Eighteenth Session of the ASEAN Climate Outlook Forum (ASEANCOF-18)

24 and 26 May 2022, PAGASA

Consensus Bulletin for June-July-August (JJA) 2022 Season

INTRODUCTION

The ASEAN Climate Outlook Forum (ASEANCOF) is an avenue to collaboratively develop consensus-based seasonal climate outlooks and related information on a regional scale. The forum's outlook and its activities contribute significantly to one of the key roles of the ASEAN Specialised Meteorological Centre (ASMC), which is to conduct climate and seasonal prediction for the Association of Southeast Asian Nations (ASEAN) region through pooling the expertise of ASEAN National Meteorological and Hydrological Services (NMHSs). In 2021, the ASEANCOF Working Group was established with the goal to guide and support the long-term development of ASEANCOF, in particular with regard to the implementation of objective outlooks.

The Eighteenth session of ASEANCOF (ASEANCOF-18) was organised by the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) in collaboration with the ASMC and the ASEANCOF Working Group. Participants from the NMHSs of ASEAN Member States created a consensus forecast for the boreal summer monsoon 2022 in the ASEAN region. The consensus for June-July-August (JJA) 2022 outlook was achieved through an online session, which included presentations from different NMHSs, questionnaires, and discussions regarding the current climate conditions and predictions in the Southeast Asia region. In particular, ASEANCOF considered the influence of the El Niño

Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD) on the climate system over Southeast Asia. There was also a special focus on monsoon variability, with a presentation from the Regional Working Group on Asian-Australian Monsoon (AAM-WG).

CONDITIONS AND OUTLOOK

Recent analyses of sea surface temperature (SST) anomalies over the equatorial Pacific show below average SSTs across the central and eastern tropical Pacific Ocean indicative of La Niña.

The international climate outlooks predict that the La Niña is likely to weaken during JJA 2022, although still overall indicate La Niña conditions. After JJA 2022, most models predict the ENSO state to be either cool ENSO neutral or La Niña.

The current IOD state is neutral. Most models predict a negative IOD developing during JJA 2022, with some models predicting the said negative IOD to be strong.

The onset of the Southwest Monsoon season has been earlier than normal in many parts of Mainland Southeast Asia, and near normal in the Maritime Continent. Over much of Southeast Asia, the strength of the Southwest Monsoon is expected to be near normal or weaker than normal, based on model predictions.

Overall, the tropical cyclone frequency is expected to be near average in the Bay of Bengal, while below to near average around the South China Sea and in the Philippine Sea. As there is an expected weakening of La Niña in JJA 2022, no significant deviation from the climatology of tropical cyclone frequency is expected during the forecast period.

Taking into consideration the national level forecasts, the present state of the climate, and the forecasts available from the global prediction centres (GPCs), the ASEANCOF-18 agreed on the following consensus-based outlook for JJA 2022 in the ASEAN region:

RAINFALL

For the upcoming boreal (Northern Hemisphere) summer season (JJA 2022):

Over much of the southern ASEAN region, near to above normal rainfall is predicted. Near to above normal rainfall is predicted over Brunei Darussalam and many parts of Malaysia, with above normal rainfall predicted most elsewhere. The exceptions include parts of the western and eastern Maritime Continent, where near to below normal rainfall is predicted.

Over much of the northern ASEAN region, a mix of below to above normal rainfall is predicted. Near to below normal rainfall is predicted over the western and southeast portion of Mainland Southeast Asia, and northwest Philippines. Near to above normal rainfall is

predicted over portions of northeast and southern Mainland Southeast Asia, and southern Philippines. Elsewhere in the northern ASEAN region, near normal rainfall is predicted.[1]

TEMPERATURE

For the upcoming boreal (Northern Hemisphere) summer season (JJA 2022):

Near to above normal temperature is predicted over the ASEAN region. The highest likelihood of above normal temperature is over the southern Maritime Continent and Lao PDR, while near normal temperature is predicted over northern Myanmar, northern and central Viet Nam, and parts of the western Maritime Continent. An equal chance of near to above normal temperature is predicted over southern Myanmar, Thailand, Cambodia, southern Viet Nam, the Philippines, Malaysia, and Brunei Darussalam. [2]

Refer to **Annex A** for reference on what is meant by "above, near, or below normal" in the outlook. For more information on the boreal (Northern Hemisphere) summer monsoon outlook and further updates on the national scale, the relevant NMHSs should be consulted (see **Annex B**).

[1] This is based on the climatology period 1991-2020. However, at the national level, Cambodia is using the 1992-2021 climatology as their new base period.

