

# Monthly Climate Bulletin

August 2023



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Photo Credit: Molly Powers (SPC) Samoa Tide Gauge





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## Issued 12 September 2023

- The Bureau's El Niño Alert continues, with El Niño development likely during spring.
- The Madden Julian Oscillation (MJO) is forecast to strengthen and move over the eastern Indian Ocean or western Maritime Continent (MC) in the coming week.
- The ITCZ was active and displaced south from its normal position in August 2023.
- Sea surface temperatures (SST) for August 2023 were warmer than average over most of the tropical Pacific Ocean.
- The Coral bleaching Outlook to 24 September shows patches of area of 'Alert Level 1 and 2' over Kiribati (central Gilbert, northern Phoenix and northern Line Islands).
- For September-November 2023, the models agree on above normal rainfall being likely or very likely from FSM, southern and central RMI, much of the PNG Islands, Solomon Islands, Nauru, Tuvalu, and Kiribati (Gilbert, Phoenix and Line Islands). Below normal rainfall is likely or very likely for CNMI, Guam, eastern RMI, most of PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue, American Samoa, central and northern Cook Island, French Polynesia and Pitcairn Islands.
- The ACCESS-S weekly tropical cyclone outlook shows a significantly increased risk in the northwest Pacific between 10 September and 23 September around, Palau, FSM, Guam, CNMI, Philippines, China and Japan

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# EL NIÑO–SOUTHERN OSCILLATION

## El Niño Alert continues, positive IOD likely for spring

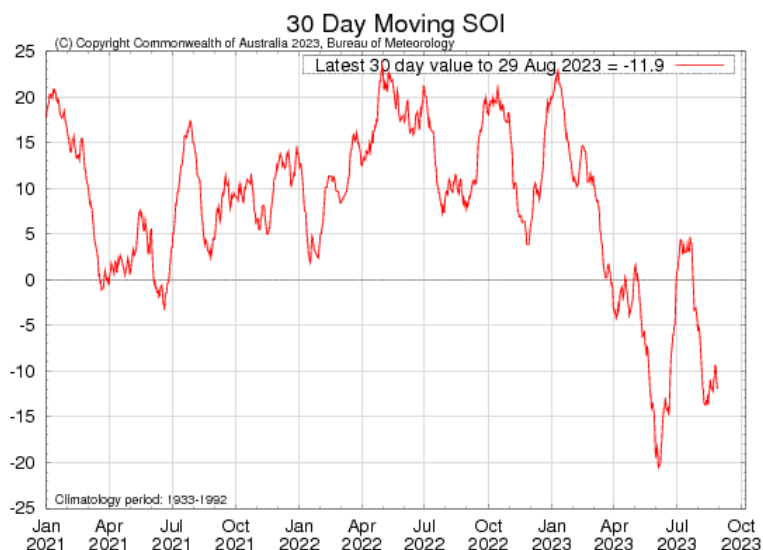
Click link to access [Climate Driver Update issued on 29 August 2023](#)

The Bureau's El Niño Alert continues, with El Niño development likely during spring. When El Niño Alert criteria have been met in the past, an El Niño event has developed around 70% of the time. Sea surface temperatures (SSTs) in the tropical Pacific are exceeding El Niño thresholds and have continued to warm slightly over the last fortnight. Climate models indicate further warming of the central to eastern Pacific is likely, with SSTs remaining above El Niño thresholds until at least early 2024.

The 90-day Southern Oscillation Index (SOI) is presently just below El Niño thresholds, while trade winds and Pacific cloudiness have not yet demonstrated sustained El Niño patterns. Overall, atmospheric indicators suggest the Pacific Ocean and atmosphere are not yet consistently reinforcing each other, as occurs during El Niño. El Niño typically suppresses spring rainfall in western Pacific region.

The latest weekly Indian Ocean Dipole (IOD) index is +1.05 °C. This is the second week it has been above the positive IOD threshold of +0.40 °C. However, before an IOD event is declared, several more weeks of the IOD index above the positive IOD threshold are required. Climate models suggest a positive IOD is likely for spring. A positive IOD typically decreases spring rainfall for central and south-east Australia and can increase the drying influence of El Niño.

The 30-day Southern Oscillation Index (SOI) for the period ending 27 August was -11, slightly less negative than last fortnight. The 60-day SOI and the 90-day SOI were -7 and -6, respectively.



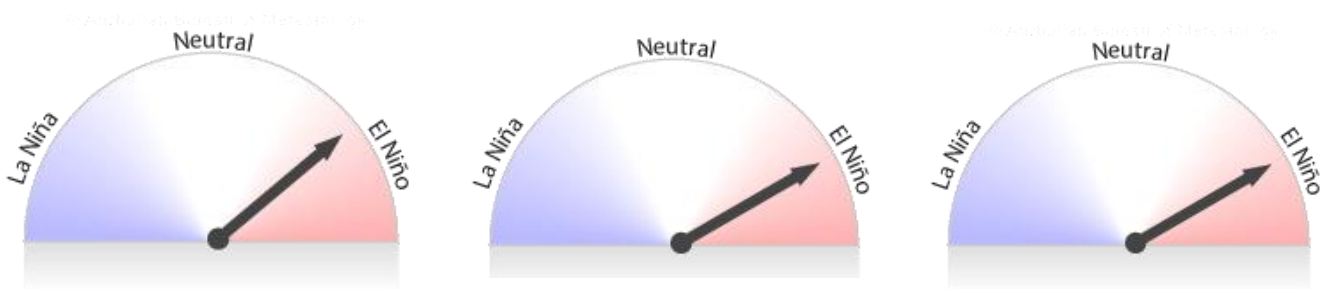


# EL NIÑO–SOUTHERN OSCILLATION

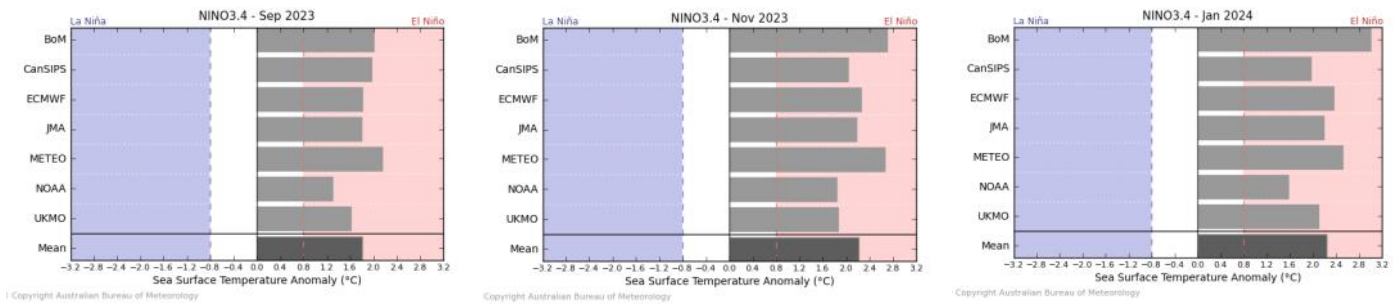
El Niño Alert continues, positive IOD likely for spring

