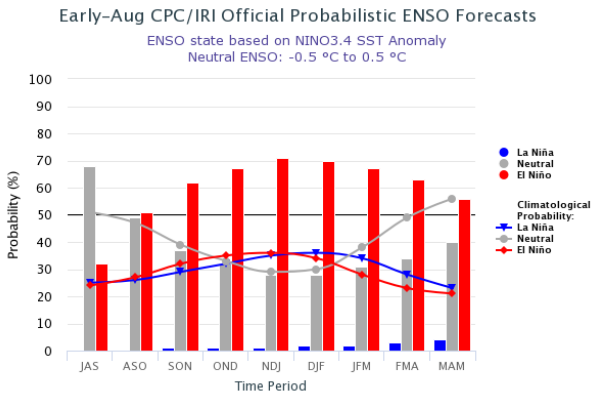

Figure 9: ENSO probabilistic forecast based on Nino3.4 index showing a higher likelihood of El Niño conditions (red) occurring from the September-November (SON) 2018 season onwards. Credit: IRI/CPC.

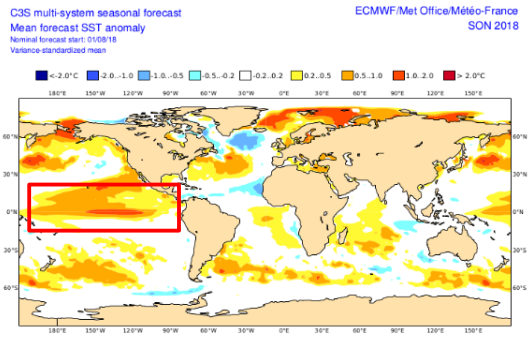

Figure 10: SST anomaly forecast for September-November (SON) 2018 from C3S model ensemble showing warm SST anomalies over the east-central tropical Pacific Ocean (red box). Credit: C3S Copernicus.

Models from the WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (WMO LC-LRFMME) favour below-normal (drier) conditions over the northeast and southwest corners of the Maritime Continent (around the Philippines, southern Sumatra, and western Borneo) for the September – November 2018 season (Figure 11). If the drier conditions were to happen, it might lead to an increased risk of hotspot activities in the fire-prone provinces of Sumatra and Kalimantan particularly in September and October 2018. The onset of the rainy season towards the end of 2018 is expected to help keep hotspot activities subdued. The northern Southeast Asia region is expected to undergo a transition from rainy to dry season towards the end of 2018. A gradual increase of hotspot activities can be expected as the season progresses in early 2019.

For the other parts of the Maritime Continent, the WMO LC-LRFMME predict near-normal conditions to be more likely. The multi-model ensemble from IRI, however, predict this region to experience below-normal conditions, which is symptomatic of a response to the possible El Niño development. The spread of possibilities in the rainfall outlook across different multi-model ensembles is notable but expected given that the El Niño forcing is not likely to be strong.

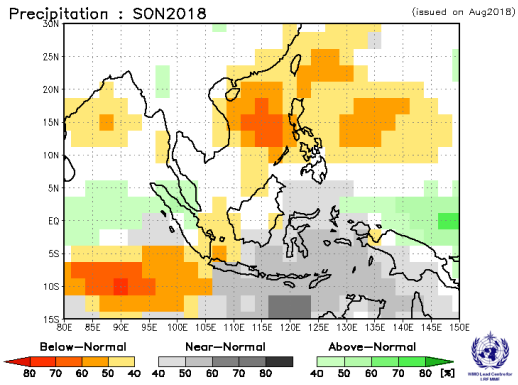

Figure 11: Multi-model ensemble rainfall probabilistic prediction from WMO LC-LRFMME for the September-November (SON) 2018 season. Credit: WMO LC-LRFMME.

Further out into the subsequent December 2018 - February 2019 season, a survey of various multi-model ensembles indicate near- to below-normal rainfall patterns to cover most of the Maritime Continent. The extent and magnitude of the drier conditions will depend on the ENSO development, and elsewhere, there is no consensus between the models. During the next six months, the northern Southeast Asia region will undergo a transition from wet to dry season. Consequently, a gradual increase of hotspot activities for this region can be expected as the season progresses.

For temperature, the region is generally expected to experience warmer-than-average conditions.