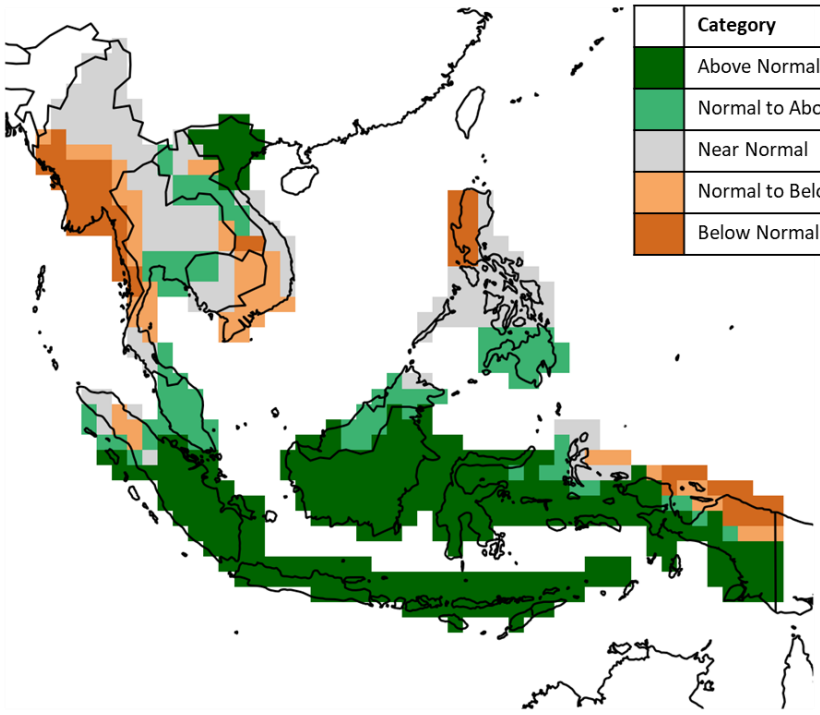
[2] This is based on the climatology period 1991-2020. However, at the national level, Cambodia is using the 1992-2021 climatology as their new base period.

CONSENSUS MAPS FOR JJA 2022

The following maps provide the probabilistic outlooks for JJA 2022 season in terms of tercile categories of “Above Normal” (AN: upper tercile), “Near Normal (NN: middle tercile) and “Below Normal” (BN: lower tercile).

PROBABILISTIC RAINFALL OUTLOOK

ASEANCOF-18 Probabilistic Rainfall Outlook JJA2022

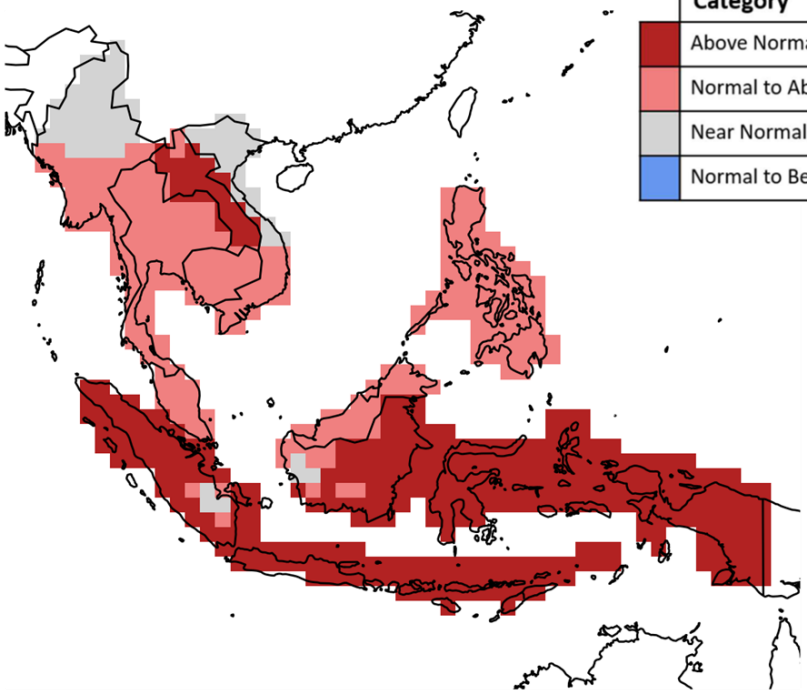


	Category	AN	NN	BN
	Above Normal	50	40	10
	Normal to Above Normal	40	40	20
	Near Normal	30	40	30
	Normal to Below Normal	20	40	40
	Below Normal	10	40	50