Click link to access [Climate Driver Update issued on 29 August 2023](#)

## Bureau of Meteorology NINO3.4 ENSO Model Outlooks for September, November and January



## 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

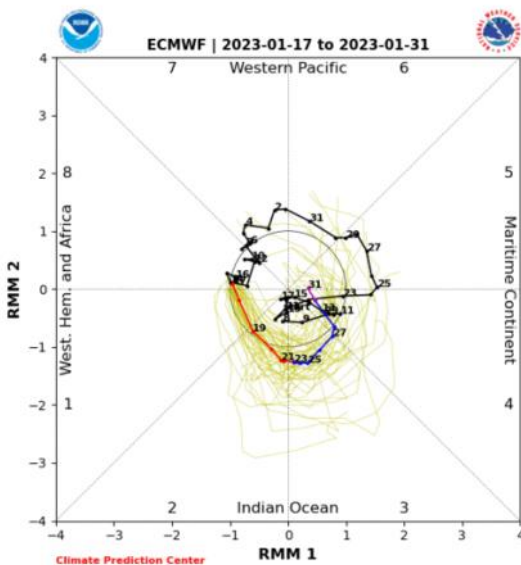
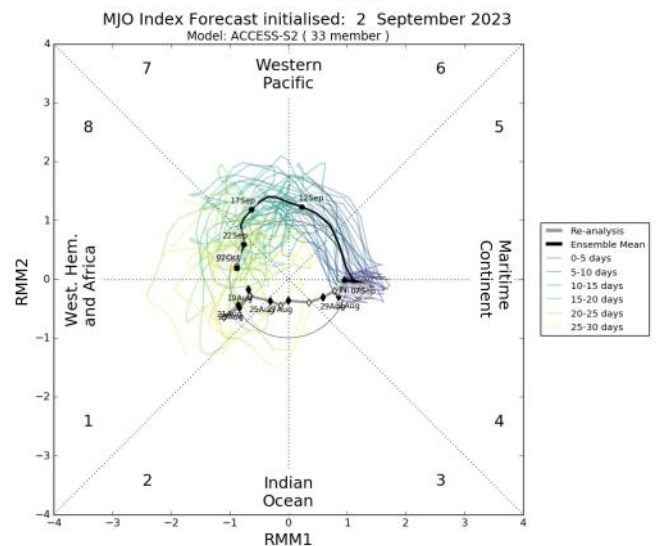
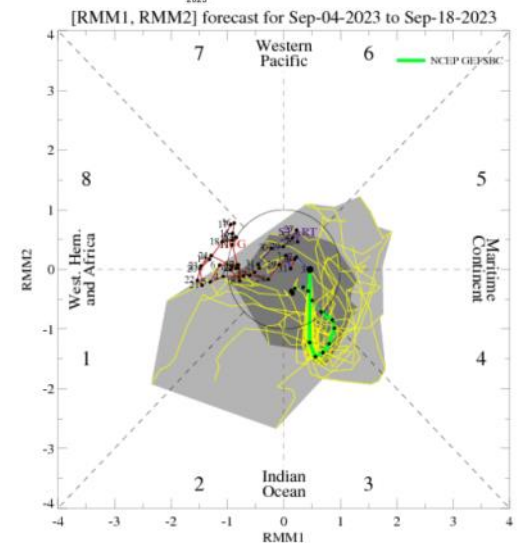
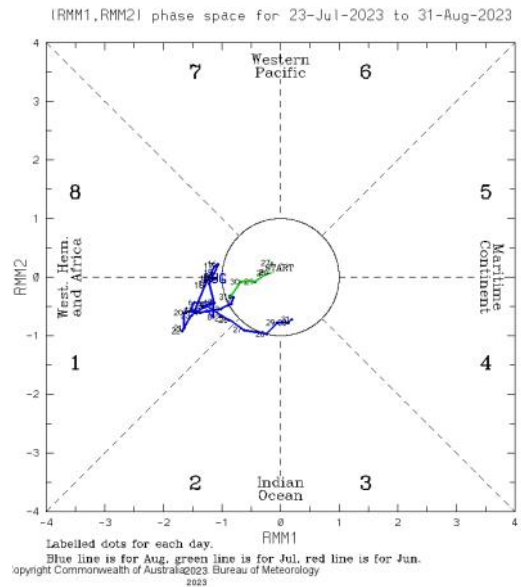
Click link to access [Tropical Climate Update](#) [Issued on Tuesday 05 September 2023]

During August, the Madden Julian Oscillation (MJO) was active over the Western Hemisphere and Indian Ocean.

Climate models surveyed by the Bureau indicate that a Madden Julian Oscillation (MJO) pulse is forecast to strengthen and move over the eastern Indian Ocean or western Maritime Continent (MC) in the coming week.

Most models indicate the coming MJO pulse will then likely track eastwards into the eastern Maritime Continent but weaken by mid-September prior to re-entering the Western Pacific region. A pulse over the Maritime Continent typically strengthens trade winds across the central Pacific, potentially further stalling development of an El Niño. Based on current model guidance, which indicates the MJO pulse will weaken before moving into either the western Maritime Continent or Western Pacific region, there is unlikely to be a significant influence on wind strength over the equatorial Indian Ocean. This implies no significant influence on development of the IOD.

