

# Monthly Climate Bulletin

May 2024



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Photo Credit: Molly Powers (SPC) Samoa Tide Gauge





# CONTENTS

Summary	2
El Niño–Southern Oscillation	3
Madden–Julian Oscillation	4
Wind	5
Cloud and Rainfall	6
Oceanic Conditions	9
Mean Sea Level Pressure	13
Model Outlooks	14
Cyclones	17
Further Information	18

## Issued 11 June 2024

- The El Niño Southern Oscillation is currently neutral.
- The Madden-Julian Oscillation (MJO) was over the Indian Ocean in late May and is expected to strengthen over the eastern Pacific in the coming week.
- The central region of the South Pacific Convergence Zone (SPCZ) was northeast over the PNG Islands, Solomon Islands, and Tuvalu over the 30 days to 7 June 2024.
- Sea surface temperatures (SSTs) for May 2024 were warmer than average across most of the tropical Pacific Ocean west of 130 °W.
- The Coral bleaching Outlook to 30 June shows 'Alert Level 2' over parts of southern Palau, northern PNG mainland and Islands, northern Tuvalu, and Kiribati (southern Phoenix Is.).
- For June to August 2024 the models agree above normal rainfall is likely or very likely for southern Palau, central RMI, northern PNG, northern Solomon Islands, northern Fiji, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern Cook Islands, and western and northern French Polynesia. In addition, the models agree that below normal rainfall is likely or very likely for Guam, CNMI, Nauru, Kiribati (northern Gilbert and Line Is.), parts of New Caledonia, southern Fiji, eastern French Polynesia, and Pitcairn Islands.
- The ACCESS-S weekly tropical cyclone outlook shows significantly increased risk over Palau, FSM, Guam, CNMI, Philippines and Japan for the week from 14 to 27 June.

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# EL NIÑO–SOUTHERN OSCILLATION

## Neutral ENSO conditions continue

Click link to access [Climate Driver Update issued on 28 May 2024](#)

The El Niño Southern Oscillation is currently neutral. However, the Bureau's ENSO Outlook is at La Niña Watch, due to some early signs that an event might form in the Pacific Ocean later in 2024. A La Niña Watch does not guarantee that a La Niña will develop. There is about an equal chance of neutral ENSO conditions in the same outlook period.

Sea surface temperatures (SSTs) in the central Pacific have been steadily cooling since December 2023. This surface cooling is supported by a significant amount of sub-surface cooling in the central and eastern Pacific. Recent cloud and surface pressure patterns are ENSO-neutral.

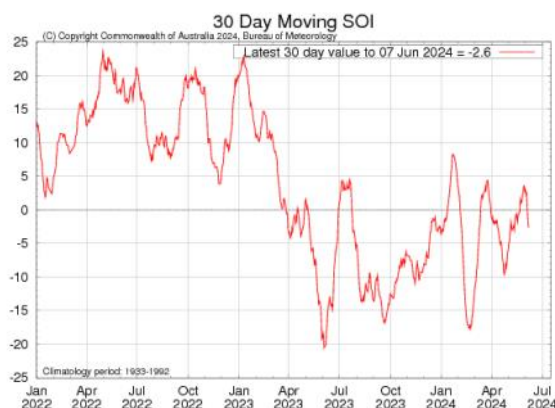
Climate models suggest that SSTs in the central tropical Pacific are likely to continue to cool over the coming months. Four of seven models suggest SSTs are likely to remain at neutral ENSO levels, with the remaining three models showing SSTs cooling to La Niña levels from August. It is important to emphasise that early signs of La Niña are most relevant to the climate of the tropical Pacific.

Global sea surface temperatures (SSTs) have been the warmest on record for each month between April 2023 and April 2024, with May 2024 SSTs on track to exceed May 2023. The global pattern of warmth is affecting the typical historical global pattern of sea surface temperatures associated with ENSO and IOD. As the current global ocean conditions have not been observed before, historical comparisons based on past ENSO or IOD events may not be reliable.

The Indian Ocean Dipole (IOD) is currently neutral. The most recent 4 weeks have seen the IOD index within neutral thresholds, with the latest week just below the positive IOD threshold (+0.40 °C). Predictability of the IOD is low at this time of year.

The Southern Annular Mode (SAM) is currently negative (as at 25 May). Forecasts indicate the index is expected to remain negative during the first two weeks of June.

The 30-, 60- and 90-day Southern Oscillation Index (SOI) values for the period ending 26 May 2024 were +1.0, -3.0 and -1.0, respectively. The SOI reflects neutral ENSO conditions.



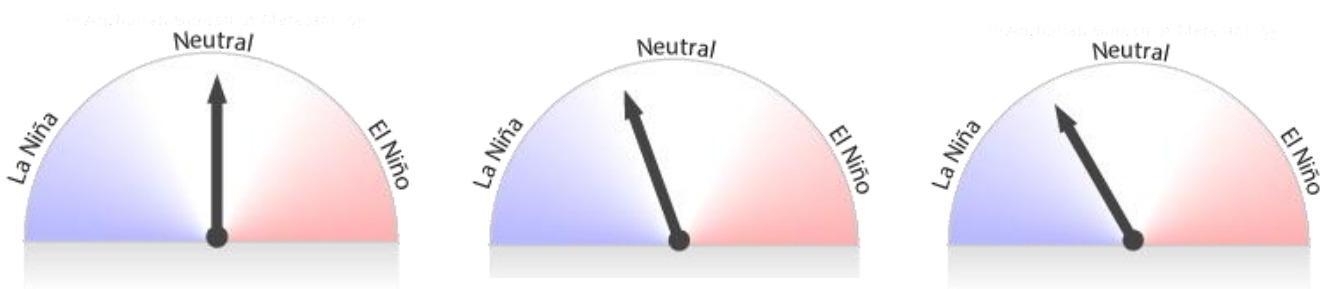


# EL NIÑO–SOUTHERN OSCILLATION

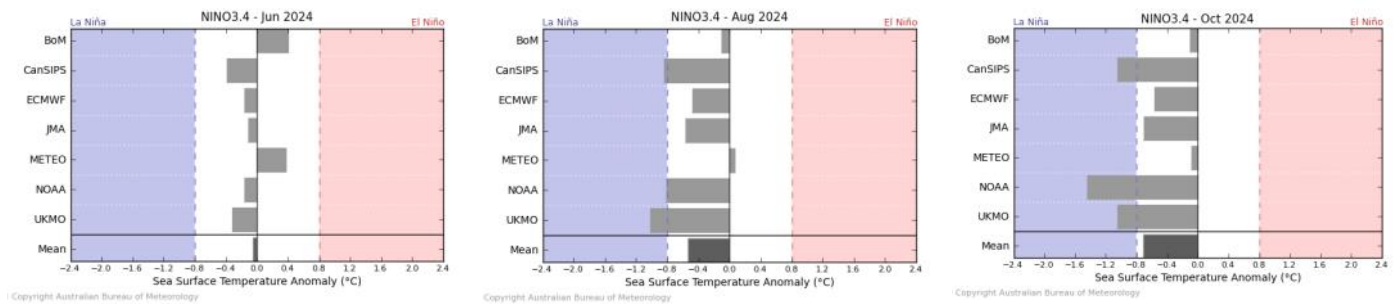
Neutral ENSO conditions continue

Click link to access [Climate Driver Update issued on 28 May 2024](#)

## Bureau of Meteorology NINO3.4 ENSO Model Outlooks for June, August and October



## Bureau of Meteorology NINO3.4 International Model Outlooks



Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

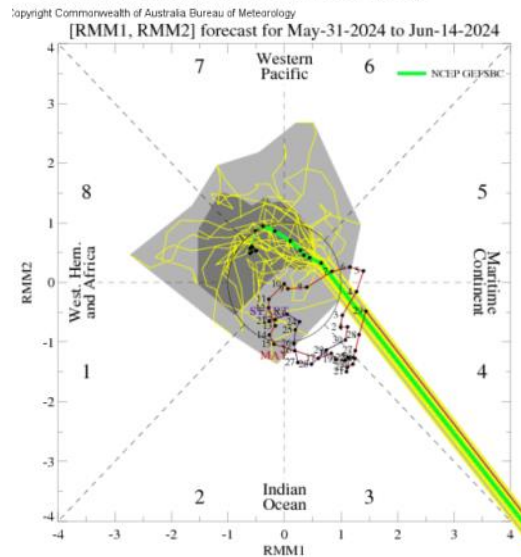
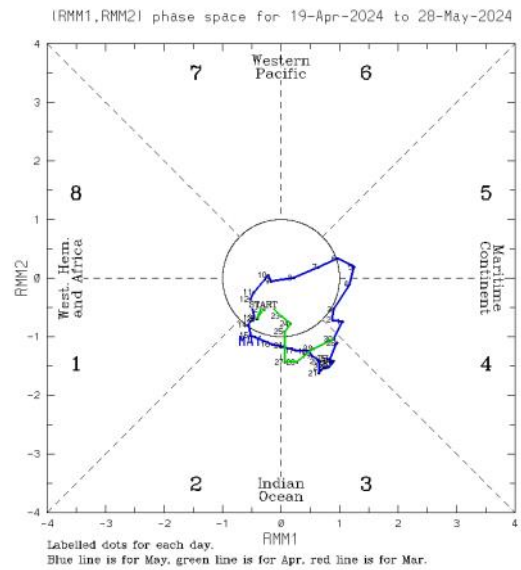