PROBABILISTIC TEMPERATURE OUTLOOK

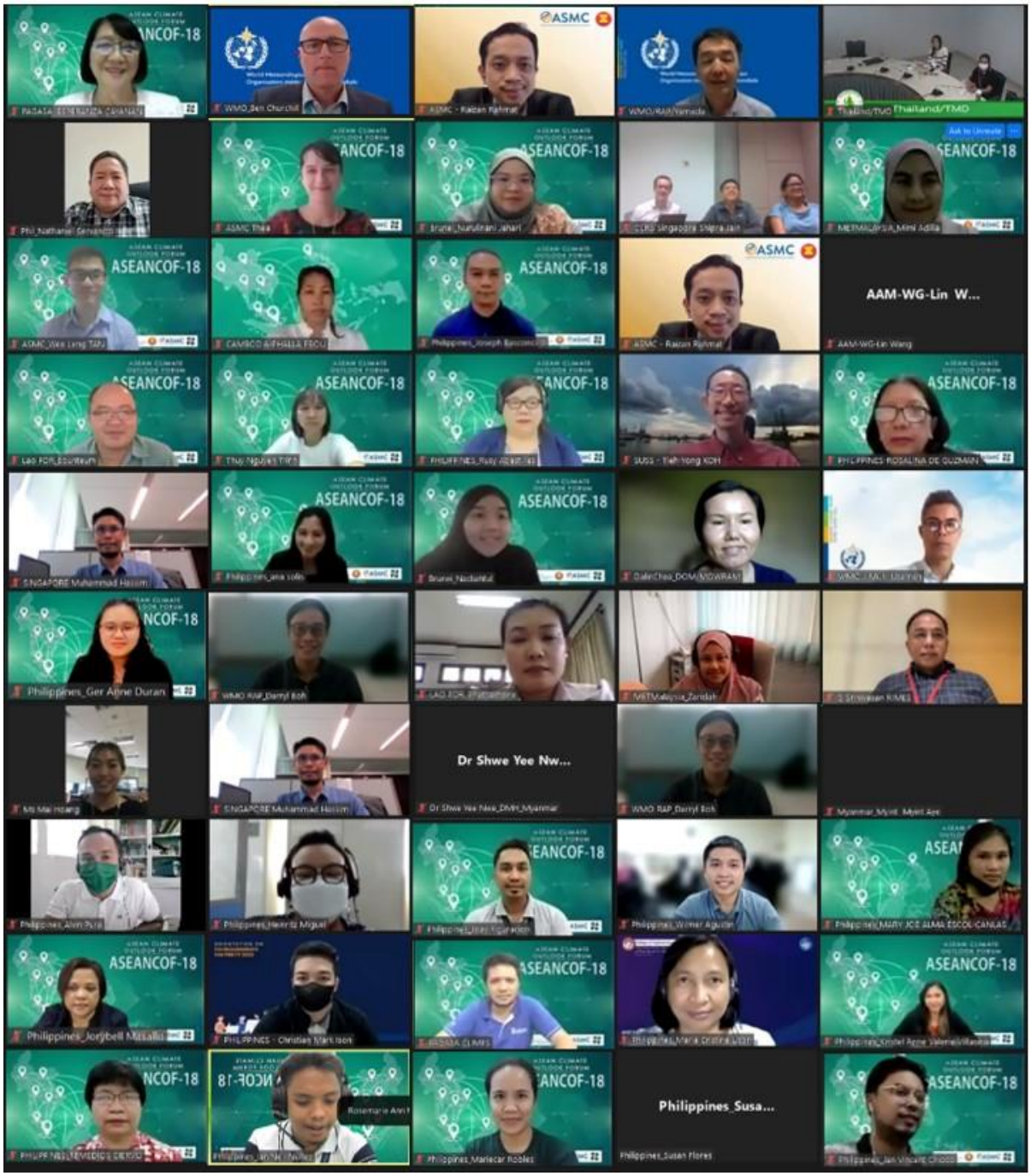
ASEANCOF-18 Probabilistic Temperature Outlook JJA2022

Category	AN	NN	BN
Above Normal	50	40	10
Normal to Above Normal	40	40	20
Near Normal	30	40	30
Normal to Below Normal	20	40	40



ACKNOWLEDGEMENTS

ASEANCOF would like to convey its appreciation to the NMHSs of the ASEAN Member States for sharing their national level forecasts, the GPCs, the Southeast Asia Regional Climate Centre – Network, and other partners of ASEANCOF for sharing their products and expertise, and the World Meteorological Organization Regional Office in Asia and the Southwest Pacific (WMO-RAP) for their continued support of ASEANCOF.