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



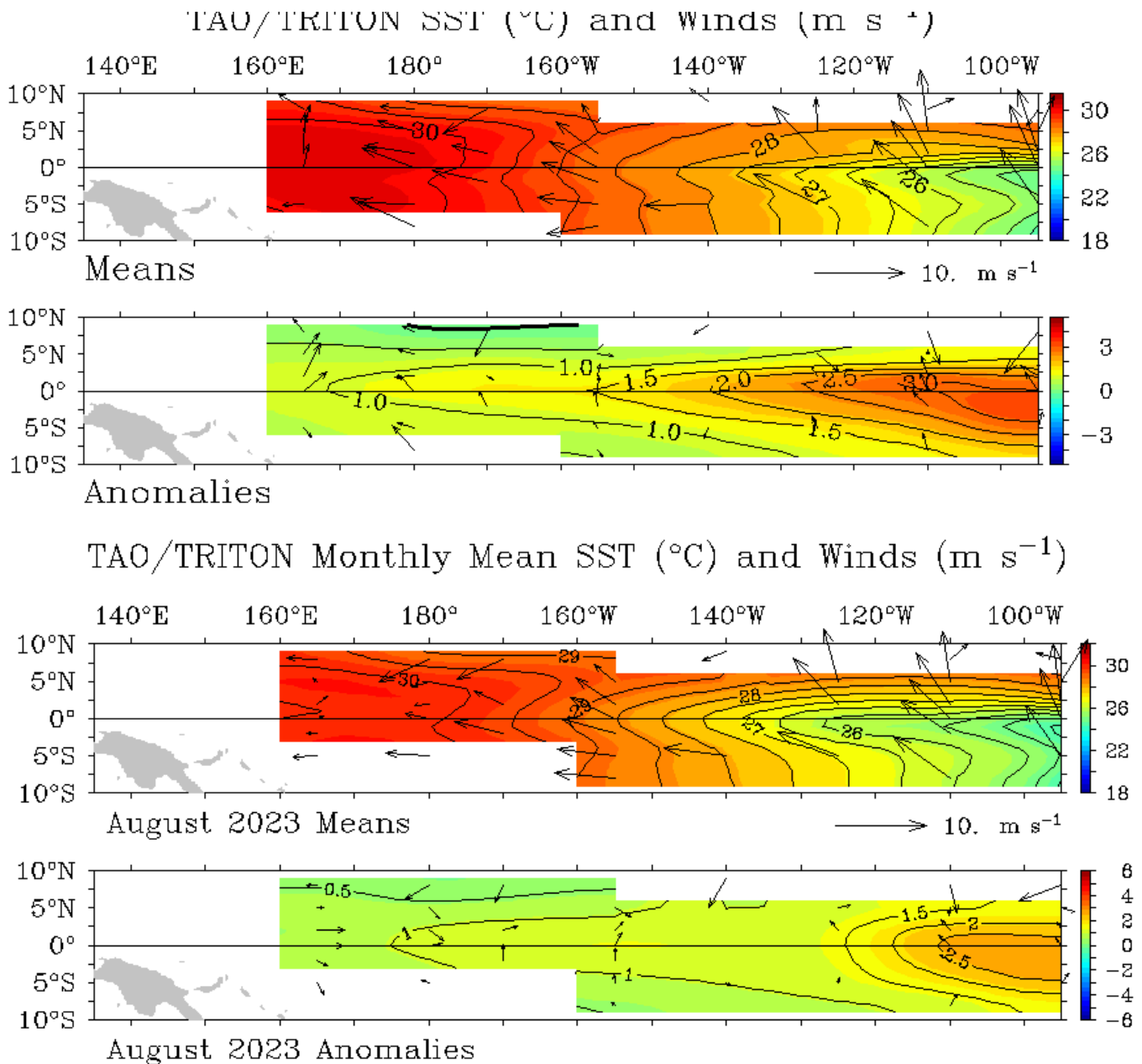


# WIND

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

During August and for the five days ending 03 September 2023, the trade winds were generally weak in the far western equatorial Pacific but normal across the rest of the 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

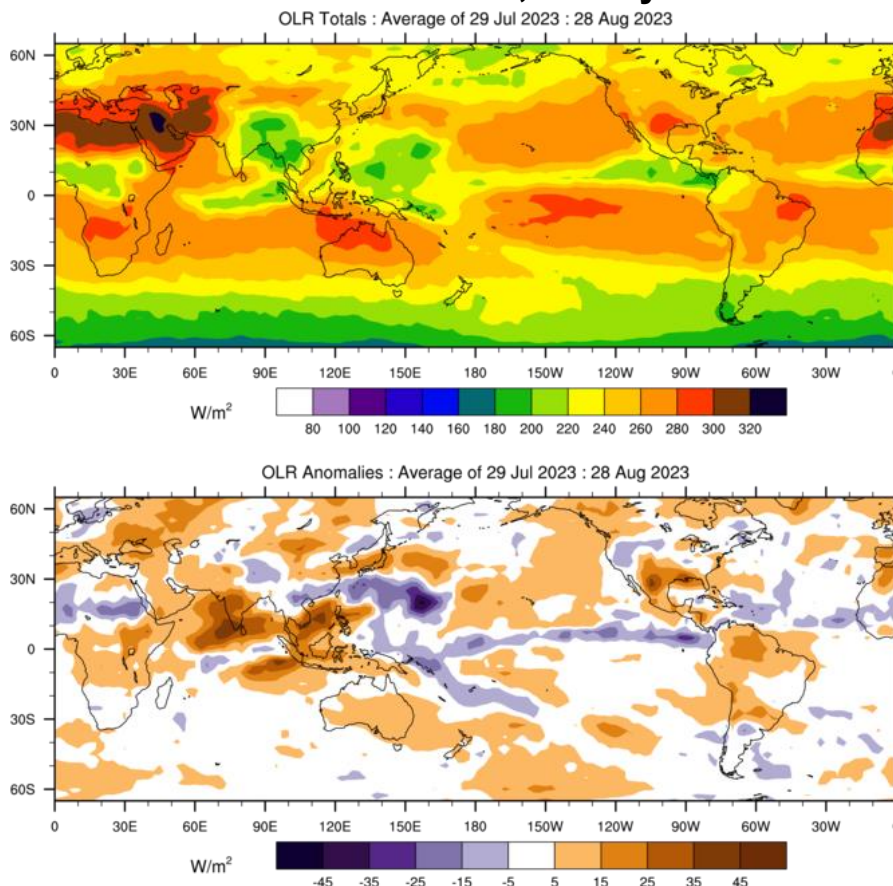
Click link to access [OLR](#)



The August 30-day OLR anomaly map shows a region of low OLR (increased convection) along the Intertropical Convergence Zone (ITCZ) and South Pacific Convergence Zone (SPCZ) region. There was also a region of negative anomalies over the northern FSM, Guam and CNMI. In between the ITCZ and SPCZ, and north and south of these regions were regions of positive anomalies (reduced convection) in a band from Tuvalu to French Polynesia and from Nauru north through RMI.