NORTHWEST PACIFIC TC SEASON SYNOPSIS (JAN – JUN 2018)

Article contributed by Rusy G. Abastillas

Weather Specialist II, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

There were seven (7) Tropical Cyclones (TCs) that developed over the Northwestern Pacific from January to June 2018, and six of these TCs entered the Philippine Area of Responsibility (PAR) (Figure 12).

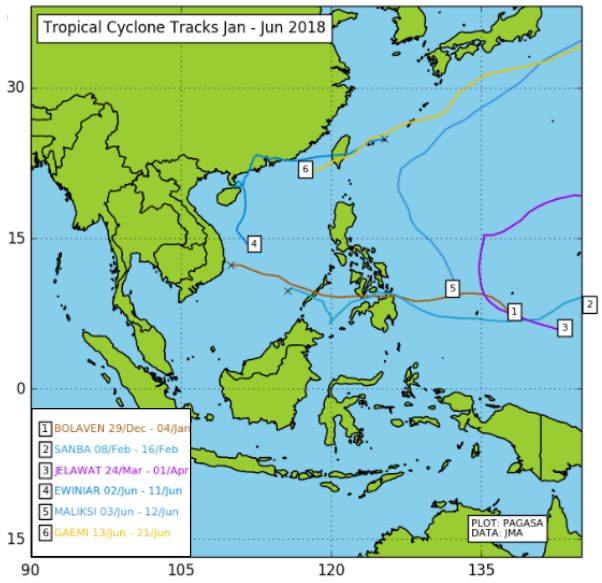

Figure 12: Tropical cyclone tracks from Northwest Pacific (boxed numbers denote starting points) affecting the region for January – June 2018. Credit: PAGASA.

The first TC of the year, Tropical Storm (TS) "Bolaven" developed from a Low Pressure Area (LPA) while it was inside the PAR on January 1. It then crossed the central islands of the Philippines making multiple landfalls. Devastating impacts such as widespread flooding, flash floods, and landslides caused by heavy rainfall (Figure 13) were experienced resulting to damages in infrastructure and agriculture, prompting the residents to flee their homes and spend the New Year in evacuation centres.

The next TC, TS "Sanba", occurred in February 2018 and made landfall over the central and southern regions of the Philippines (northern Mindanao and the Visayas), where it then weakened into an LPA before exiting the country. In February, TC occurrences are typically low but during La Nina, the probability of TC development is high as was the case in February 2018. The third TC, TS "Jelawat", that developed in March did not make any impact on any part of the country. The tracks of these first quarter TCs were typical during this time of the year.

The second quarter TCs all occurred in the month of June, with no TC in April and May that entered the PAR. Typhoon "Maliksi" that developed into a TC in the PAR did not make landfall in any part of the Philippines. However, this enhanced the Southwest Monsoon and triggered the declaration of the onset of rainy season in the western section of the country. Widespread flooding, flash floods, and landslides were experienced in most areas of the country because of the heavy rainfall associated with this TC.

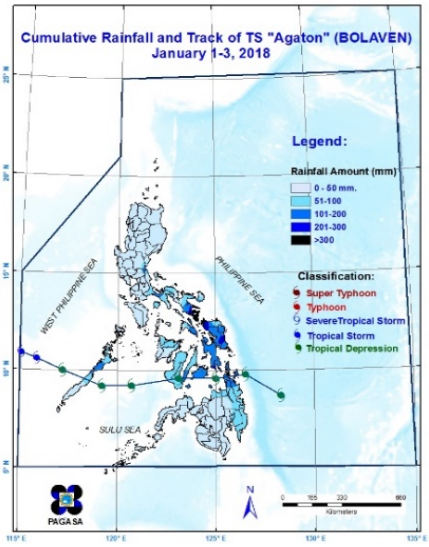

Figure 13: Track and cumulative rainfall over PAR during TS "Bolaven". Credit: PAGASA.

Tropical Depression "Gaemi" developed over the West Philippine Sea and moved in a northwesterly direction, entered in the northwestern section of extreme Luzon which brought rain to the western sections of Luzon. Severe Tropical Storm "Prapiroon" had no significant impact during its occurrence. These three TCs did not make landfall in the Philippines which is normal during this month.