WORLD METEOROLOGICAL ORGANIZATION

ASMC
ASEAN SPECIALISED METEOROLOGICAL CENTRE

Photo of online participants from NMHSs, WMO-RAP, AAM-WG, ASMC and the ASEANCOF Working Group during the first day of ASEANCOF-18.

ANNEX A: RAINFALL AND TEMPERATURE TERCILE CLIMATOLOGIES

The following figures include mean rainfall and temperature and tercile boundary climatology to reference against the consensus outlook. Only a single source of data for each variable is provided: for rainfall CHIRPS (Funk et al. 2014) and for temperature ERA5 (Hersbach et al. 2019). For more representative climatologies, reference should be made also against observational datasets known to better characterize local patterns (e.g. quality-controlled station data from the respective NMHSs).

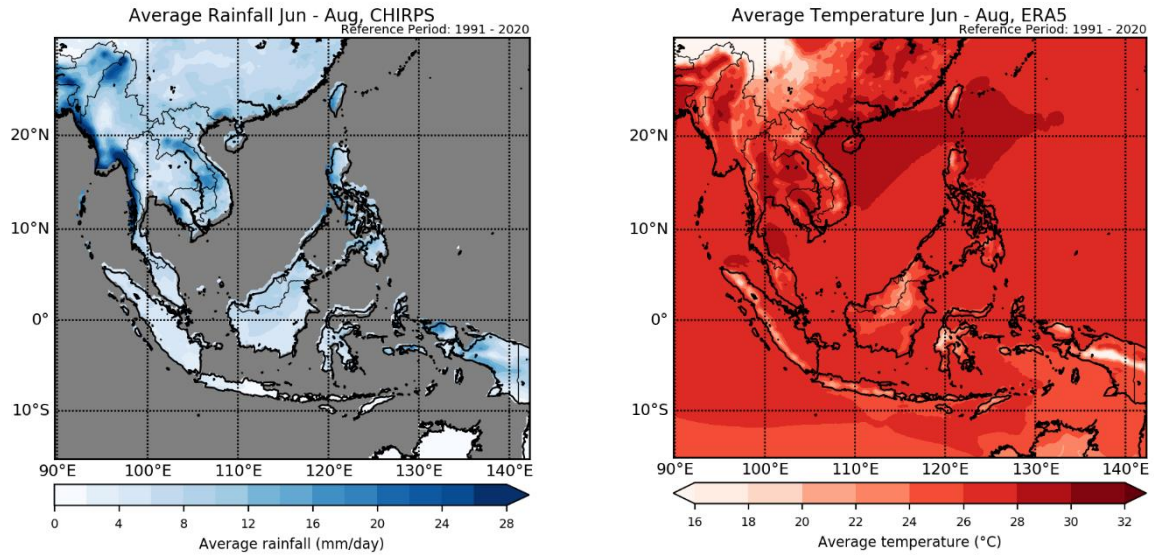


Figure A1: Mean rainfall (left, CHIRPS) and mean temperature (right, ERA5) for JJA for the climatology period 1991-2020.

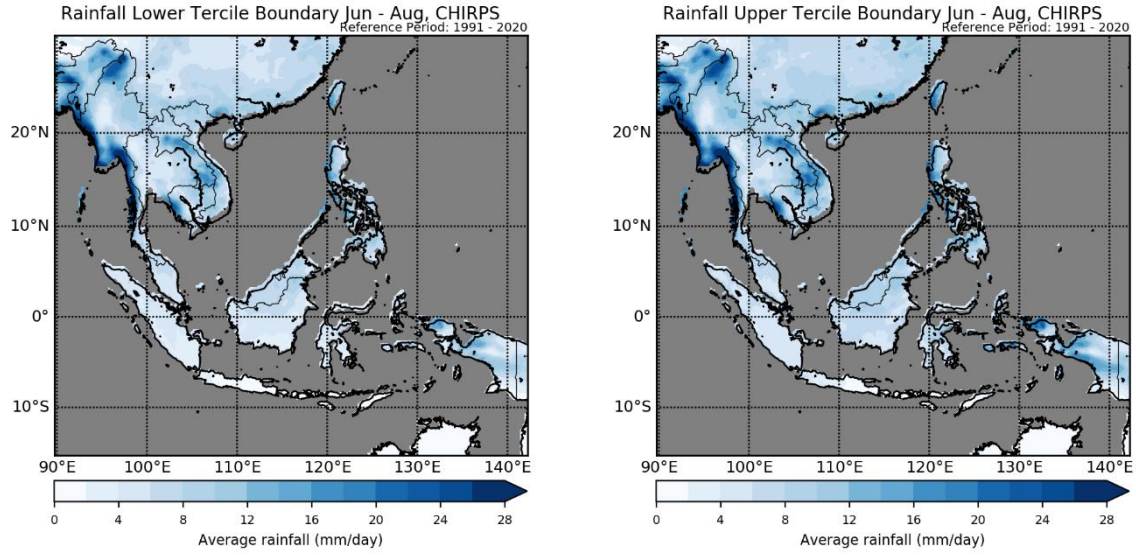


Figure A2: Rainfall climatology of the lower tercile boundary (left) and the upper tercile boundary (right) for JJA from 1991-2020 using CHIRPS.

