

1. Review of Regional Weather Conditions in March 2017

1.1 The Northeast Monsoon conditions in the region gave way to inter-monsoon conditions in the second half of March 2017. During the month, there was a gradual increase of shower activities over parts of the Mekong sub-region, particularly over Thailand, Cambodia and central Vietnam was observed while over most parts of the southern ASEAN region, wet weather conditions continued to prevail. The rainfall distribution for March 2017 is shown in Figure 1.

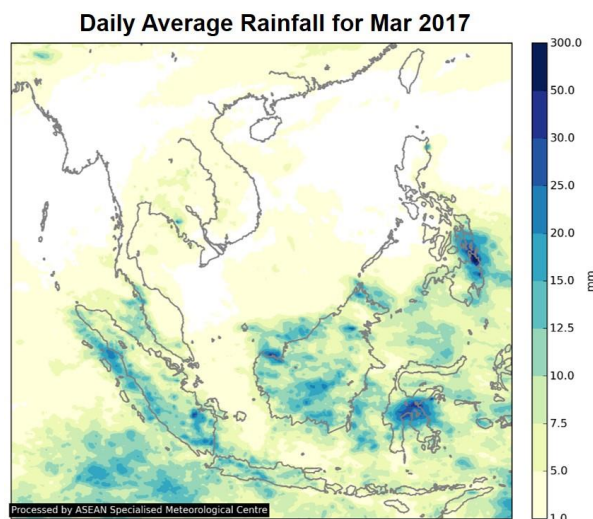


Figure 1: Daily average rainfall for the ASEAN region in March 2017. (Source: JAXA Global Satellite Mapping of Precipitation)

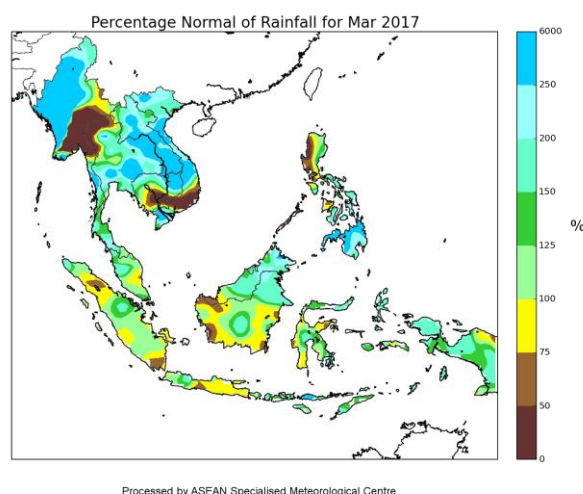


Figure 2: Percentage of Normal Rainfall for March 2017. The rainfall data may be less representative for areas with low density of rainfall network.

1.2 In March 2017, rainfall was near to above-normal over most parts of the northern ASEAN region, except in parts of Myanmar, Cambodia and southern Vietnam where below-normal rainfall was received. Likewise in most parts of the Philippines, near- to above-normal rainfall prevailed with most of the rainfall affecting the Mindanao area. In the southern ASEAN region, rainfall received was mostly near to above-normal, and in the second half of March 2017, parts of West Java and Peninsular Malaysia were affected by floods due to the occurrence of heavy thunderstorm activities on some days. Figure 2 shows the percentage normal of rainfall for March 2017.

1.3 The prevailing winds during the month were predominantly from the north-east or east over the northern ASEAN region, and from the west or northwest over the southern ASEAN region. In the second half of March 2017, there was a gradual weakening of winds over the ASEAN region around and north of the Equator. Westerly wind anomalies prevailed over the equatorial region between the Indian Ocean and the eastern parts of Indonesian Archipelago. The anomalous convergence observed over the northern parts of Borneo and southern Philippines could have contributed to above-normal rainfall over those areas. Figure 3 shows the average and anomalous winds at 5000 feet.