# MADDEN–JULIAN OSCILLATION

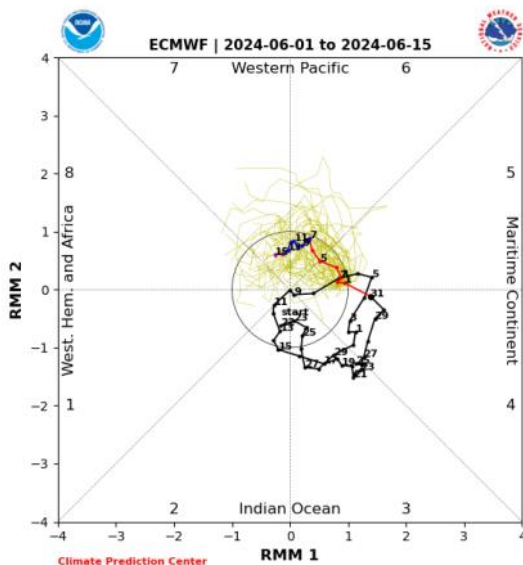
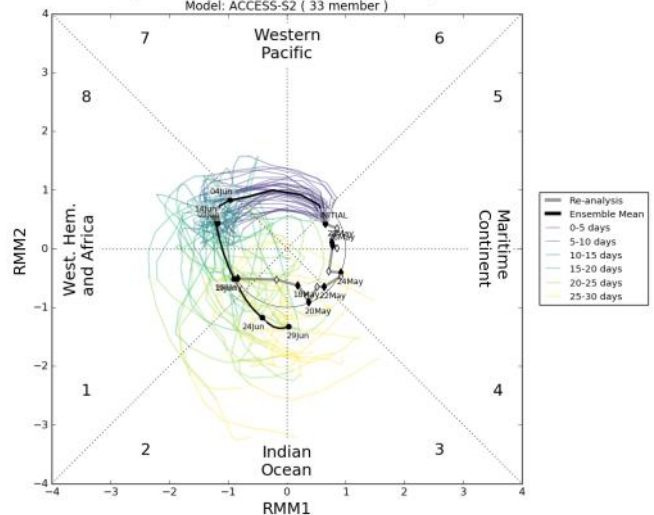
Click link to access [Tropical Climate Update](#) [Issued on Tuesday 04 June 2024]

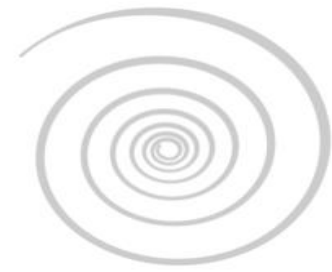
The Madden Julian Oscillation (MJO) is currently weak and is expected to remain weak for the coming fortnight. A weak MJO has little impact on tropical Pacific and Australian rainfall.

This is an abbreviated version of the Tropical Climate Update. Click on the [Weekly Tropical Update](#) for more information .



MJO Index Forecast initialised: 30 May 2024  
Model: ACCESS-S2 ( 33 member )



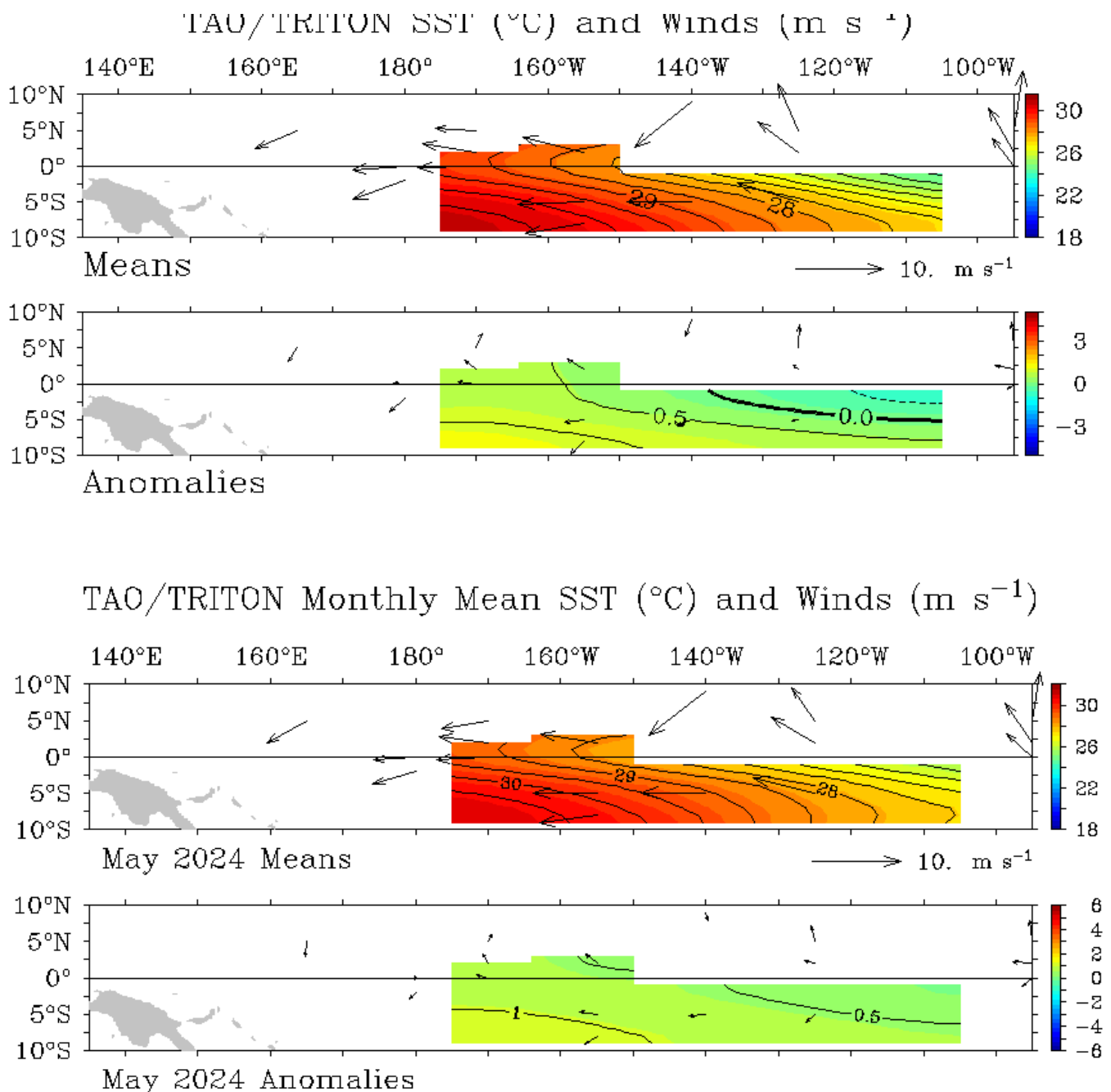


# WIND

Click link to access [Wind plots link](#)

During May, the trade winds were generally close to normal over the equatorial western Pacific with some stronger than normal trade winds over the equatorial eastern Pacific. For the five days ending 30 May 2024, the trade winds were generally a little stronger than normal over most of the near-equatorial Pacific.

During El Niño events there is a sustained weakening, or even reversal, of the trade winds across much of the tropical Pacific, while during La Niña, there is a sustained strengthening of the trade winds.



# CLOUD AND RAINFALL

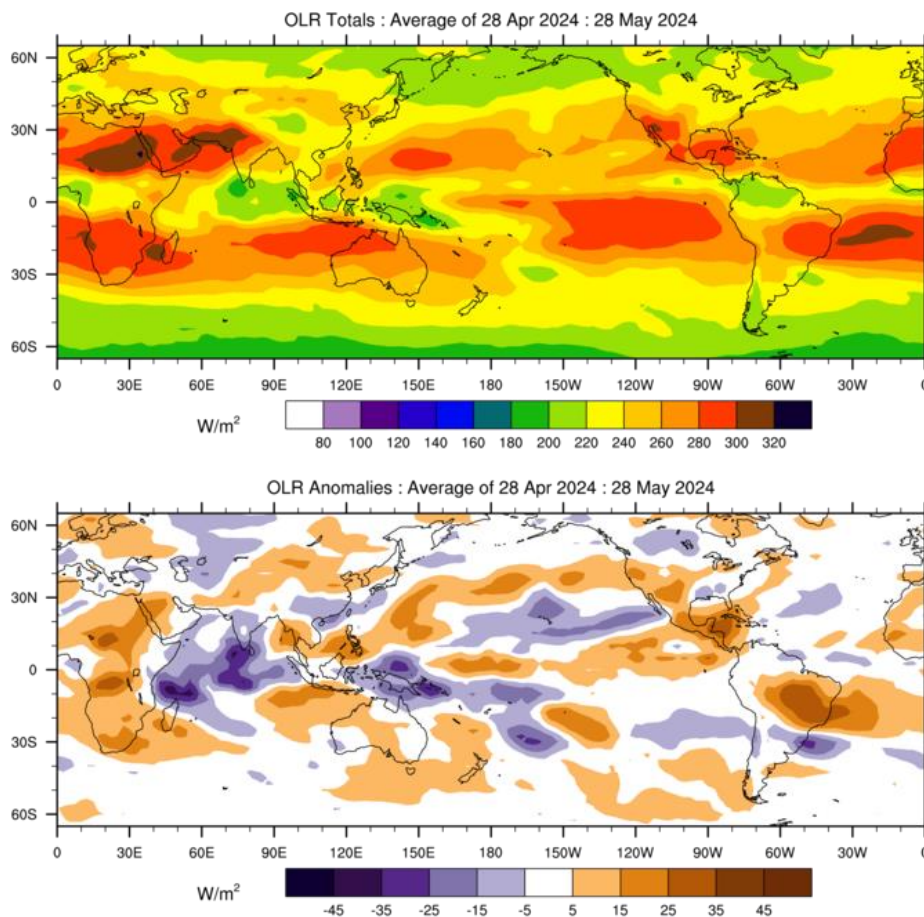
Click link to access [OLR](#)



The May 30-day OLR anomaly map shows a large region of low OLR (increased convection) that stretched east-southeastwards from PNG's Islands in the west, to northern Cook Islands in the east. This line of enhanced cloud cover can be used to estimate the position of the South Pacific Convergence Zone (SPCZ), which was shifted northeast over PNG Islands. Another area of low OLR (likely increased convection) stretched from Samoa, Niue and Tonga. Areas of high OLR (decreased convection) were evident over Palau, Guam, CNMI, Nauru, and Kiribati in the northern hemisphere. In the southern hemisphere, anomalously high OLR stretched southwards from New Caledonia to New Zealand, and another region of high OLR over French Polynesia.

Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre ( $W/m^2$ ) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in  $W/m^2$ . In the bottom panel, negative values (blue shading) represent above normal cloudiness while positive values (brown shading) represent below normal cloudiness.