Annex A: Rainfall and Temperature Tercile Climatologies

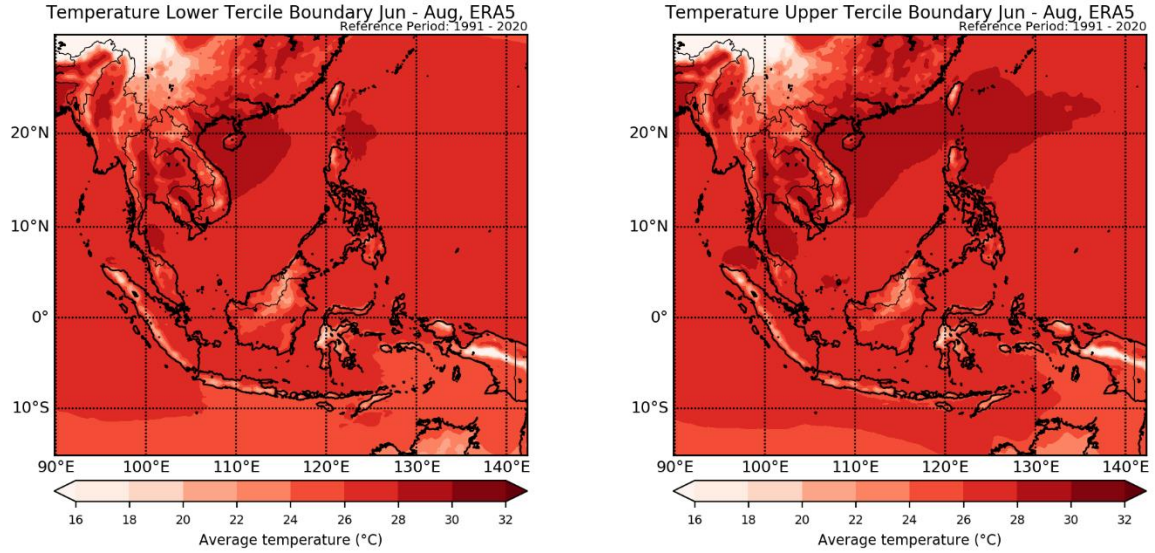


Figure A3: Temperature climatology of the lower tercile boundary (left) and the upper tercile boundary (right) for JJA from 1991-2020 from ERA5.

ANNEX B: NATIONAL METEOROLOGICAL SERVICES' CONTACT INFORMATION

- Brunei Darussalam Meteorological Department (BDMD)

http://www.met.gov.bn/weather

- Department of Meteorology, Cambodia

http://www.cambodiameteo.com/map?menu=3&lang=en

- Badan Meteorologi, Klimatologi dan Geofisika, Indonesia (BMKG)

http://www.bmkg.go.id

- Department of Meteorology and Hydrology (DMH), Lao

http://dmh.monre.gov.la/

- Malaysian Meteorological Department (MET Malaysia)

http://www.met.gov.my/

- Department of Meteorology and Hydrology (DMH), Myanmar

https://www.moezala.gov.mm/

- Philippines Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

http://bagong.pagasa.dost.gov.ph/

- Meteorological Service Singapore Government (MSS)

http://www.weather.gov.sg/home/

- Thai Meteorological Department (TMD)

http://www.tmd.go.th/en/

- National Center for Hydro-Meteorological Forecasting (NCHMF), Vietnam

https://nchmf.gov.vn/KttvsiteE/en-US/2/index.html

ANNEX C: REVIEW OF DECEMBER-JANUARY-FEBRUARY (DJF) 2021/2022 CONSENSUS OUTLOOK

SUMMARY

The rainfall and temperature outlooks were representative of the actual conditions over much of the Southeast Asia. Most parts of the ASEAN region experienced near to above normal rainfall, while only a few areas experienced below normal rainfall .

In November 2021, La Niña conditions were present with cool sea surface temperatures (SSTs) across most of the central and eastern tropical Pacific Ocean. The international climate outlooks predicted weak to moderate La Niña conditions to prevail during DJF 2021/2022. La Niña conditions were then predicted to weaken in boreal spring 2022. In the Indian Ocean, the Indian Ocean Dipole (IOD) was neutral. The consensus from ASEANCOF was that the La Niña conditions were likely to continue during DJF, with the IOD expected to remain neutral.