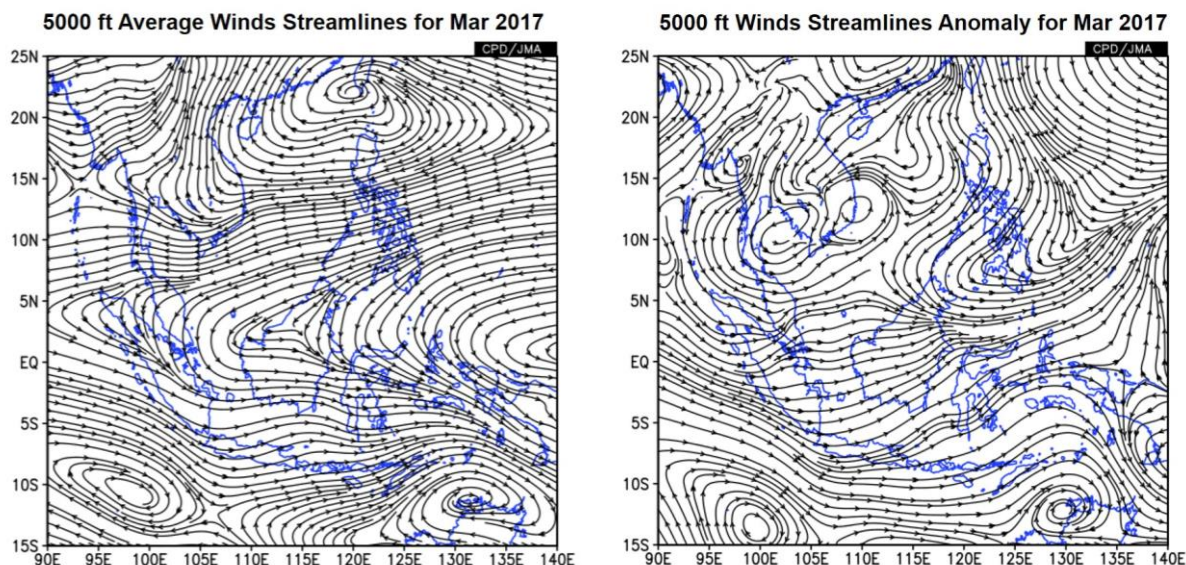


Figure 3: 5000 ft average winds streamlines (left) and anomaly (right) for March 2017. (Source: JMA)

1.4 The cool anomalies of the equatorial Pacific Ocean's sea-surface temperature (SST) over the Niño3.4 region further weakened towards neutral (neither El Niño nor La Niña) values, and most of the atmospheric indicators over the equatorial Pacific were in the near average conditions.

1.5 In early March 2017, the Madden Julian Oscillation (MJO)¹ progressed through Phase 3 to Phase 4 in early March 2017, and this was a contributing factor to the increased rainfall received over the Indonesian Archipelago. The strength of the MJO gradually weakened towards mid-March 2017, and did not have a significant influence on the rainfall in the second half of the month.

¹ The MJO is characterised by an eastward propagation of clouds and rainfall over the tropics with an average cycle of 30 to 60 days. The MJO is more prominent between the Indian and western Pacific Ocean, and consists of two phases – an enhanced rainfall (convection) phase and a suppressed rainfall phase.

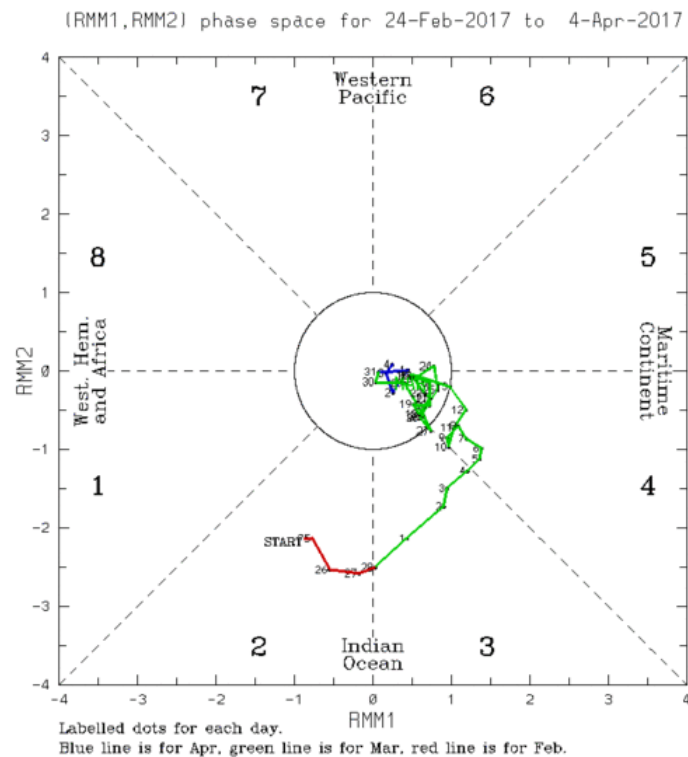


Figure 4: The MJO phase diagram for March 2017 (green). The MJO phase diagram illustrates the movement of the MJO through different phases, which correspond to different locations along the equator. The distance of the index from the centre of the diagram is correlated with the strength of MJO. When the index falls within the circle, the MJO is considered weak or indiscernible. (Source: Bureau of Meteorology)