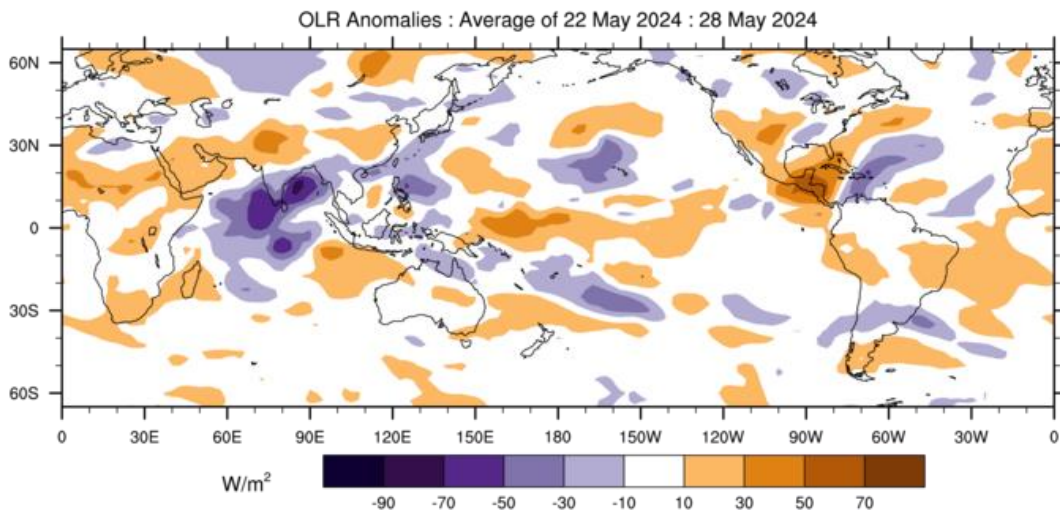
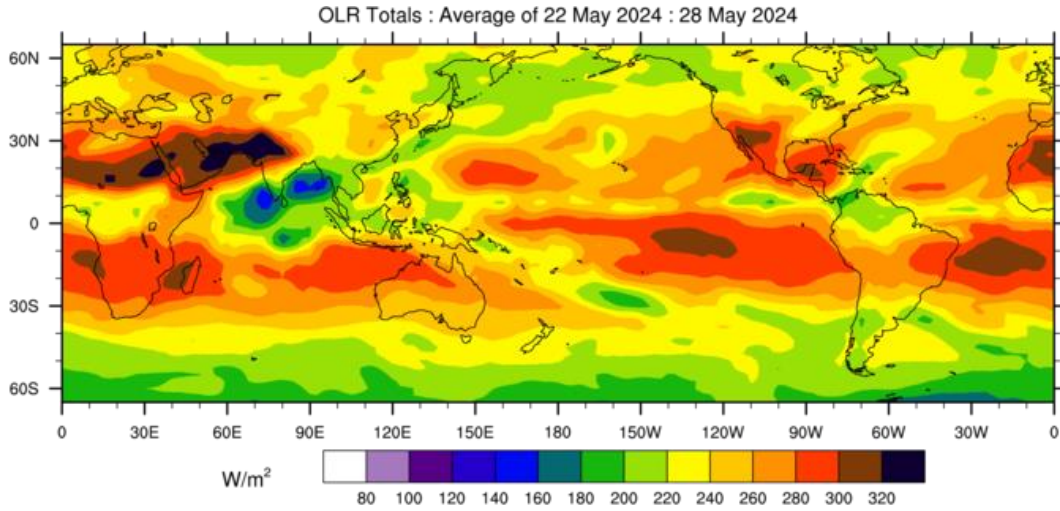
## OLR Total and Anomalies, 30 Day OLR



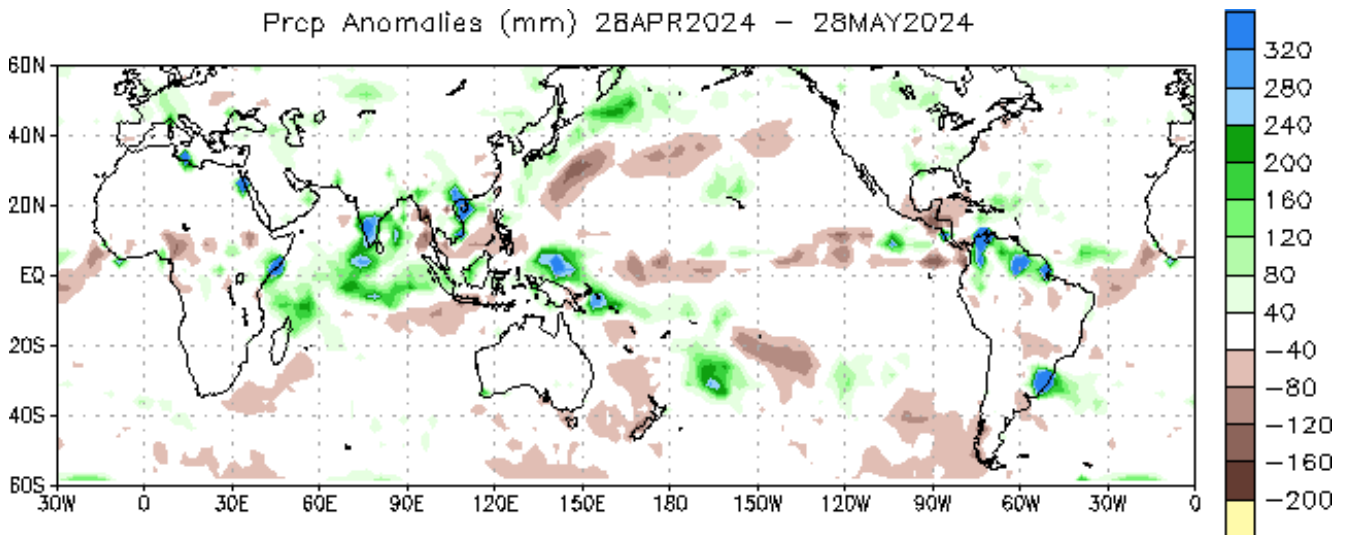
(C) Copyright Commonwealth of Australia 2024. Bureau of Meteorology



# OLR Total and Anomalies, 7 Day OLR

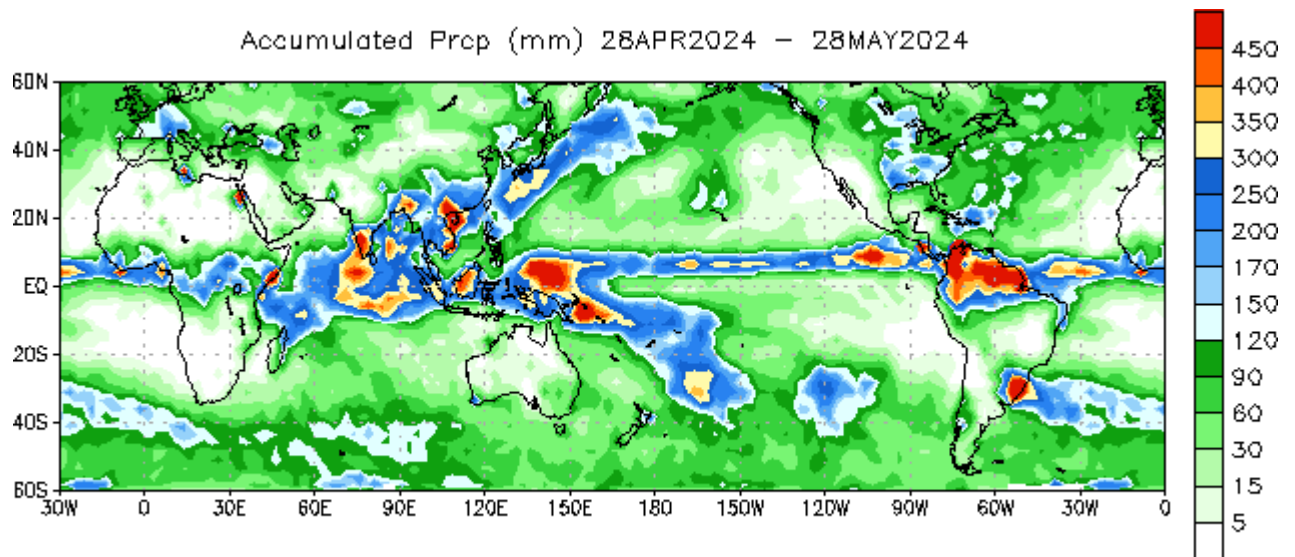


(C) Copyright Commonwealth of Australia 2024. Bureau of Meteorology

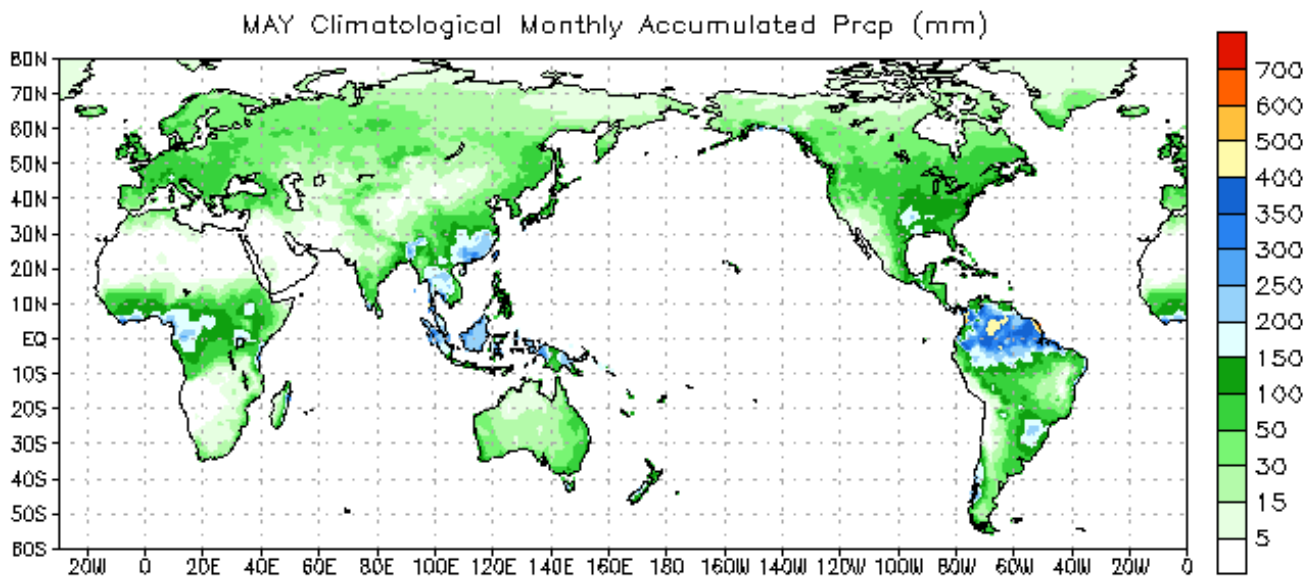


Data Source: NCEP CMAP Precipitation  
Climatology (1991-2020)