Based on the assessment as part of ASEANCOF, as well as by the SEA RCC Climate Monitoring Node, and the WMO El Niño/La Niña Updates the DJF 2021/2022 period experienced La Niña conditions and the Indian Ocean Dipole was neutral.

In the sections below, a combination of global gridded data and reviews by NMHSs was used to verify the outlook.

DJF 2021/2022 RAINFALL OUTLOOK

For the upcoming boreal (Northern Hemisphere) winter season (DJF 2021/22):

Over much of the Maritime Continent, near to above normal rainfall is expected. In particular, above normal rainfall is predicted for central parts of the Philippines, while near to above normal rainfall is predicted over Malaysia, Singapore, and Brunei Darussalam.

Over Mainland Southeast Asia, a mix of below to above normal rainfall is predicted. Below to near normal rainfall is predicted over northern Myanmar, northern Lao PDR, and northern Viet Nam. Above normal rainfall is predicted over southern Lao PDR, while near to above normal rainfall is predicted over parts of southern Myanmar, southern Thailand, parts of Cambodia, and southern Viet Nam. Elsewhere in Mainland Southeast Asia, rainfall is predicted to be near normal.

Overall, the regions with an increase in chance of above normal rainfall aligned with the CHIRPS gridded product in **Figure C1** and **Table C1**, although regions where near and near to below normal rainfall tended to be wetter than predicted. Approximately half of the regions (51%, Table C1) with the highest probability of above normal rainfall received above normal

rainfall including parts of Lao PDR, Cambodia, and the Philippines. Most of the regions where near to above normal rainfall predicted received either near normal or above normal rainfall, including parts of Malaysia, Cambodia, Viet Nam, and the Philippines (87%, Table C1). In regions with an increased chance of either near normal or below normal rainfall, more than half of the said regions received above normal rainfall based on CHIRPS (55% where near normal was predicted and 78% for where below to near normal rainfall was predicted, Table C1). However, much of these regions are found over central and northern Mainland Southeast Asia, which typically experiences their dry season during December to February, and therefore can be sensitive to small changes in the amount of rainfall recorded.

Based on the country reviews by NMHSs (Table C2), there was a good agreement between the outlook and the observed values where in some cases a closer agreement than for the gridded dataset. Such closer agreements include Viet Nam, where the NMHS observed near normal rainfall over the northern part of the country and near to above normal rainfall elsewhere. The same situation also applies in Malaysia, where Sarawak recorded near to above normal rainfall based on the NMHS assessment, and Thailand, where the southern part experienced above normal rainfall, while the rest of the country experienced near to above normal rainfall. There were a few differences between the outlook and the country reviews, which include Brunei Darussalam and the central Philippines where below to near normal rainfall was recorded. Both countries observed drier conditions than the CHIRPS dataset.

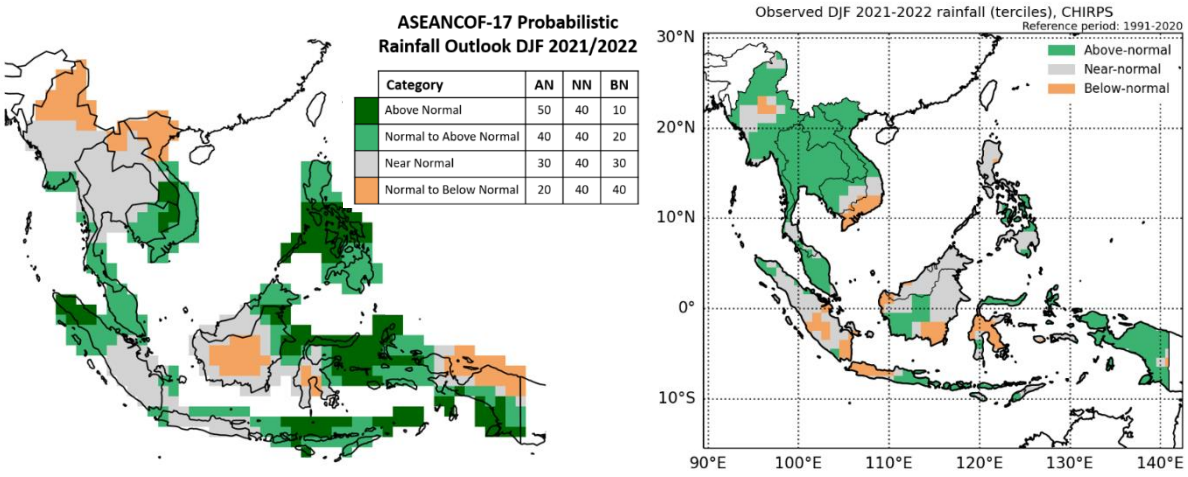


Figure C1: DJF 2021/2022 ASEANCOF outlook (left) observed DJF rainfall in terciles (right, climatology 1991-2020). The rainfall dataset is CHIPRS (Funk et al 2014).