2. Review of Land/Forest Fires and Smoke Haze Situation

2.1 In March 2017, the hotspot activities in the northern ASEAN region remained active under the prevailing dry weather conditions. Large clusters of hotspots were detected in Myanmar and northern Thailand compared to February 2017. Most of the hotspots and areas of smoke haze were detected close to the border of Myanmar and Thailand, in the provinces of Mae Hong Son, Chiang Rai and Kamphaeng Phet. In the second half of March 2017, there was a further deterioration in the air quality in northern Thailand, and the PM_{10} readings exceeded $150\mu g/m^3$ (Unhealthy range) on several days in Mae Hong Son and Chiang Rai provinces. In Lao PDR, a high density of hotspots was detected in Xiangkhoang and Xaignabouri provinces. On the other hand, there was an increase in shower activities in Cambodia during the month which helped to ease the hotspot situation there.

2.2 In contrast, hotspot activities in the southern ASEAN region remained low and were mostly subdued due frequent shower activities in the region. Satellite images depicting some of the hotspot activities over parts of the ASEAN region during March 2017 are shown in Figure 5 - Figure 9.

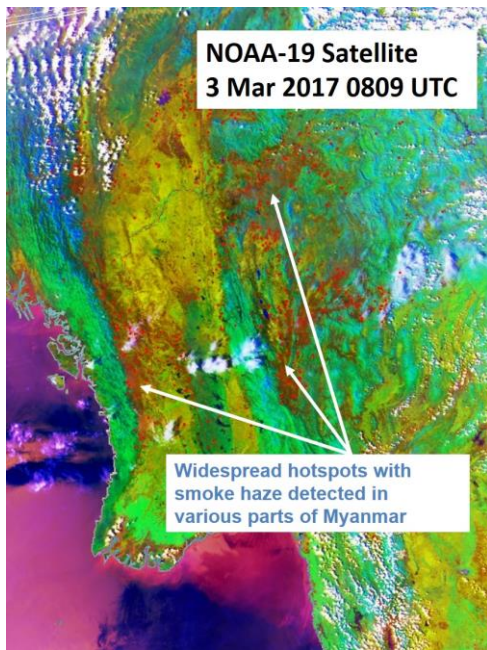


Figure 5: NOAA-19 satellite image on 3 March 2017 shows widespread hotspots with smoke haze in parts of Myanmar.

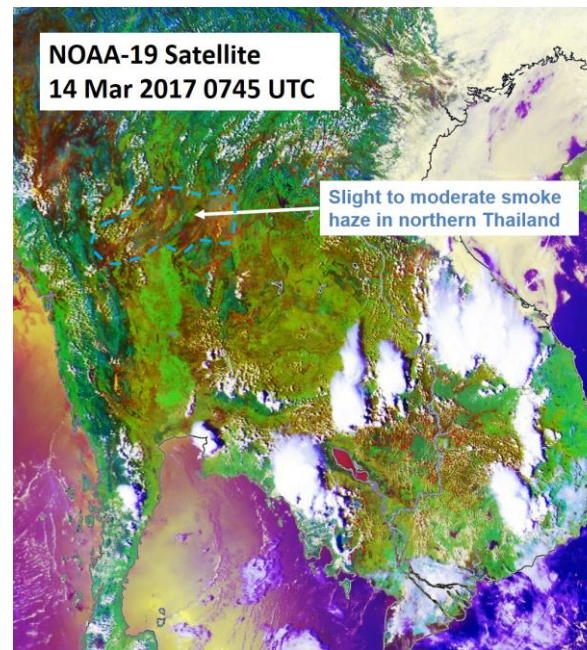


Figure 6: NOAA-19 satellite image on 14 March 2017 shows slight to moderate smoke haze over parts of northern Thailand.