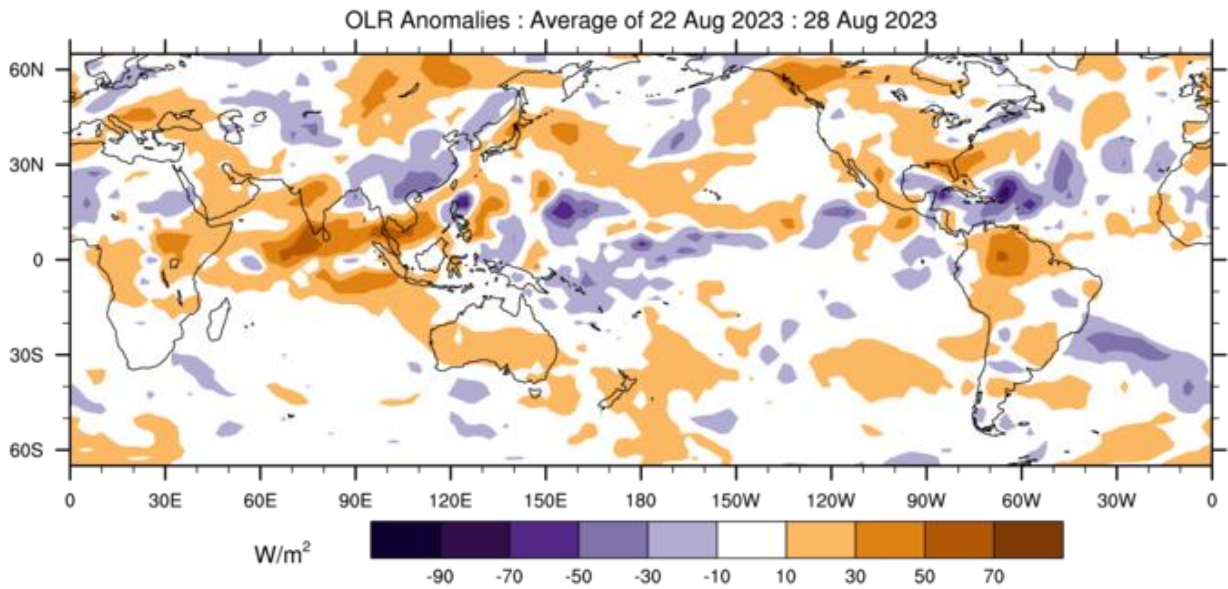
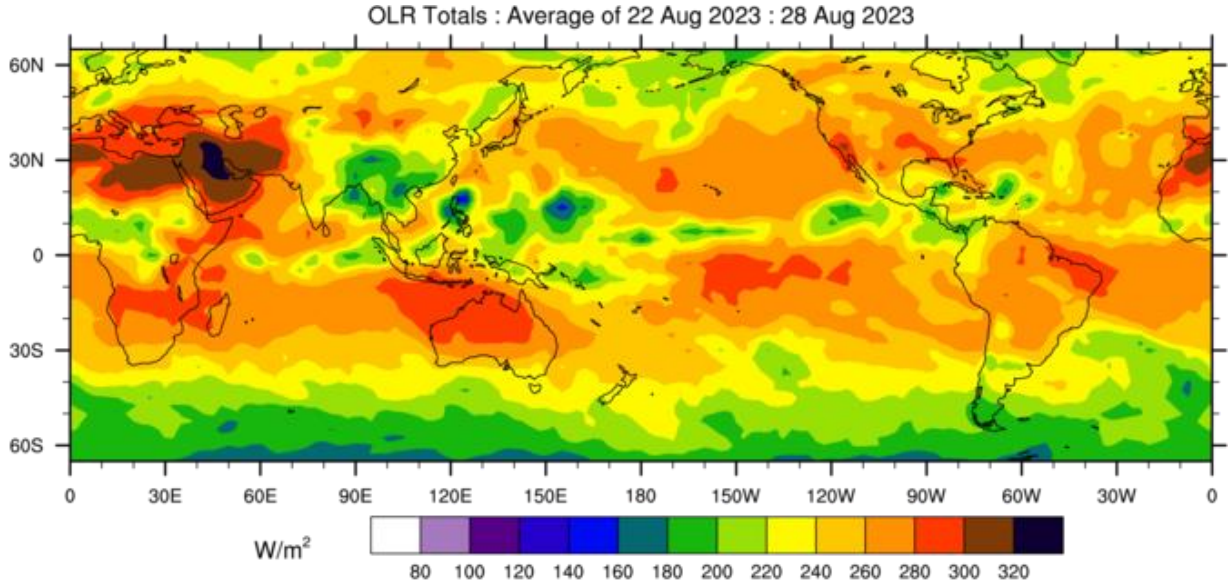
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre ( $W/m^2$ ) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in  $W/m^2$ . In the bottom panel, negative values (blue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