## 30-Day Rainfall Accumulated



Data Source: NCEP CMAP Precipitation



Data Source: CPC Unified (gauge-based) Precipitation  
Climatology (1979–1995)

NOAA Climate Prediction Centre - NCEP CMAP precipitation:

[https://ww.cpc.ncep.noaa.gov/products/Global\\_Monsoons/Global-Monsoon.shtml](https://ww.cpc.ncep.noaa.gov/products/Global_Monsoons/Global-Monsoon.shtml)

# OCEAN CONDITIONS

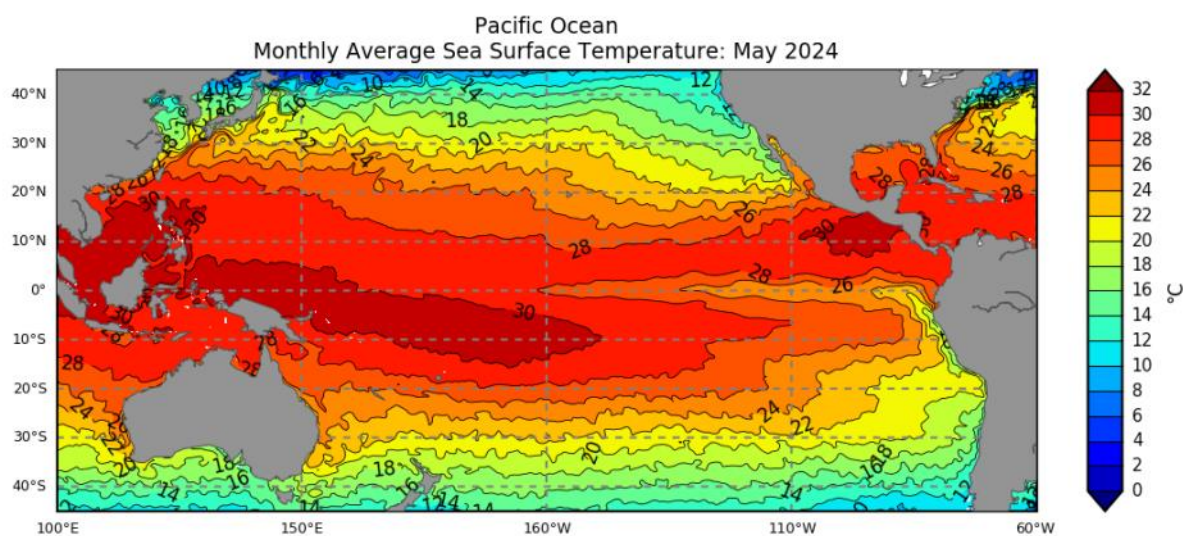
## SEA SURFACE TEMPERATURE



Click link to access [Pacific Community COSPPac Ocean Portal](#)

Sea surface temperatures (SSTs) for May 2024 were warmer than average across most of the tropical Pacific Ocean west of 130 °W. Between 20°S and equator, SST anomalies were more than 1.0 °C warmer than average in most of the central and western Pacific Ocean. The extent and magnitude of warm anomalies across the equatorial Pacific has decreased compared to April 2024, reflecting the decay of El Niño to neutral El Niño-Southern Oscillation (ENSO) conditions.

Highest-on-record May SSTs occurred in southern Palau, extending eastwards over northern PNG's EEZ, southern Nauru, parts of Kiribati (southern Gilbert, and southern Phoenix), northern Solomon Islands, northern Fiji, northern Tonga, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern Niue, and central and northern Cook Islands. The SSTs in decile 10 (very much above average) stretched east-southeastwards from PNG to northern half of Fiji, to northern French Polynesia, and from southern Nauru to Kiribati (most of Gilbert, Phoenix and southern Line Islands). Another band stretched from southern Palau, to eastern FSM, to, central RMI. Above average (8-9) decile were observed for majority of the Pacific Island Countries, spanning east-south-eastward from northern Palau, western FSM, northern RMI, southern Solomon Islands, central Vanuatu to central French Polynesia. Average SSTs (4-7) for May were observed in northern RMI, southeast PNG, New Caledonia, southern Vanuatu, southern Fiji, southern Tonga, southern Cook Islands and southern French Polynesia. Patches of decile 2-3 (below average) were observed in southeastern New Caledonia, southern Vanuatu, south-eastern Fiji, and southern French Polynesia.



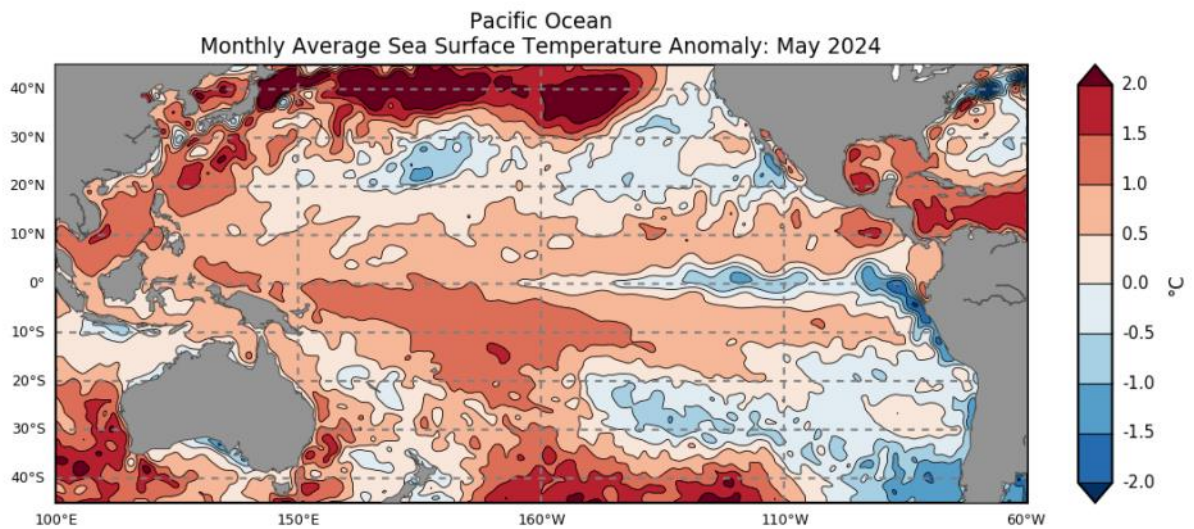


# OCEAN CONDITIONS

Click link to access [SEA SURFACE TEMPERATURE](#)

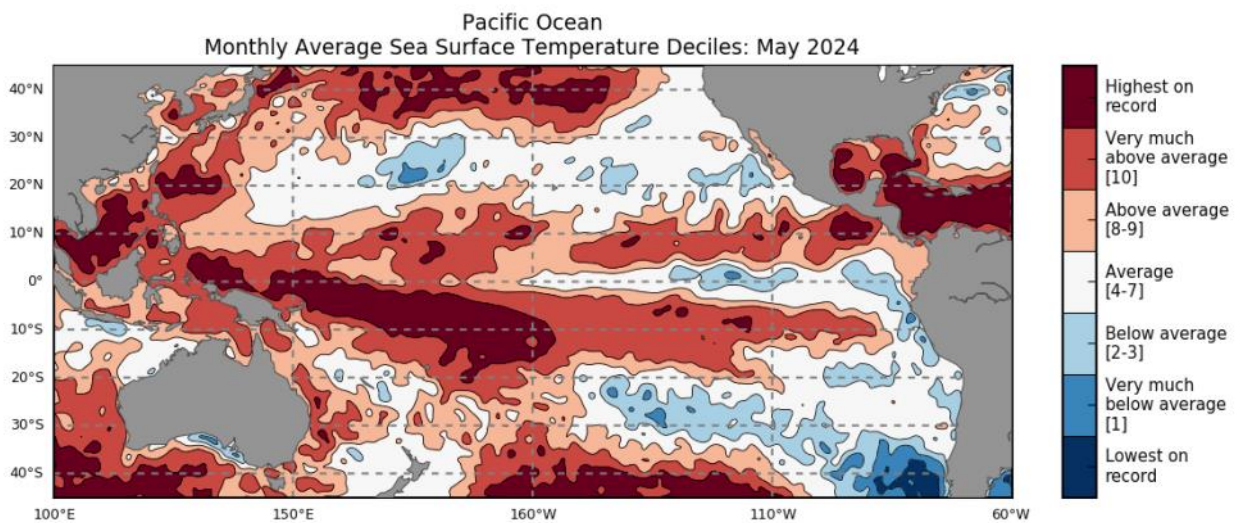


## Anomalous Sea Surface Temperature



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Australian Bureau of Meteorology, COSPPac