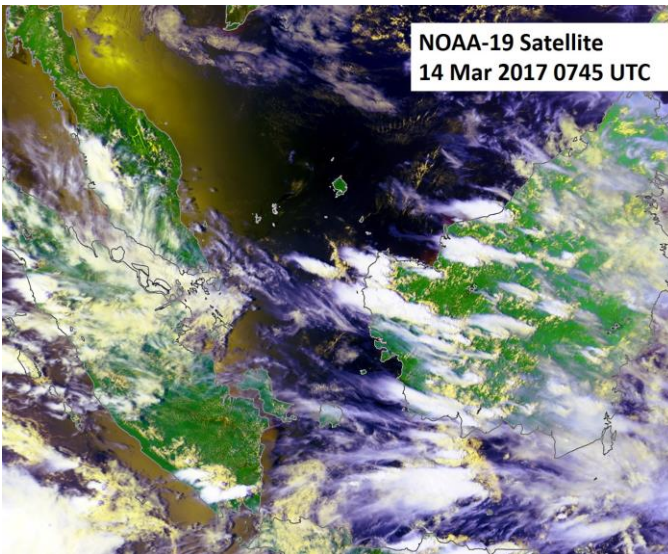


Figure 7: NOAA-19 satellite image on 14 March 2017 shows occurrence of shower activities which has helped to subdue the hotspot activities over the southern ASEAN region.

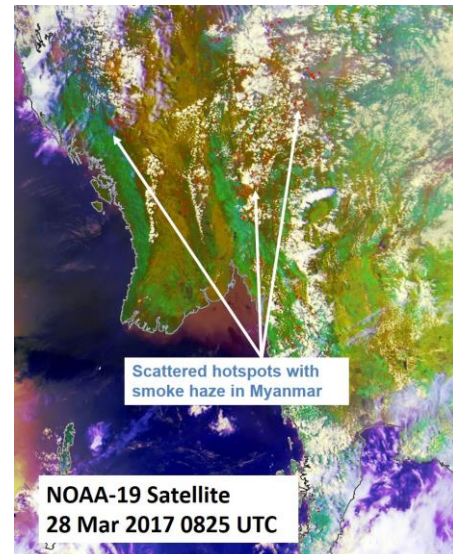


Figure 8: NOAA-19 satellite image on 28 March 2017 shows scattered hotspots with smoke haze in Myanmar.

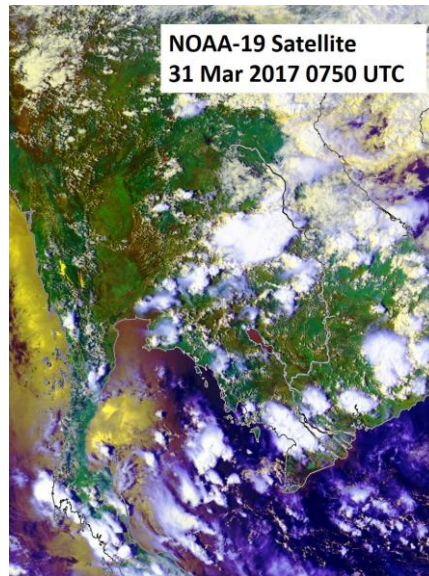


Figure 9: NOAA-19 satellite image on 31 March 2017 shows more occurrence of shower activities over the Mekong sub-region.

2.3 The hotspot distribution and daily hotspot charts for March 2017 are shown in Figure 10, Figure 11 and Figure 12 respectively.