## OLR Total and Anomalies, 30 Day OLR

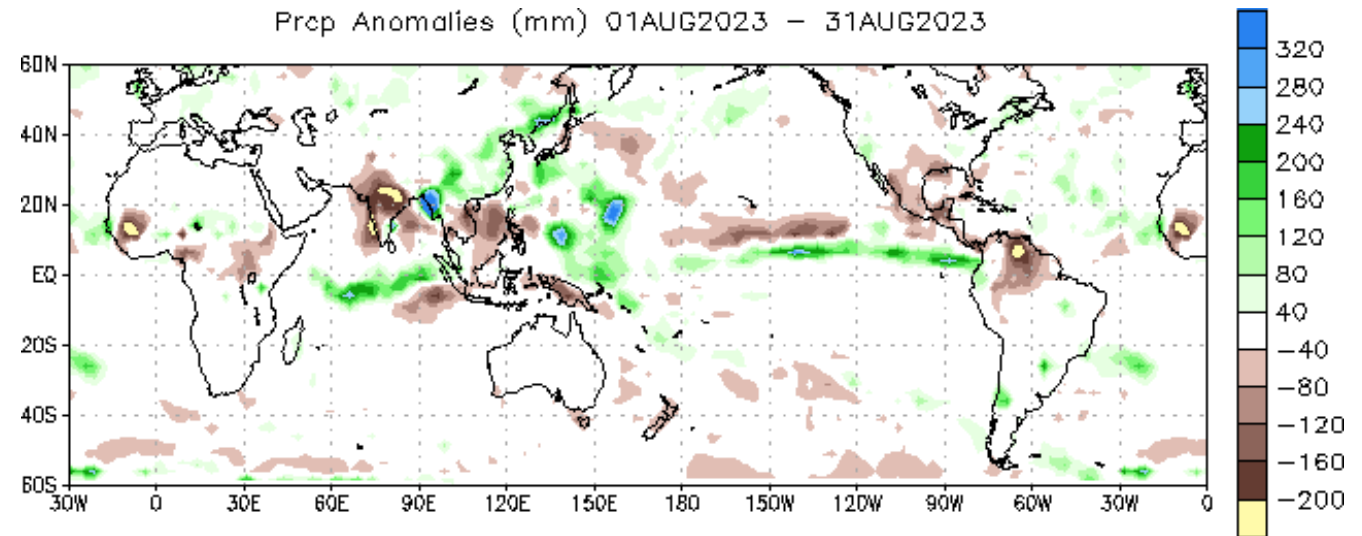




# OLR Total and Anomalies, 7 Day OLR

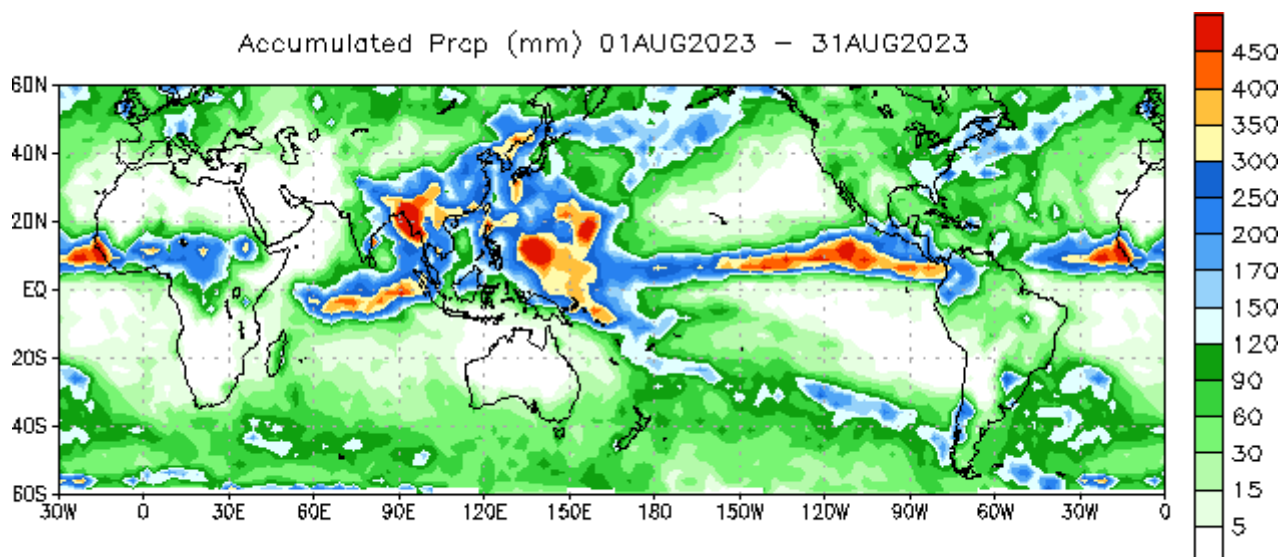


(C) Copyright Commonwealth of Australia 2023. Bureau of Meteorology

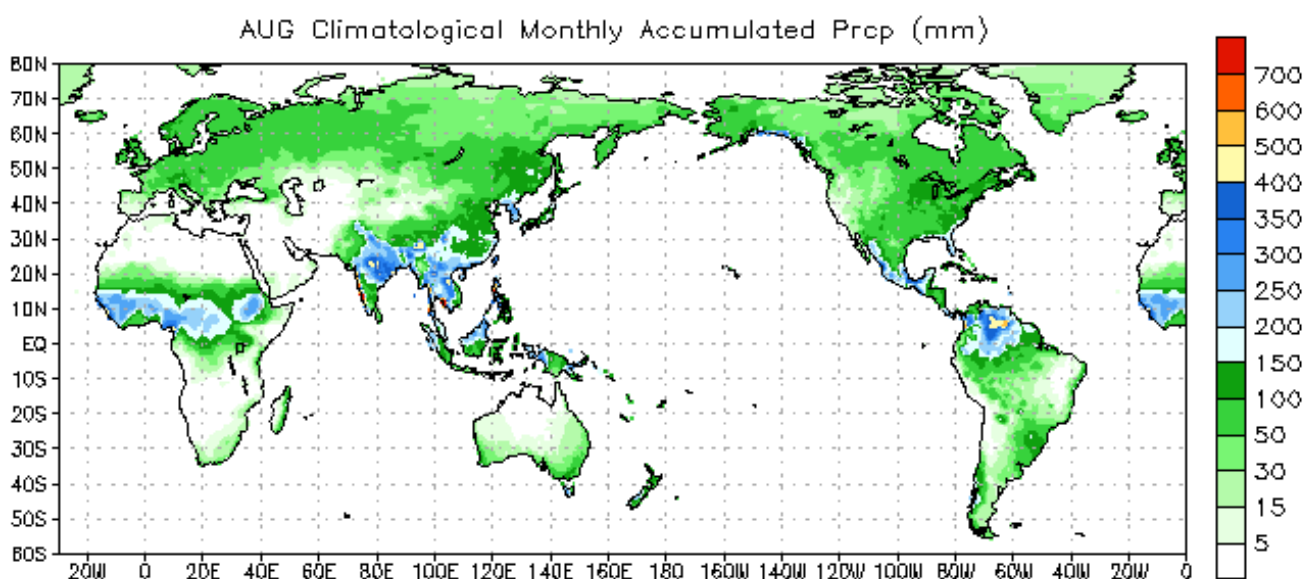


Data Source: NCEP CMAP Precipitation Climatology (1991–2020)