Reynolds SST



©Commonwealth of Australia 2024  
Australian Bureau of Meteorology, COSPPac

Reynolds SST

# OCEAN CONDITIONS

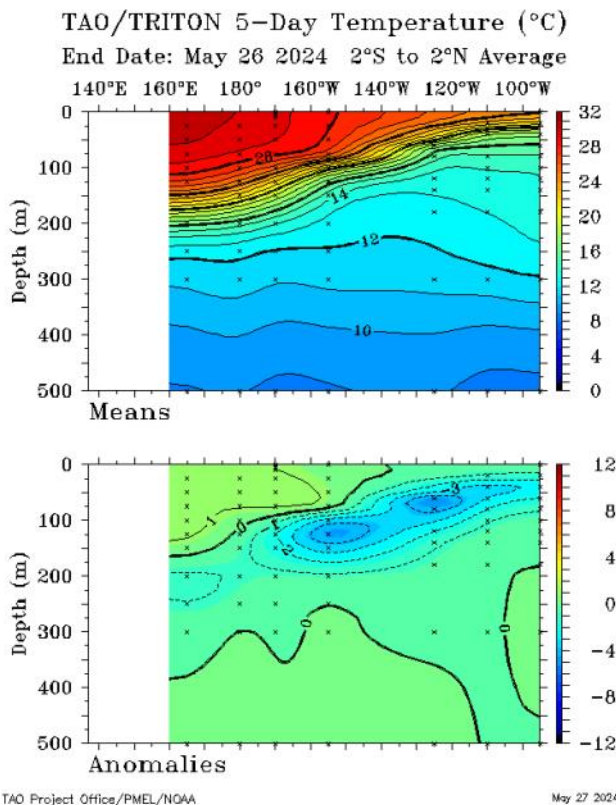
## SUB SURFACE



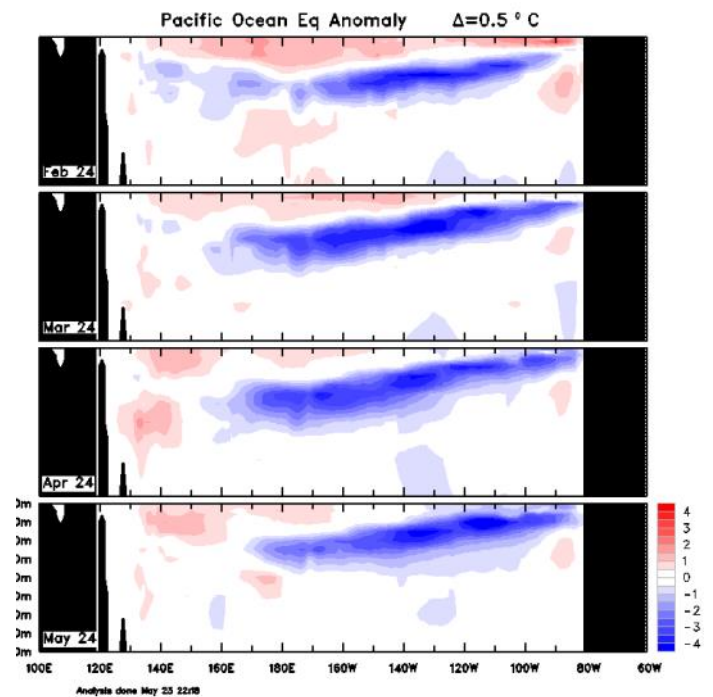
The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 23 May 2024) shows patches of weak warm anomalies of up to 1.5 °C warmer than average across the top 50 m to 100 m of the central and western equatorial Pacific during May, which have decreased in magnitude and extent compared to April. In the central Pacific, cool anomalies are present below this shallow layer. These cool anomalies are more than 3.5 °C cooler than average eastwards of 140 °W and rise eastwards to the top 50 to 100m of the eastern Pacific where anomalies are up to 4 °C cooler than average.

The depth and magnitude of warm anomalies has significantly decreased over the February to May period. The magnitude and extent of cool anomalies has also increased and has spread eastwards over the February to May period. The presence of a substantial layer of cooler than average waters near the surface suggests some cooling of the surface is likely over the next few months.

**Weekly Temperatures Mean and Anomalies**



**Monthly Temperatures Anomalies**



Bureau of Meteorology Sea Temperature Analysis: <http://www.bom.gov.au/marine/sst.shtml>

TAO/TRITON Data Display: <http://www.pmel.noaa.gov/tao/jsdisplay/>



# OCEAN CONDITIONS

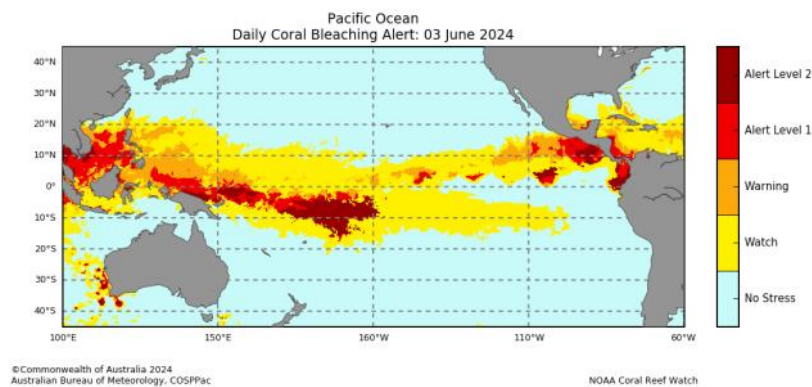
## CORAL BLEACHING



The daily Coral Bleaching Alert status for 03 June 2024 shows an area of 'Alert Level 2' over parts of northern PNG's mainland, northeastern PNG's EEZ, most of Tuvalu, Tokelau, Kiribati (southern Phoenix Islands), northern Wallis and Futuna, Samoa, American Samoa, and northern Cook Islands. 'Alert Level 1' over parts of southern Palau, northern PNG, northern Solomon Islands, southern Nauru, western Tuvalu, and Kiribati (southernmost Gilbert and northern Phoenix Is.). 'Warning' status over northern Palau, western and southern FSM, Nauru, and Kiribati (southern Gilbert Is.). 'Watch' or 'No stress' for the rest of the countries. The four-week Coral Bleaching Outlook to 30 June shows 'Alert Level 2' over parts of southern Palau, northern PNG mainland and Islands, northern Tuvalu, and Kiribati (southern Phoenix Is.). 'Alert Level 1' rating stretches southeastwards from central Palau, southern FSM, northern PNG, northern Solomon Islands' EEZ, Nauru, and Kiribati (southern Gilbert Is.). 'Warning' extends from northern Palau, central FSM, southern RMI, northern Nauru and Kiribati (northern Gilbert). 'Watch' or 'No Stress' over the rest of the countries.

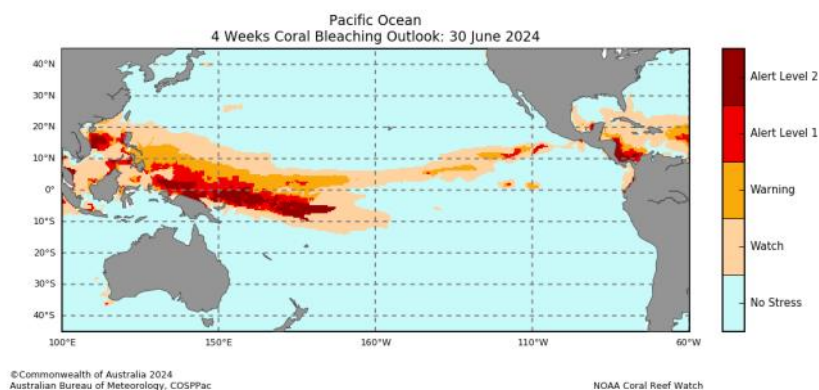
### Daily Coral Bleaching Alert

(Source: [Pacific Community COSPPac Ocean Portal Coral Bleaching](#))



### 4 Weeks Coral Bleaching Outlook

(Source: [Pacific Community COSPPac Ocean Portal](#))



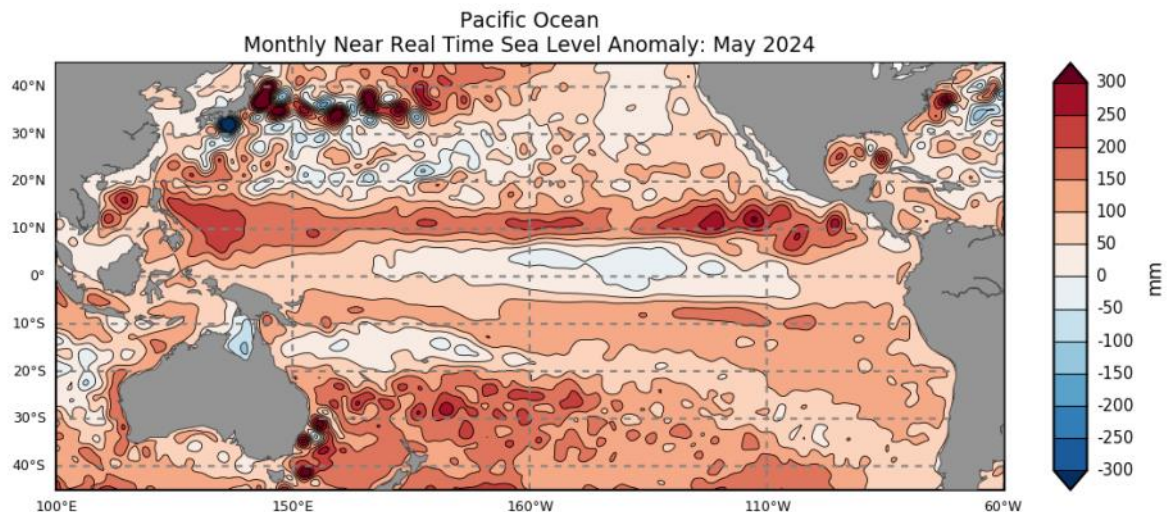
# OCEAN CONDITIONS

## OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea levels observed in May were above normal over most COSPPac countries. Patches of anomalies from +200 to +300 mm were observed along the southeastern Australia coast, and southern New Caledonia's EEZ. Anomalies of up to +250 were observed over Palau and FSM, with patches over parts of southern Fiji, southern Tonga, and southern Cook Islands. However, near-normal anomalies southern part of Marshall Islands, Nauru and Kiribati Islands (northern half of Gilbert islands, northern Phoenix Islands, and northern half of Line Islands), southern PNG, southern Solomon Islands, most of Vanuatu, northern half of Fiji, northern Tonga, northern Niue, and part of central Cook Islands and patches over French Polynesia. The rest of the region were observed with anomalies between +50 and +100mm.