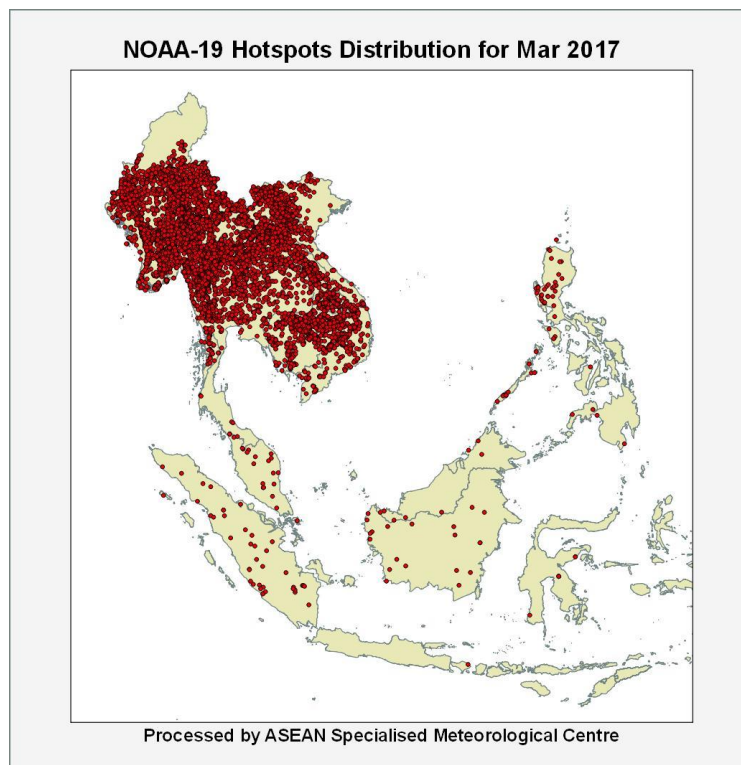


Figure 10: NOAA-19 hotspots distribution in March 2017.

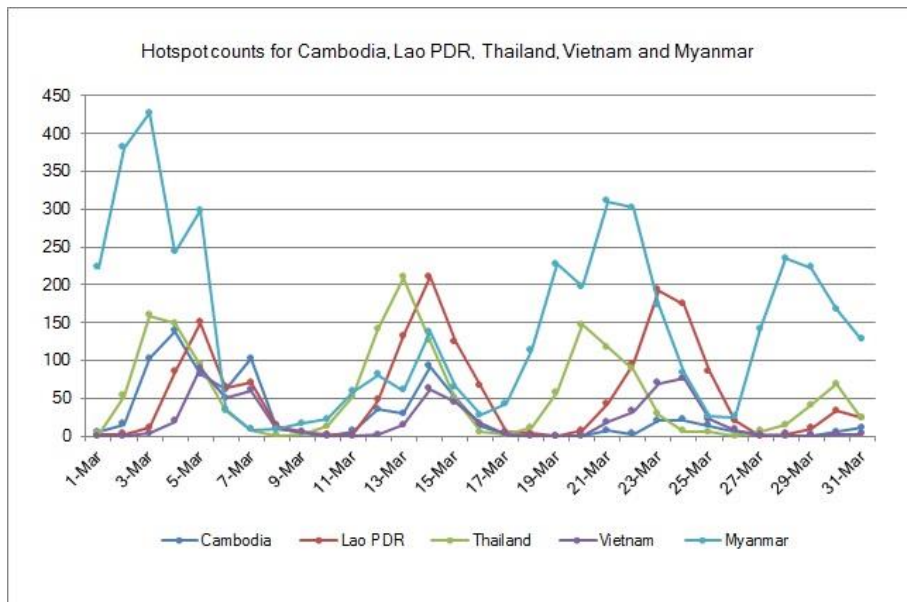


Figure 11: Hotspot Counts in Cambodia, Lao PDR, Thailand, Vietnam and Myanmar in March 2017.

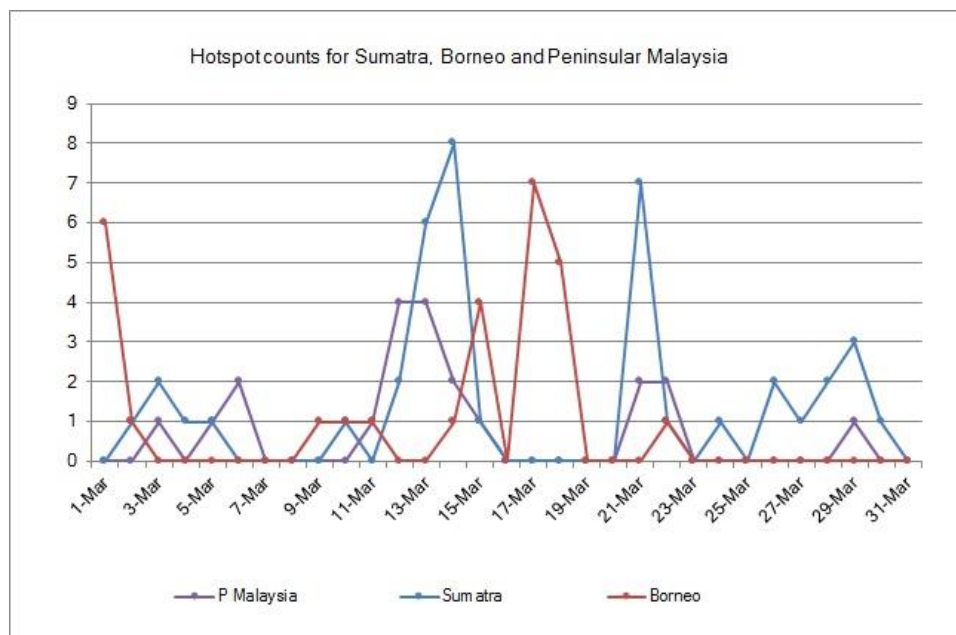


Figure 12: Hotspot Counts in Sumatra, Borneo and Peninsular Malaysia in March 2017.