ASMC EVENTS

ASMC 25th Anniversary

Commemorating 25 years of advancing weather and climate services for ASEAN

The ASEAN Specialised Meteorological Centre (ASMC) commemorated its 25th anniversary at the Opening Ceremony of the 40th Meeting of the ASEAN Sub-Committee on Meteorology and Geophysics (SCMG), which was held in Singapore from 2 to 4 May 2018.

The Centre was officially established in 1993 to foster collaboration among the ASEAN Member States' National Meteorological and Hydrological Services (NMHSs) in weather and climate science. The underlying objective was to avail quality services to the weather- and climate-sensitive segments of the region.

Following the ASEAN Committee on Science and Technology (COST)'s proposal and the ASEAN Standing Committee's endorsement that the regional centre be established and located in Singapore, the ASMC was officially established and hosted by the Meteorological Service Singapore in 1993. The Centre was inaugurated by Mr Mah Bow Tan, then Singapore's Minister for Communications and Minister for the Environment.

Over the years, the role of the ASMC has been expanding to serve the region's evolving needs. Today, its remit covers research in weather and climate systems of Southeast Asia, regional smoke haze monitoring and assessment, and capability building for the region.

During the Opening Ceremony of the 40th SCMG, Guest-of-Honour Dr Amy Khor, Singapore's Senior Minister of State for the Environment and Water Resources, noted that the ASMC is one of the longest-established ASEAN centres under the ASEAN Committee on Science and Technology (COST). She congratulated the Centre on reaching the 25th-year milestone, and in particular, on having made significant progress in transferring meteorological knowledge and skills to the ASEAN NMHSs.

In her address at the Opening Ceremony of the 40th SCMG, Dr Amy Khor, Singapore's Senior Minister of State for the Environment and Water Resources, reiterated ASMC's commitment to helping raise the effectiveness of meteorological services in ASEAN countries through capability building and announced the Centre's plans for a 5-year Regional Capability Building Programme.

ASMC's 5-year Regional Capability Building Programme

Dr Khor emphasised the importance of continued capability development for the region to address the evolving needs and challenges in areas such as climate change and weather extremes. On this note, she announced the

Centre's plans to boost efforts in this aspect through a 5-year Regional Capability Building Programme, which would engage the regional stakeholders through platforms like training workshops, customised courses, and discussion forums.

In conjunction with its 25th anniversary, ASMC also unveiled its refreshed logo, which reiterates the Centre's commitment towards contribution to the region.

The launch of ASMC's refreshed logo was officiated by (from left) Dr Flaviana Hilario (Chairperson of the 40th SCMG), Dr Amy Khor, Ms Wong Chin Ling (Director of ASMC) and Ms Alice Cheong (Assistant Director and Head of Science and Technology Department, ASEAN Secretariat) at the Opening Ceremony of the 40th SCMG on 2 May 2018.

About the new ASMC logo

ASMC
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The symbolism of the logo is twofold. The circular motif, with arrows in opposing directions within, represents the cyclical nature of the Northeast and Southwest Monsoons, which are the key drivers of the weather and climate systems in the Southeast Asia region. At the heart of the motif, the blue and orange strips resting in harmony with each other is a creative visualisation of two holding hands symbolising ASEAN cooperation and collaboration, which are the values underpinning the Centre's mission.

The colours of the logo – blue represent the Centre's professionalism and commitment towards the scientific advancement, and orange represents the Centre's dynamism and innovation in the pursuit of excellence in serving the needs of the region. In the meteorological context, blue and orange represents the oceans and the sun respectively, which are both integral drivers of the Earth's weather and climate.

Best Practice Workshop on Climate Change Projections & Their Applications in ASEAN Countries, Singapore, 20-23 March 2018.

The Workshop was organised in collaboration with the World Meteorological Organization (WMO) as part of the initiative by the WMO RA V Working Group on Climate Services (WG-CLS) to consolidate existing activities in the region in the generation of climate projections. The Workshop was co-funded by the Environment and Climate Change Canada (ECCC) and ASMC. The aims of the Workshop included reviewing existing methodologies in the development and use of regional climate change projections for national-level adaptation planning across the ASEAN Member States, assessing critical regional scientific challenges in the generation of these projections, and evaluating the uptake of these projections by the Vulnerability and Impact Assessment community across the region.

Mr Abdalah Mokssit informed on the role of IPCC in interfacing science and policy as well as the focus and challenges for the next phase of the IPCC Assessment Report 6 (AR6) and Coupled Model Intercomparison Project Phase 6 (CMIP6) programmes. Outreach and engagement are also high on the priority list of the IPCC.