### Monthly Sea Level Anomalies

Source: [Pacific Community COSPPac Ocean Portal](#)



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Australian Bureau of Meteorology, COSPPac

AVISO Ssalto/Duacs SLA

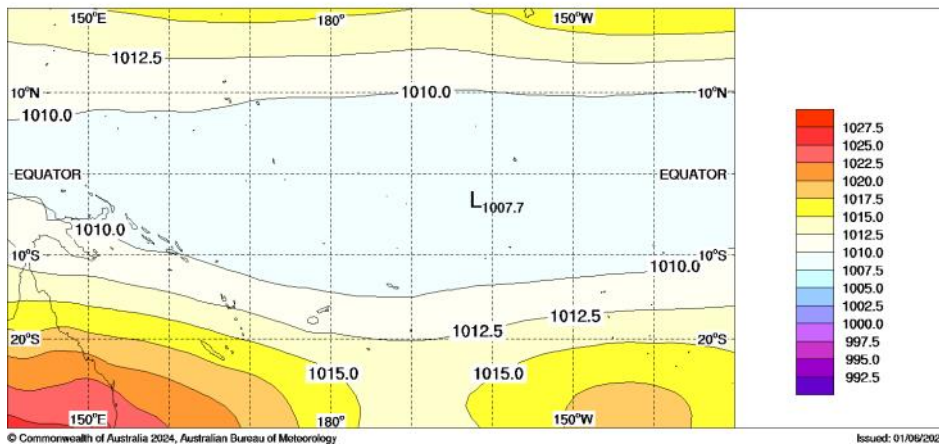
# MEAN SEA LEVEL PRESSURE

The May mean sea level pressure (MSLP) anomaly map displays negative anomalies of 1 hPa or greater over the tropical Pacific east of 175 °E, and positive anomalies of 1 hPa or greater over Australia to New Caledonia, and south of French Polynesia.

Areas of above (below) average MSLP usually coincide with areas of suppressed (enhanced) convection and rain throughout the month.

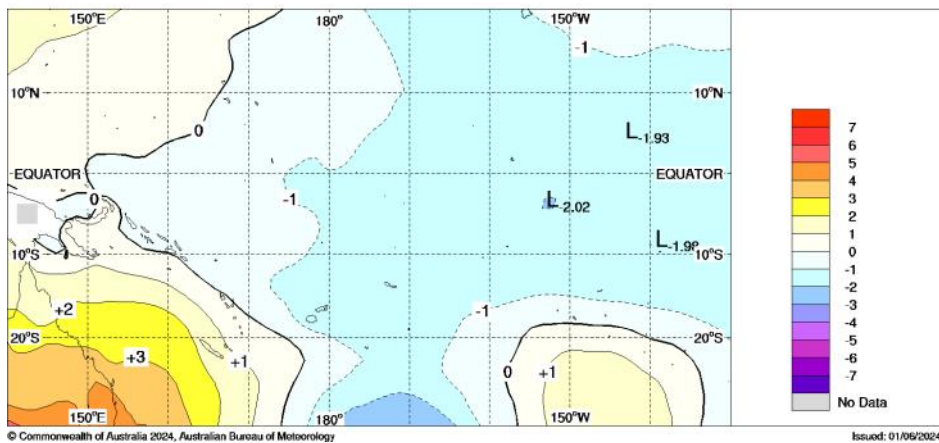
## Mean

MSLP 2.5X2.5 ACCESS OP. ANAL. (hPa) 20240501 0000 20240531 0000



## Anomalous

MSLP 2.5X2.5 ACCESS OP. ANAL.-NCEP2 (hPa) 20240501 0000 20240531 0000



Bureau of Meteorology South Pacific Circulation Patterns: <http://www.bom.gov.au/cgi-bin/climate/cmb.cgi?variable=mslp&area=spac&map=anomaly&time=latest>

# SEASONAL RAINFALL OUTLOOK

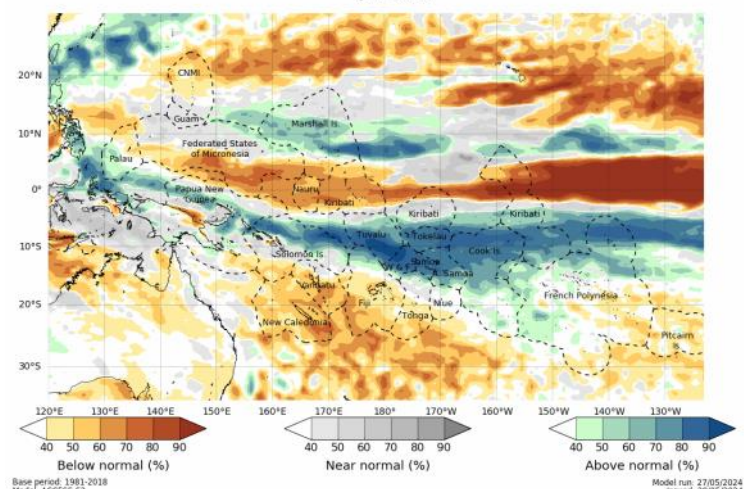
June—August 2024



The ACCESS-S model forecast for June 2024, shows above normal rainfall is likely or very likely for southern Palau, central RMI, northern and eastern PNG, northern Solomon Islands, Kiribati (far southwest Gilbert, and southern Line Islands), northern Fiji, far northern Tonga, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, most of Cook Islands, and western and northern French Polynesia. Below normal rainfall is likely or very likely for northern Palau, CNMI, southern FSM, southern most RMI, northern mainland PNG, southern most Solomon Islands, New Caledonia, most of Vanuatu, most of Fiji, southern Tonga, southern in Niue, Nauru, Kiribati (Gilbert, northern most Phoenix and central Line Islands), eastern French Polynesia, and Pitcairn Islands.

The ACCESS-S three-month rainfall outlook (June to August 2024) is very similar to the May outlook, but with the below normal rainfall region in the southern hemisphere extending only from New Caledonia to western Fiji and Guam in the northern hemisphere. The above normal rainfall region cover most of Palau and the extension to the southeast is much stronger compare to the June Outlook.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for June to August 2024 is very similar to the ACCESS-S outlook, but with a stronger equatorial dry signal from Nauru to Kiribati (Gilbert and northern Phoenix Is.).

The APEC Climate Centre multi-model outlook (June to August 2024) is similar to both the ACCESS-S and the Copernicus model.

For June to August 2024 the models agree that above normal rainfall is likely or very likely for southern Palau, central RMI, northern PNG, northern Solomon Islands, northern Fiji, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern Cook Islands, and western and northern French Polynesia. In addition, the models agree that below normal rainfall is likely or very likely for Guam, CNMI, Nauru, Kiribati (northern Gilbert and Line Is.), parts of New Caledonia, southern Fiji, eastern French Polynesia, and Pitcairn Islands.

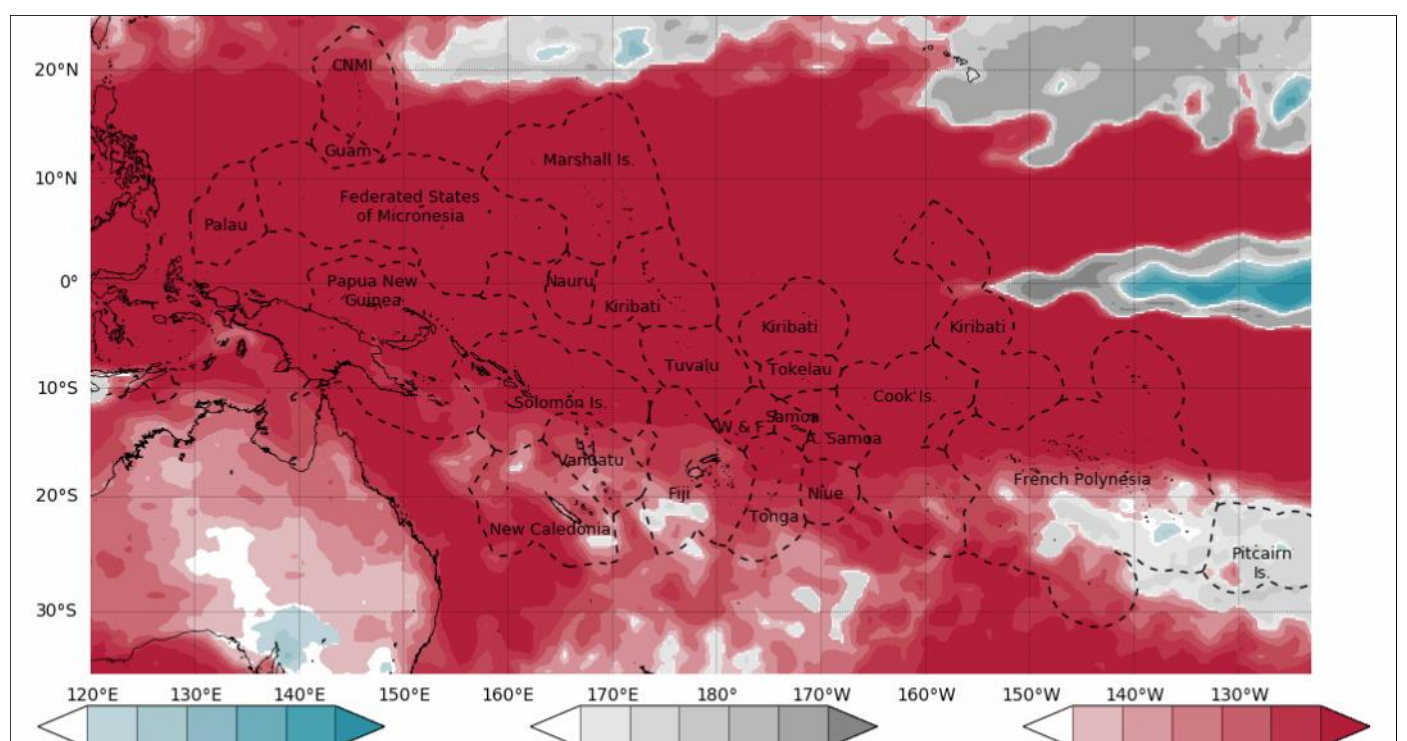
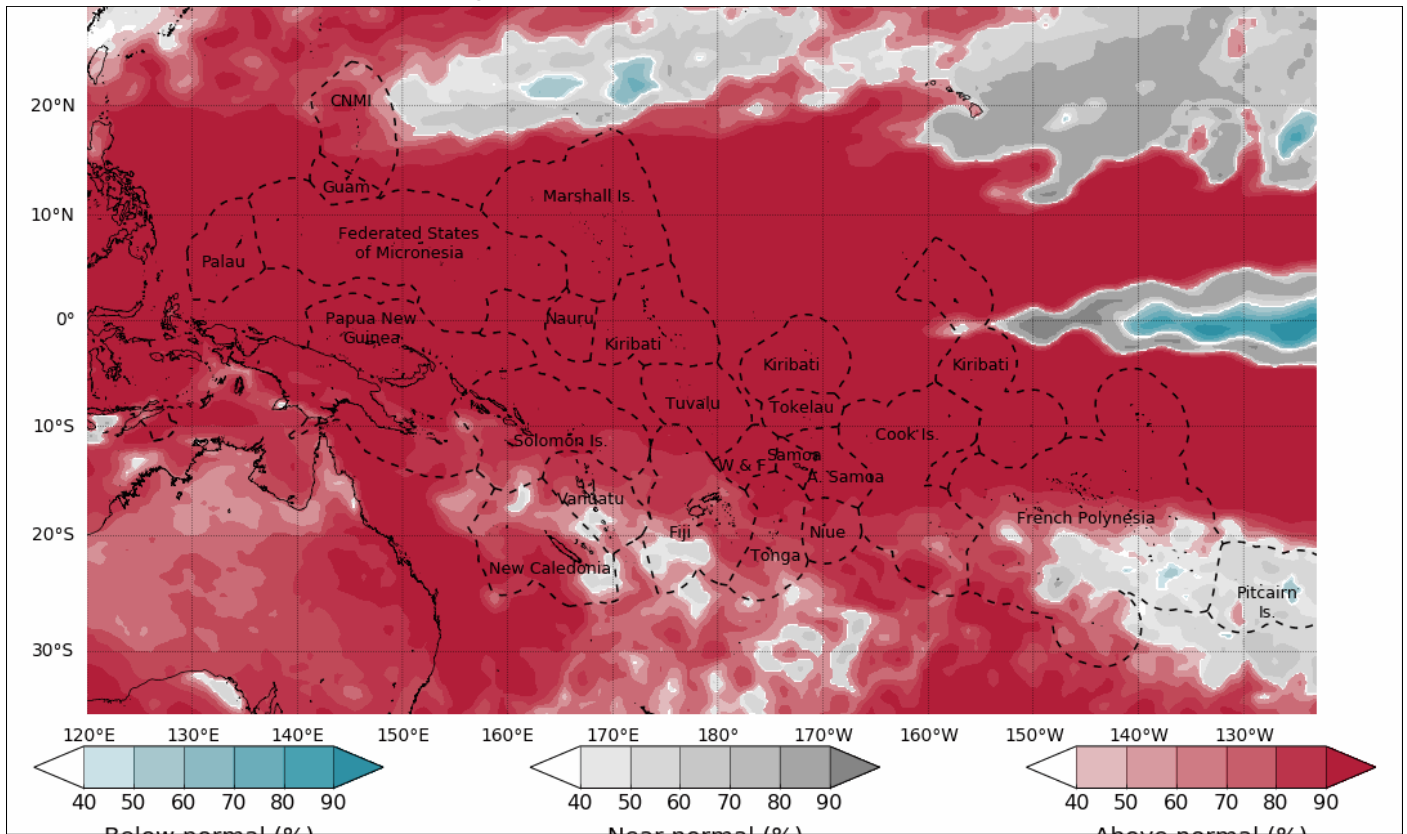