3. Outlook of El Niño/La Niña and Indian Ocean Dipole

3.1 Most models from major climate centres indicate the tropical Pacific Ocean will continue to gradually warm over the next 6 months, and there is an increasing chance that weak El Niño conditions could develop in the second half of 2017.

3.2 As the seasonal prediction model outlooks of El Niño at this time of the year is known to have the least skill, a more confidence assessment of El Niño risk would be available around mid-2017 onwards.

3.3 Typically, El Niño brings drier-than-normal rainfall conditions to most parts of Southeast Asia during the Southwest Monsoon season. During La Niña events, the opposite, i.e wetter-than-normal condition, normally occurs. Locally specific impact differs from place to place and for different seasons.

3.4 In March 2017, the Indian Ocean Dipole (IOD) index was at neutral levels (Figure 13). In the next few months, based on international climate models, the IOD is forecast to remain neutral and it would unlikely have a significant influence on the weather over the ASEAN region. The formation of IOD typically starts around May or June, and peaks between August and October before decaying rapidly between December and April.

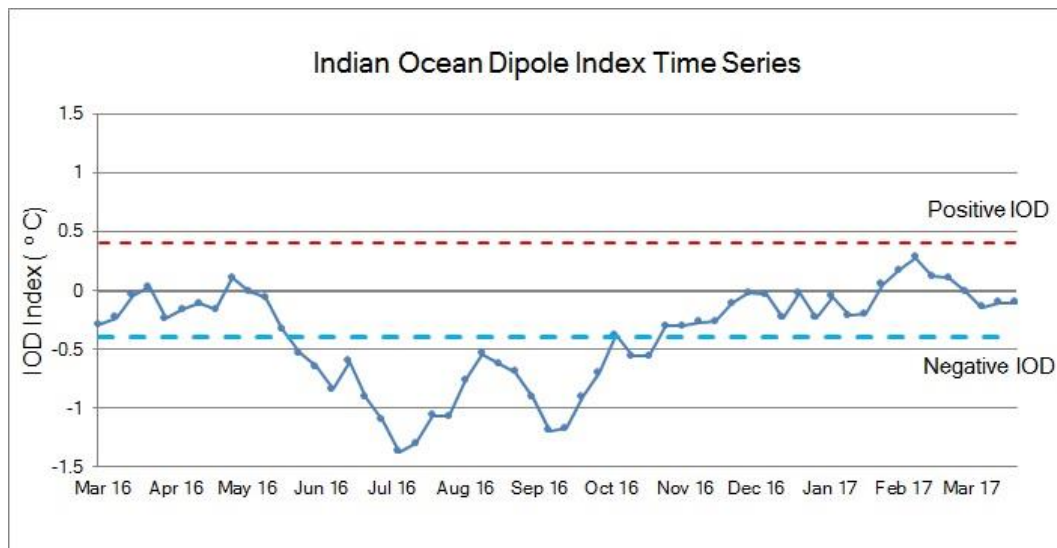


Figure 13: Indian Ocean Dipole (IOD) index time series. The IOD index was at neutral levels in March 2017. (Source: Bureau of Meteorology, Australia)

4. Outlook

4.1. For the April-May-June season, the prevailing inter-monsoon conditions are expected to prevail and extend into May 2017. During this period, prevailing winds are light and variable in direction, and the weather patterns are typically characterised by afternoon showers. The monsoon rain band is expected to migrate towards the north, and a gradual increase of shower activities can be expected over the northern ASEAN region. The increased shower activities would help alleviate the hotspot and haze situation in the northern ASEAN region. In the southern ASEAN region, frequent shower activities are expected to continue to persist. However, occasional isolated hotspot activities can still be expected during brief periods of dry weather conditions.