The Workshop was graced by Mr Abdalah Mokssit, Secretary of the Intergovernmental Panel on Climate Change (IPCC). It was attended by representatives from the NMHSs of 9 ASEAN Member States namely Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

The Workshop was also attended by international experts from the UK Met Office, Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Bureau of Meteorology (BoM), along with regional experts from the WMO's Coordinated Regional Climate Downscaling Experiment Southeast Asia (CORDEX-SEA) community. It also involved Singapore's research institutions: the Centre for Climate Research Singapore (CCRS), Tropical Marine Science Institute (TMSI), and Earth Observatory of Singapore (EOS).

Breakout group discussions on Day 2 and 3 of the Workshop.

Representatives from regional users of climate projections, including the ASEAN Coordinating Centre for Humanitarian Assistance (AHA Centre), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Global Water Partnership Southeast Asia (GWP-SEA), the Mekong River Commission (MRC), and Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) were present. A representative from the Pacific Island region,

Pacific-Australian Climate Change Science Adaptation Planning (PACCSAP) also attended.

At the close of the Workshop, a number of best practice recommendations were identified. In the production of climate projections, participants called for greater regional collaboration to conduct model intercomparison studies (particularly in anticipation of the next phase of the IPCC Assessment Report), develop technical guidelines for model development and usage, and consolidate existing sources of climate information and services. Active and sustained end-user engagement was recognised as key to the delivery of effective climate services, and various strategies were shared during the Workshop. The need for a regional platform for collaboration, both in the production and delivery of climate services, was emphasised, with the Workshop itself being a step towards this direction. The full Workshop recommendations will be detailed in an upcoming Meeting Report.

Second Subseasonal-to-Seasonal Predictions Workshop for Southeast Asia (S2S-SEA II), Singapore, 13-17 August 2018.

This training workshop is the second in the series of workshops aimed at building capability in subseasonal to seasonal predictions (2-week to 2-month timescale) among NMHSs in Southeast Asia. The Workshop involved two participants each from 8 of the NMHSs, namely Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

NMHSs participants, trainers, and end-users of the S2S-SEA II Workshop.

The Workshop was conducted in collaboration with the WMO S2S Prediction Project, International Research Institute for Climate and Society (IRI), and RIMES. Funding for the Workshop was provided by ASMC and the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP).

Participants at the Workshop assessed model performance on weekly/biweekly time periods for rainfall-related climate indices such as the number of dry days or number of days above or below certain percentile thresholds of their interests. Participants also explored using statistical techniques to correct for biases in the models, or "Model Output Statistics", to improve the S2S model performance in the region using the IRI's Climate Predictability Tool (CPT). These activities, developed based on feedback from participants of the first workshop in March 2017, are a progression from the standard weekly mean temperature and rainfall anomalies analysed during the first workshop.

> *Overall, what we have learnt will be useful for our job. Now we ourselves can explore developing some model outputs or tools for fortnightly or monthly predictions. – Ms. Nichanun Trachow, Thai Meteorological Department.*

Another new aspect of the workshop was the involvement of users, AHA Centre, GWP-SEA, RIMES, and UN ESCAP in a 1-day plenary to consolidate and present results from the Workshop, discuss the outputs with the users and explore how these could be useful for various applications.

Participants discussing on the requirements of end users and the challenges and opportunities of using the S2S model output in applications.

Upcoming Events

29 Oct-2 Nov 2018, Kuala Lumpur, Malaysia: *11th Session of the ASEAN Climate Outlook Forum (ASEANCOF-11)*. The Forum, conducted in collaboration between the ASMC and MetMalaysia (*Jabatan Meteorologi Malaysia)*, aims to generate consensus rainfall and temperature outlooks for the December 2018 - February 2019 boreal winter monsoon season alongside related information on weather and climate drivers in the Southeast Asia region such as the El Niño/La Niña and monsoons. It will be held in conjunction with the Space-based Weather and Climate Extremes Monitoring Demonstration Project (SEMDP) Workshop organised by the WMO and its partners in this region.

This bulletin is a biannual publication of ASMC. It is published annually in March and September, providing 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. **For feedback and contributions to articles, please email: ASMC_Enquiries@nea.gov.sg.** Web: asmc.asean.org.