# SEASONAL TEMPERATURE OUTLOOK

June—August 2024



## Monthly Tmax and Tmin **ACCESS-S** Maps





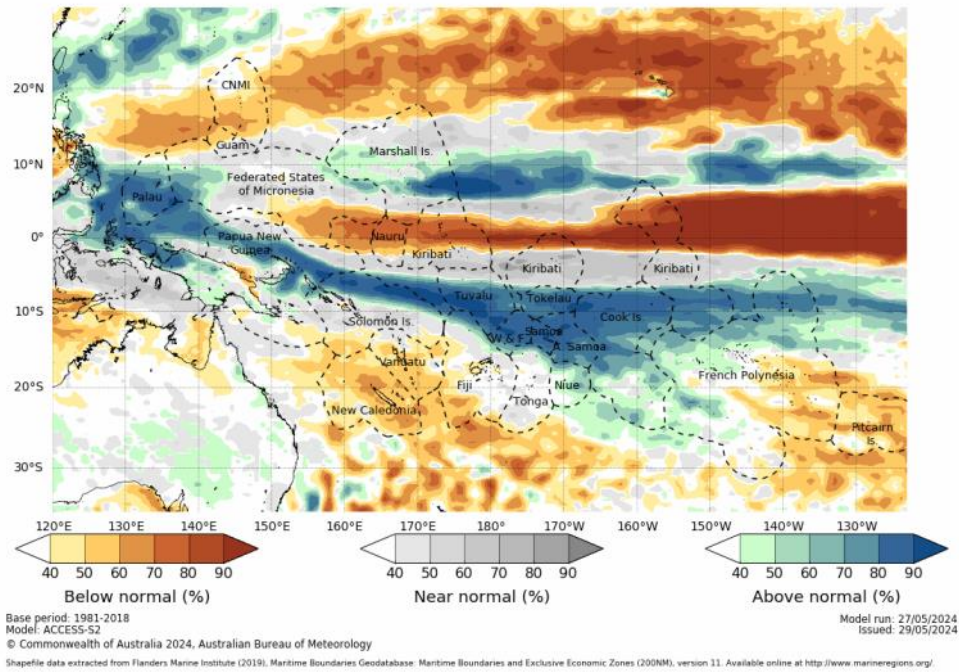
# SEASONAL RAINFALL OUTLOOK

June—August 2024

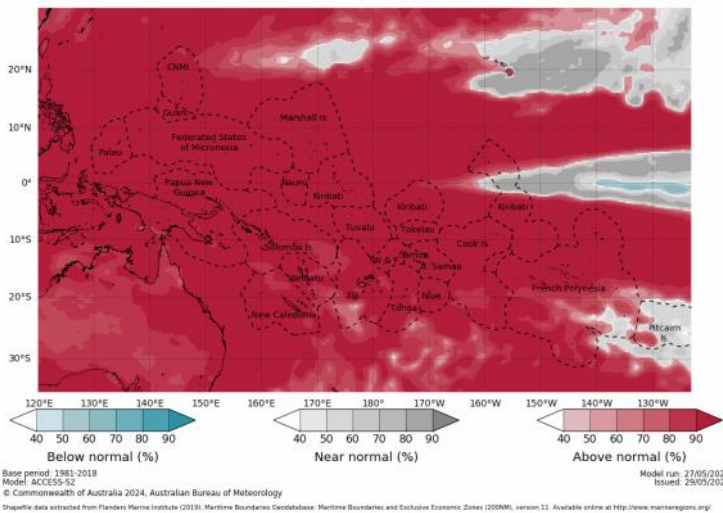


## Seasonal ACCESS-S maps

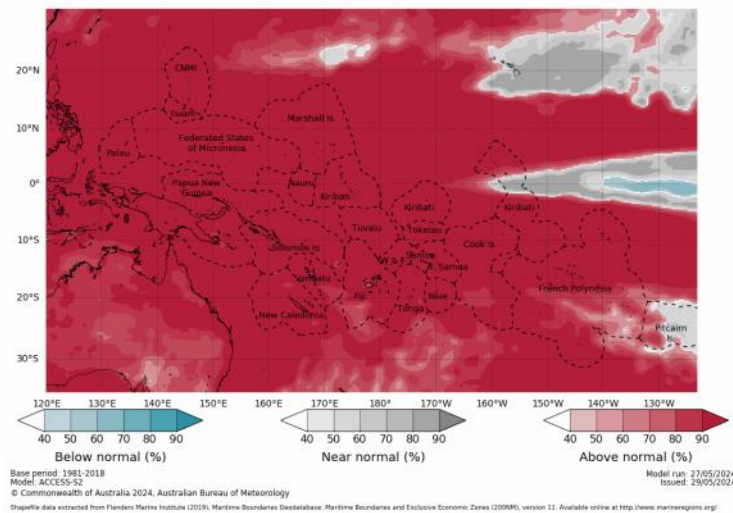
Tercile rainfall probabilities for June to August 2024



Tercile maximum temperature probabilities for June to August 2024



Tercile minimum temperature probabilities for June to August 2024



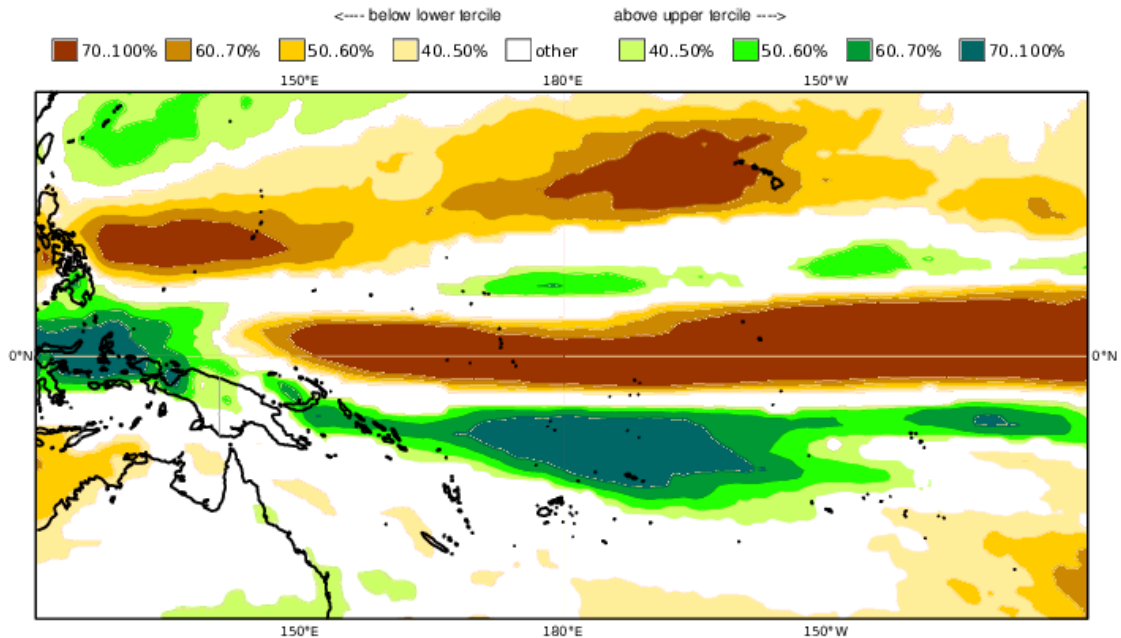
*About ACCESS-S <http://access-s.clide.cloud/>*