Annex C: Review of DJF 2021/2022 Consensus Outlook

Table C1: Summary of the percentage of grid boxes that observed above, near and below normal rainfall during DJF 2021/2022 using the CHIRPS dataset. The average outlook probability for each of the colours is also shown.

	Above normal (green)		Normal to Above Normal (lightly green)		Near Normal (grey)		Normal to Below Normal (orange)	
	Outlook	Observed	Outlook	Observed	Outlook	Observed	Outlook	Observed
Above normal	50%	51%	40%	44%	30%	55%	20%	78%
Near Normal	40%	47%	40%	43%	40%	25%	40%	15%
Below Normal	10%	2%	20%	12%	30%	20%	40%	7%

Table C2: Observed rainfall based on the national level assessment for DJF 2021/2022. The Most Likely Category from the outlook (MLC), the observed rainfall as noted by the NMHS (obs. tercile) are included. The tercile categories are above normal (AN), near normal (NN), and below normal (BN). Bold texts highlights discrepancies between the most likely category for the outlook and observed rainfall.

Country	Location (- indicates the entire country)	Outlook (MLC*)	NMHS obs. tercile
Brunei	-	**NN-AN (40%)**	**BN-NN**
Cambodia	-	NN-AN (40%)	AN
Malaysia	Sarawak	NN (40%)	NN - AN
	Rest	NN-AN (40%)	NN - AN
Myanmar	Northern	BN-NN (40%)	NN
	Central	NN (40%)	NN
	Southern	NN-AN (40%)	AN
Philippines	Central	**AN (50%)**	**BN-NN**
	Rest	NN-AN (40%)	NN-AN
Singapore	-	NN-AN (40%)	NN
Thailand	Southern	NN-AN (40%)	AN
	Rest	NN (40%)	NN-AN
Viet Nam	Northern	BN-NN (40%)	NN
	Rest	NN-AN (40%)	NN-AN

* MLC: Most Likely Category

DJF 2021/2022 TEMPERATURE OUTLOOK

For the upcoming boreal (Northern Hemisphere) winter season (DJF 2021/22):

Over much of the Maritime Continent, near to above normal temperature is predicted. Near normal temperature is predicted for Brunei Darussalam and northern Philippines, with near to above normal and above normal temperature predicted elsewhere.

For Mainland Southeast Asia, a mix of below to above normal temperatures are predicted. The highest likelihood of below normal temperature is over southern Lao PDR and southern Viet Nam. The highest likelihood of above normal temperature is over central Myanmar, followed by northern Thailand and northern Lao PDR.

Most of the Maritime Continent experienced above normal temperature as depicted in the ERA5 observed temperature data while Mainland Southeast Asia experienced predominantly below and near normal temperature (Figure C2). This was generally in good agreement with the outlook (Table C3). Although based on the ERA5 dataset, below normal temperature covered northern parts of Mainland Southeast Asia when compared to the predicted increase chance over southeastern Mainland Southeast Asia. Moreover, when compared with the observations from the NMHS weather stations (Table C4), Myanmar and northern Viet Nam were closer to near normal, while southern Viet Nam experienced below normal temperature.