## 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



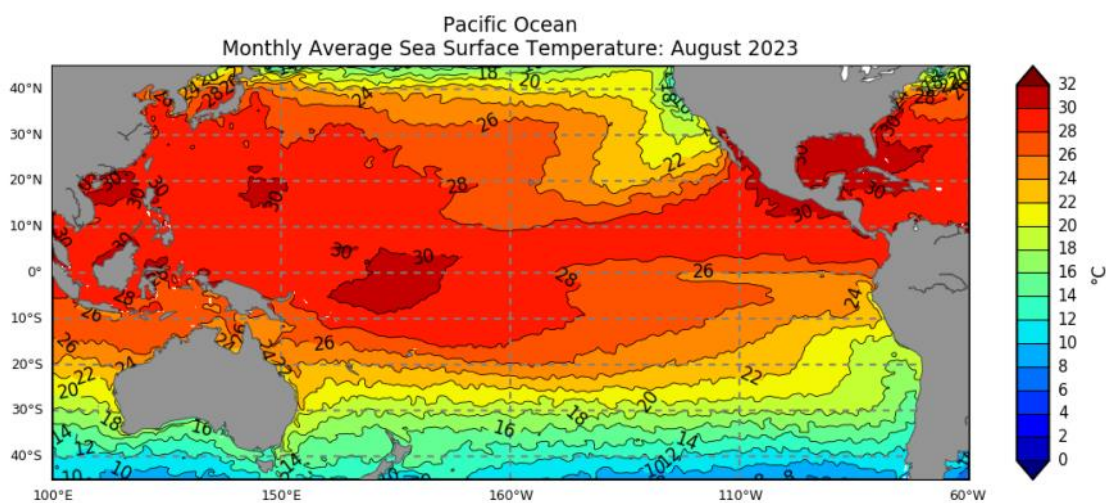
Click link to access [Pacific Community COSPPac Ocean Portal](#)

Sea surface temperatures (SST) for August 2023 were warmer than average over most of the tropical Pacific Ocean. Warm anomalies more than 1.0°C warmer than average were present over parts of these regions, increasing to more than 2°C warmer than average over parts of the South American coast extending to 130° W. Compared to July, the area with warm anomalies at 1.5°C was less especially in the west but still observed in tropical equatorial Pacific with the anomalies of 2.0°C extended further westwards over the Date Line.

Warm SST anomalies also continued in the southern Tasman Sea, between south-east Australia and New Zealand, and along the Coral Coast. There were patches of cold SST anomalies south-west and western Australia, Tasman Sea, western FSM, southeast PNG, western Solomon Islands, Vanuatu, southern French Polynesia and Pitcairn Islands.

Record-high August SSTs occurred in parts of eastern Solomon Islands, Tuvalu, parts of Gilbert and Phoenix Islands of Kiribati, northern Fiji, Wallis and Futuna, eastern Tokelau, Samoa, American Samoa, northern Tonga, patches in Niue, and northern and central Cook Islands. The SST in decile 10 (very much above average) and above average (8-9) are observed for majority of the Pacific Island Countries, spanning southeastward from Guam to eastern French Polynesia, and along the islands located near the equatorial region of the Pacific. Average SSTs (4-7) for August were observed in parts of Palau, southern FSM, northern PNG, and western Solomon Islands. Patches were also observed in New Caledonia, Vanuatu, Fiji, Tonga, Niue, Cook Islands, and central and south French Polynesia.