# SEASONAL RAINFALL OUTLOOK

June—August 2024

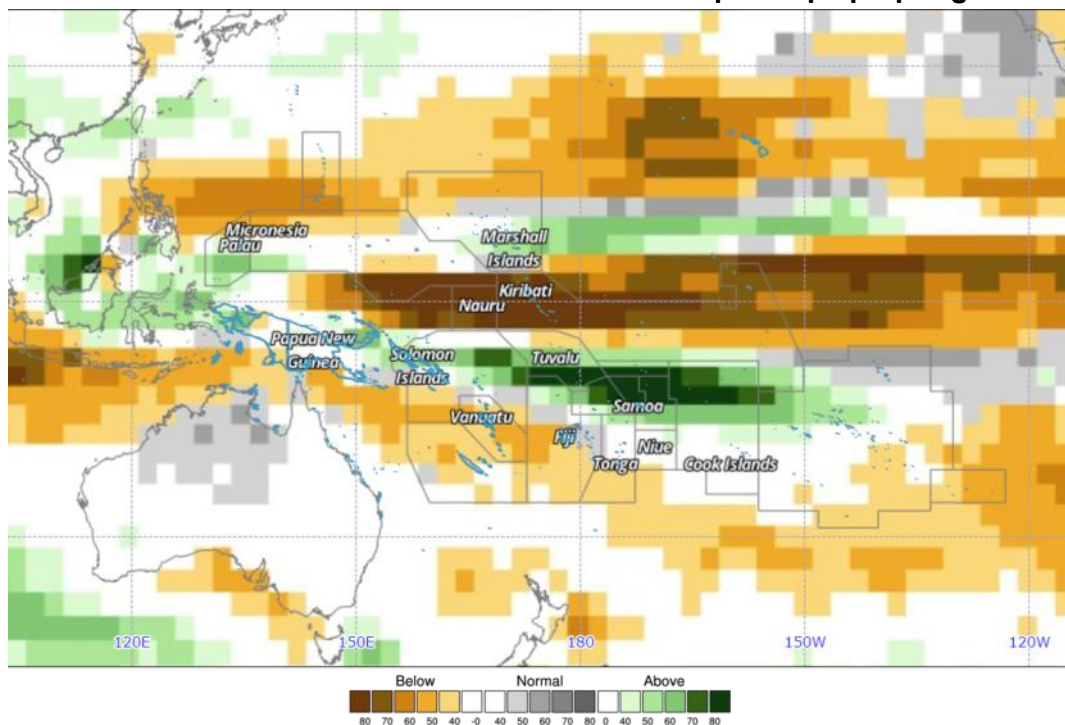


**Copernicus (C3S multi-system)-Rainfall**  
 Prob(most likely category of precipitation) JJA 2024  
 Nominal forecast start: 01/05/24  
 Unweighted mean



Copernicus Rainfall: <https://climate.copernicus.eu/charts/>

APEC Climate Information Toolkit for the Pacific: <http://clikp.sprep.org/>



24, Season: JJA, Lead Month: 3, Method: GAUS  
 © CC, BOM, CMCC, MSC, NASA, PNU  
 ted using CLIK® (2024-6-6)

© APEC Climate

# TROPICAL CYCLONE

## 2023/2024 Season

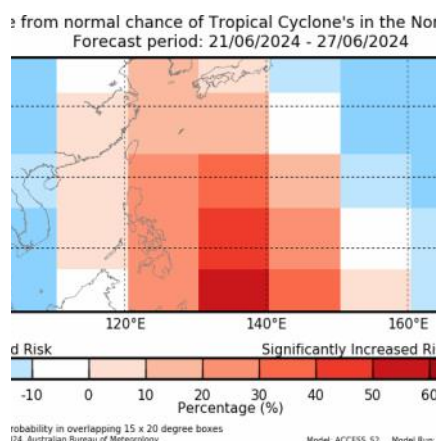
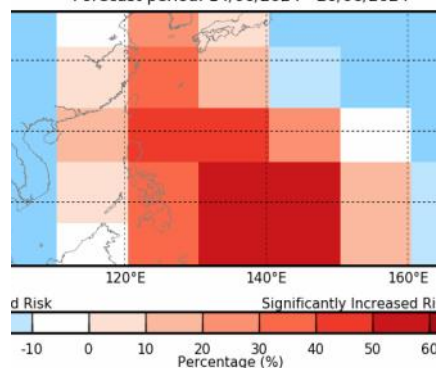


The northwest Pacific tropical cyclone season is year-round, with most cyclones occurring between May and December. In the WNP, the genesis and track of TCs show a relationship with the ENSO cycle: activity typically shifts eastward during El Niño and westward during La Niña. In the southwest Pacific, the 2024-25 tropical cyclone season officially started on 1 November 2024. Seven TCs formed in the BOM forecast area (east of the tip of Cape York) to date (four severe) with one of the seven occurring in the pre-season month of October 2023. This is below the long term (1981/82-present) average of nine in terms of total numbers. The long term average for severe Category 3-5 events is four. Nine occurred in the NIWA forecast area (east of Darwin, five severe). The official season ended on 30 April 2024. There have been fewer TCs than forecast in the eastern SW Pacific basin (east of 165 °E) to date, while the western part of the basin experienced normal to reduced activity, as predicted. In the SW Pacific basin there has been a declining trend in the total number and severe TCs since 1981/82. The quieter than normal season contributes to this trend. In 2023, the TC pattern in the WNP was unconventional for an El Niño year. TC activity was well below normal with a distribution that did not follow expectations for an El Niño year.

It's important to remember that history shows that tropical cyclones can happen outside the normal cyclone season, and it does not take a severe cyclone to produce severe impacts. Coastal and river flooding rainfall can occur with a distant, weak, or former cyclone, especially if the system is slow-moving. Communities should remain vigilant, and follow forecast information provided by their National Meteorological and Hydrological Service (NMHS).

The weekly tropical cyclone forecasts from the ACCESS-S model show significantly increased risk over Palau, FSM, Guam, CNMI, Philippines and Japan for the week from 14 to 27 June.

**ACCESS-S Weekly Forecasts –Northwest Pacific**  
from normal chance of Tropical Cyclone's in the Nor  
Forecast period: 14/06/2024 - 20/06/2024



**ACCESS-S Weekly Forecasts –Southwest Pacific**

**OUT OF SEASON**

brated Tropical Cyclone outlc  
are for November to April

**OUT OF SEASON**

alibrated Tropical Cyclone outlool  
are for November to April

### Individual Model Links

UKMO Global long-range model probability maps: <http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-looks/glob-seas-prob>

ECMWF Rain (Public charts) - Long range forecast: <http://www.ecmwf.int/en/forecasts/charts/seasonal/rain-public-charts-long-range-forecast>

POAMA Pacific Seasonal Prediction Portal: <http://poama.bom.gov.au/experimental/pasap/index.shtml>

APEC Climate Center (APCC): <http://www.apcc21.org/eng/service/6mon/>



# OTHER INFORMATION

## Southern Oscillation Index

The Southern Oscillation Index, or SOI, gives an indication of the development and intensity of El Niño and La Niña events across the Pacific Basin. The SOI is calculated using the difference in air pressure between Tahiti and Darwin. Sustained negative values of the SOI below  $-7$  often indicate El Niño episodes. These negative values are usually accompanied by sustained warming of the central and/or eastern tropical Pacific Ocean, and a decrease in the strength of the Pacific Trade Winds. Sustained positive values of the SOI greater than  $+7$  are typical of La Niña episodes. They are associated with stronger Pacific Trade Winds and sustained cooling of the central and eastern tropical Pacific Ocean. In contrast, ocean temperatures to the north of Australia usually become warmer than normal.

## Multivariate ENSO Index (MEI)

The Climate Diagnostics Center Multivariate ENSO Index (MEI) is derived from a number of parameters typically associated with El Niño and La Niña. Sustained negative values indicate La Niña, and sustained positive values indicate El Niño.

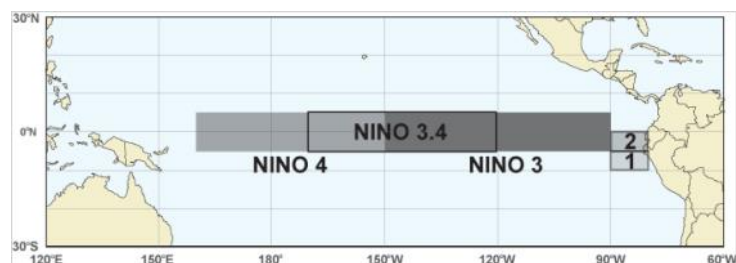
## 20 degrees Celsius Isotherm Depth

The 20°C Isotherm Depth is the depth at which the water temperature is 20°C. This measurement is important, as the 20°C isotherm usually occurs close to the thermocline, the region of most rapid change of temperature with depth, or the division between the mixed surface layer and deep ocean. A 20°C isotherm that is deeper than normal (positive anomaly) implies a greater heat content in the upper ocean, while a shallower 20°C isotherm (negative anomaly) implies a lower-than-normal heat content in the upper ocean.

## Regions

SST measurements may refer to the NINO1, 2, 1+2, 3, 3.4 or 4 regions. These descriptions simply refer to the spatially averaged SST for the region described. The NINO regions (shown in the figure below) cover the following areas:

Region	Latitude	Longitude
NINO1	5-10°S	80-90°W
NINO2	0-5°S	80-90°W
NINO3	5°N to 5°S	150-90°W
NINO3.4	5°N to 5°S	120-170°W
NINO4	5°N to 5°S	160°E to 150°W



NOTE: NINO1+2 is the combined areas 1 and 2