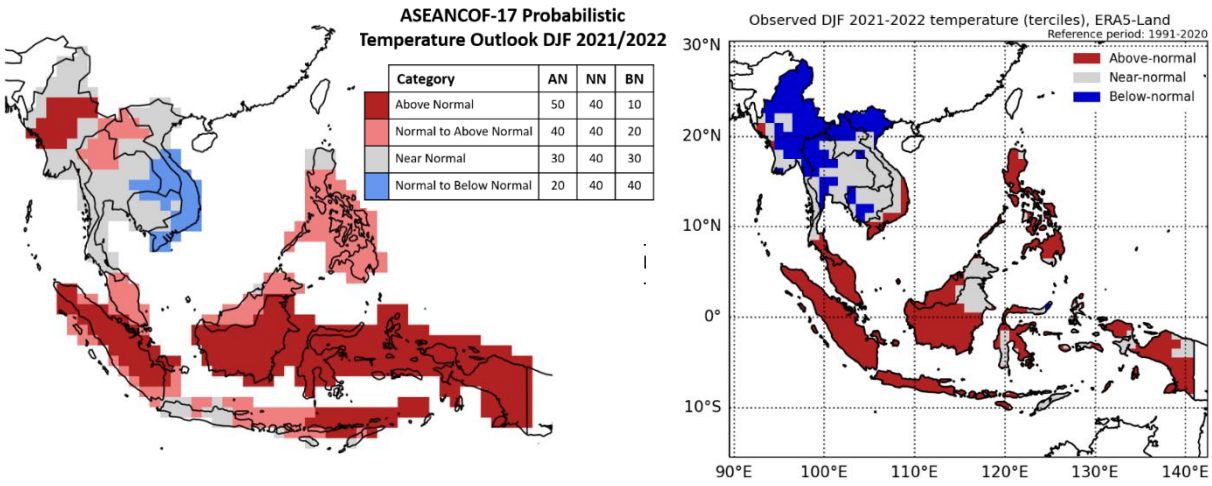


Figure C2: DJF 2021/2022 ASEANCOF outlook (left) observed DJF temperature in terciles (right, climatology 1981-2010). The temperature dataset used is ERA5 reanalysis dataset ((Muñoz Sabater et al. 2019).

Table C3: Summary of the percentage of grid boxes that observed above, near, and below normal temperature during DJF 2021/2022, using the CHIRPS dataset. The average outlook probability for each of the colours is also shown.

	Above Normal (red)		Normal to Above Normal (pink)		Near Normal (grey)		Below to Near Normal (light blue)	
	Outlook	Observed	Outlook	Observed	Outlook	Observed	Outlook	Observed
Above normal	50%	70%	40%	77%	30%	20%	20%	33%
Near Normal	40%	24%	40%	12%	40%	38%	40%	67%
Below Normal	10%	6%	20%	11%	30%	42%	40%	0%

Table C4: Observed temperature based on the national level assessment. The Most Likely Category from the outlook (MLC), the observed temperature as noted by the NMHS (obs. tercile) are included. The tercile categories are above-normal (AN), near-normal (NN), and below-normal (BN). Bold texts highlights discrepancies between the most likely category for the outlook and observed temperature.

Country	Location (- indicates the entire country)	Outlook (MLC*)	NMHS obs. tercile
Brunei	-	NN (40%)	NN-AN
Cambodia	-	NN (40%)	NN
Malaysia	--	NN-AN (40%)	NN-AN
Myanmar	Central	**AN (50%)**	**NN**
	Rest	NN-AN (40%)	NN
Philippines	Northern	NN (40%)	NN-AN
	Rest	NN-AN (40%)	NN-AN
Singapore	-	NN-AN (40%)	AN
Thailand	Northwest	NN-AN (40%)	NN
	Rest	NN (40%)	NN
Viet Nam	Northern	NN (40%)	NN-AN
	Rest	BN-NN (40%)	BN- NN

SIGNIFICANT EVENTS IN DJF 2021/22

Typhoon Rai (local name: Odette) entered the Philippine Area of Responsibility (PAR), intensified into a Typhoon category and made nine (9) landfalls while traversing the central Philippines (i.e. Visayas, Northern Mindanao, and Palawan). Typhoon Rai brought severe winds, heavy to intense rainfall, massive flooding, storm surges, and rain-induced landslides, which considerably affected several areas in the central and southern part of the Philippines.

Myanmar sets new extreme rainfall records in its four (4) stations due to the influence of low pressure area, deep depression, the western disturbances, the convergence of warm air from the Andaman Sea, Bay of Bengal, cold air from China high pressure system, and the easterly waves.

Multiple flooding events were reported in Peninsular Malaysia due to continuous heavy rain. Major floods also occurred in several states in Peninsular Malaysia on 16 to 19 December 2021 due to the monsoon surge and tropical depressions TD29 that crossed the central part of the Peninsular Malaysia resulting to the evacuation of thousands of people and many casualties.

In Brunei Darussalam, the highest daily rainfall recorded during was on the 26th January 2022 with 140.9 mm, which is nearly half (~45%) of the normal total rainfall value for January.

REFERENCES

CHIRPS: Funk et al. 2014: A quasi-global precipitation time series for drought monitoring: U.S. Geological Survey Data Series 832, 4 p., doi:110.3133/ds832.

ERA5: Hersbach et al. 2019: Global reanalysis: goodbye ERA-Interim, hello ERA5. ECMWF Newsletter, doi:10.21957/vf291hehd7.

Muñoz Sabater, J., (2019): ERA5-Land monthly averaged data from 1981 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). (Accessed on < 01-Nov-2021 >), 10.24381/cds.68d2bb3