4.2. In the second week of April, a strengthening of north-easterly winds can be expected and this would bring drier than usual conditions over the Mekong sub-region. During the same period, near to above-normal rainfall is expected for most parts of the southern ASEAN region. In the third week of April, drier than usual conditions are forecast for the Philippines while near-normal rainfall is expected for the rest of the region.

4.3. By June 2017, the inter-monsoon conditions are expected to give way to the onset of the Southwest Monsoon conditions, and mark the beginning of the traditional dry (wet) season of the

southern (northern) ASEAN region. For the southern ASEAN region, extended periods of dry weather conditions can be expected and this could lead to an increase or escalation in hotspot activities over the fire-prone provinces of Sumatra and Kalimantan. Typically, in the early part of the traditional dry season in the southern ASEAN region, most of the fires emerge in northern and central Sumatra and western Kalimantan.

4.4. For the April-May-June 2017 season, near-normal rainfall is expected over most parts of the Mekong and southern ASEAN region. In April 2017, slightly above-normal rainfall is forecast for Thailand. In June 2017, slightly below-normal rainfall is expected for South Sumatra and West Kalimantan. The rainfall outlooks for the April to June 2017 season are shown in Figure 14.

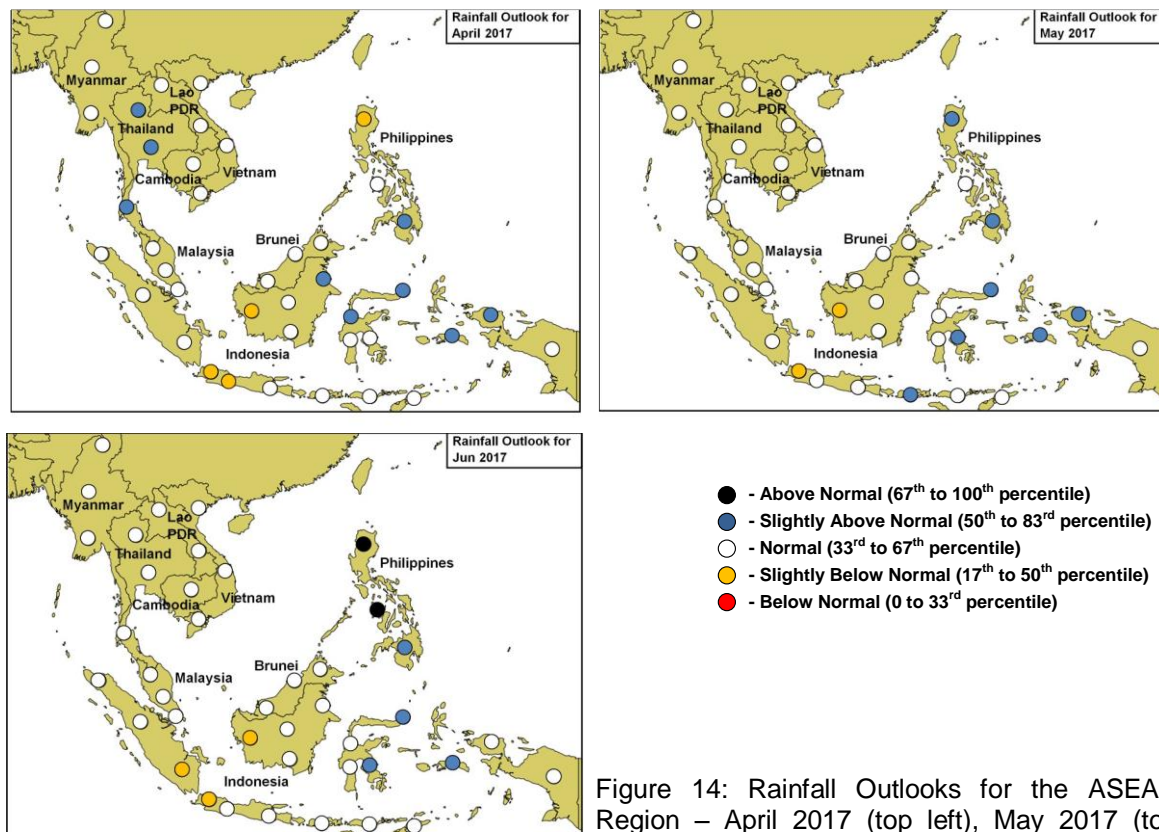


Figure 14: Rainfall Outlooks for the ASEAN Region – April 2017 (top left), May 2017 (top right), and June 2017 (bottom left)