### Mean Sea Surface Temperature

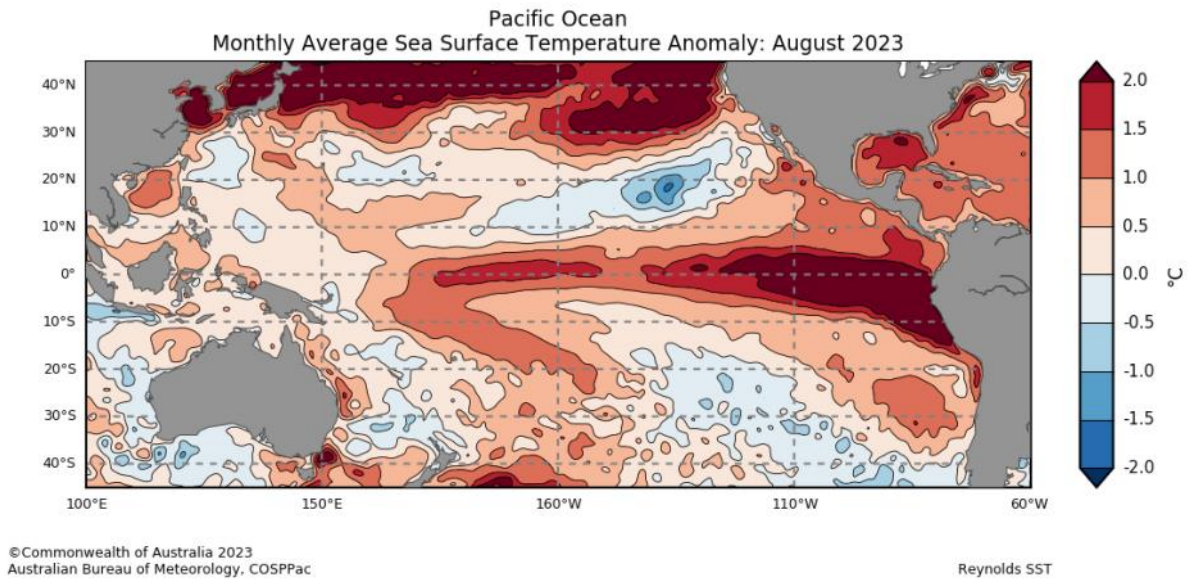


# OCEAN CONDITIONS

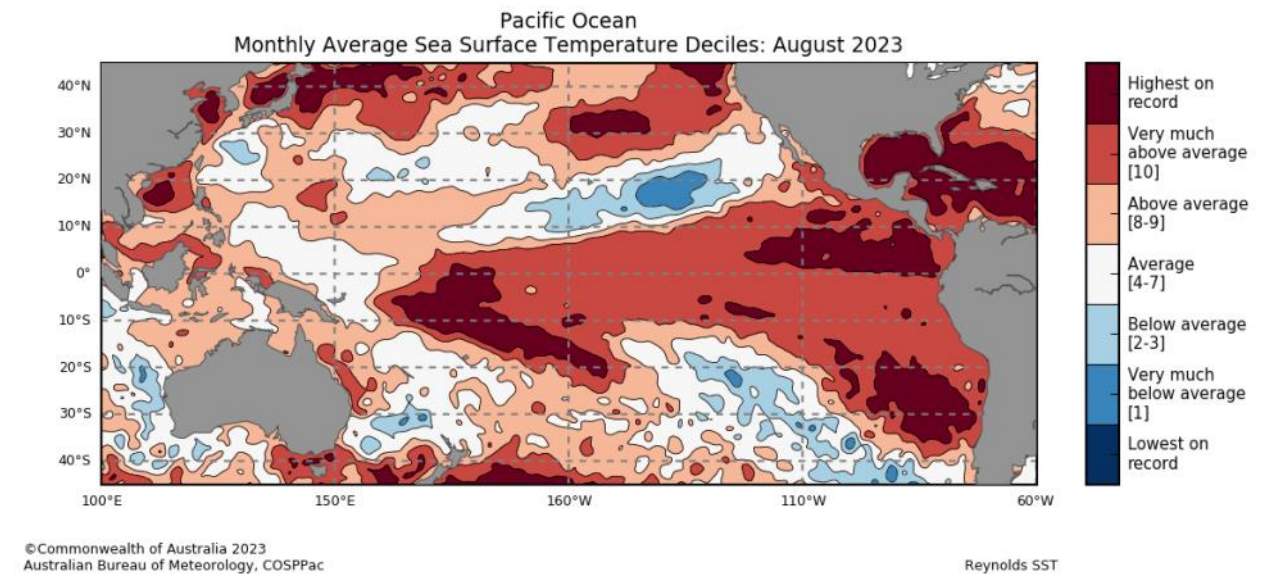
Click link to access [SEA SURFACE TEMPERATURE](#)



## Anomalous Sea Surface Temperature



## Sea Surface Temperatures Deciles



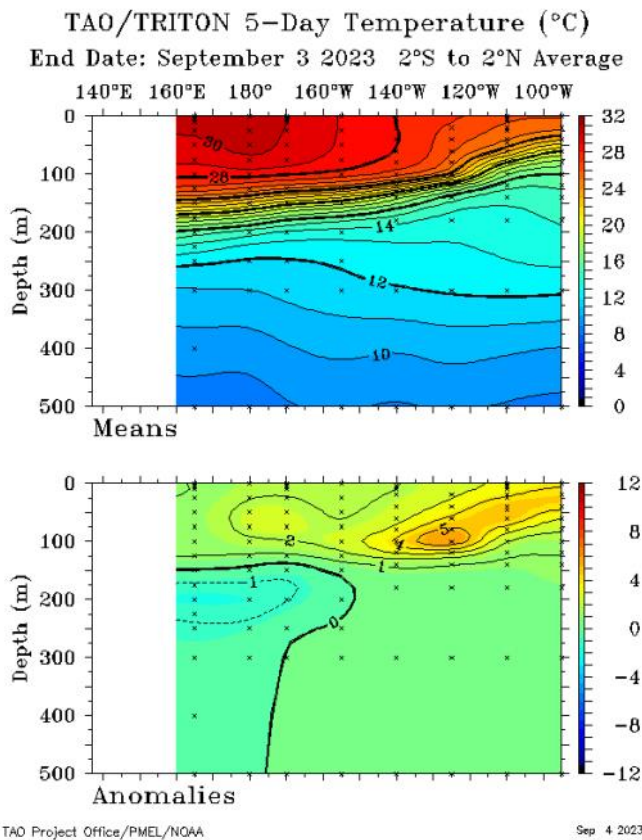
# OCEAN CONDITIONS

## SUB SURFACE

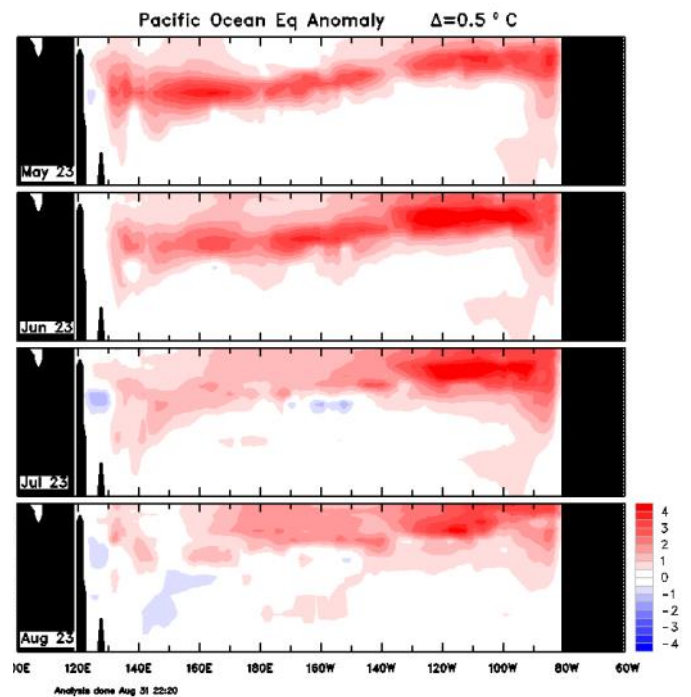


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 24 August 2023) shows warm anomalies across most of the top 100 m of the equatorial Pacific band, except in the far west. Anomalies increase in magnitude eastwards across the equatorial Pacific band, with the far west close to average and the eastern Pacific more than 3 °C warmer than average. The last three months have seen sub-surface heat shift towards the eastern Pacific, between the surface and 150 m depth. Temperatures have decreased in the western Pacific such that most of the water column is now mostly close to average. August has seen a decrease of positive anomalies in the eastern Pacific sub-surface.

**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

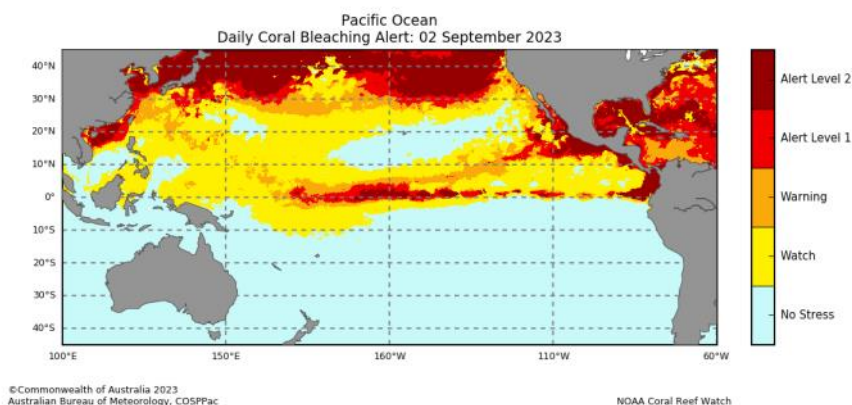
## CORAL BLEACHING



The daily Coral Bleaching Alert status for 02 September 2023 shows patches of 'Alert Level 1 and 2' for Kiribati (central Gilbert Islands, northern Phoenix Islands and Line Islands). Patches of 'Warning' over eastern FSM, Nauru, and Kiribati (Gilbert, northern Phoenix and northern Line Islands). The four-week Coral Bleaching Outlook to 24 September shows patches of area of 'Alert Level 1 and 2' over Kiribati (central Gilbert, northern Phoenix and northern Line Islands). 'Watch to Warning' ratings from Guam, CNMI, FSM, RMI, north-east PNG, northeast Solomon Islands, and Tuvalu.

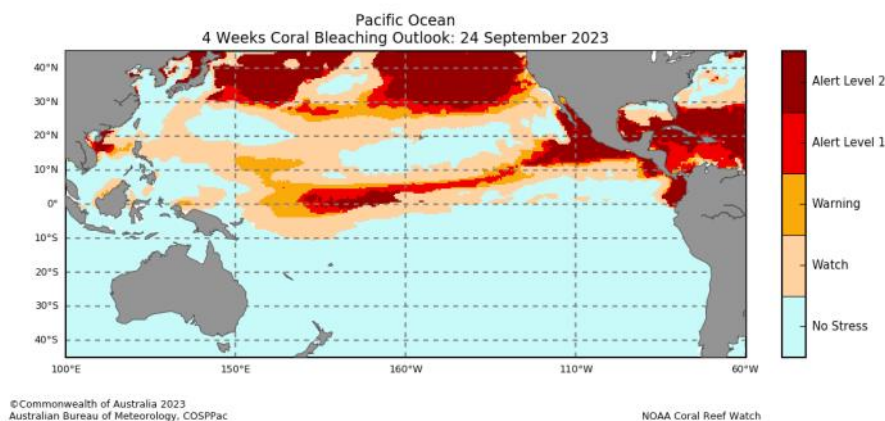
### Daily Coral Bleaching Alert

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



### 4 Weeks Coral Bleaching Outlook

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



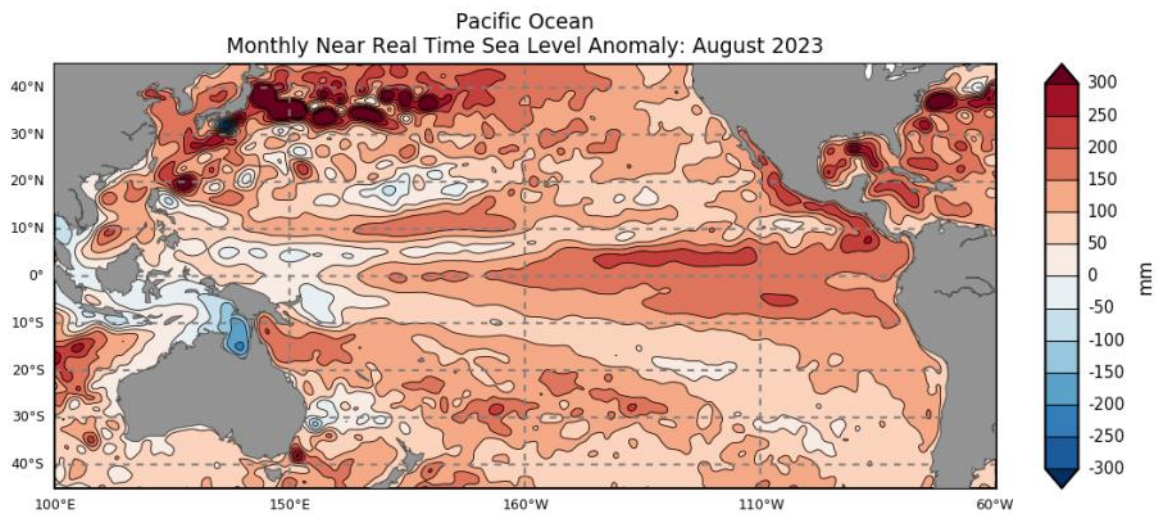
# OCEAN CONDITIONS

## OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea level in August was above normal over COSPPac countries. Patches of anomalies above +250 mm were observed in southern PNG, and Coral Sea. Areas of +100 to 200 were observed in northern FSM to northern RMI, Kiribati and from southeastern PNG to southern French Polynesia. Anomalies of +50 to +150 mm were observed in most of the COSPPac countries, apart from patches of below normal sea level anomalies observed in central FSM, eastern PNG and, northern and eastern Australia.

### Monthly Sea Level Anomalies

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



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Australian Bureau of Meteorology, COSPPac

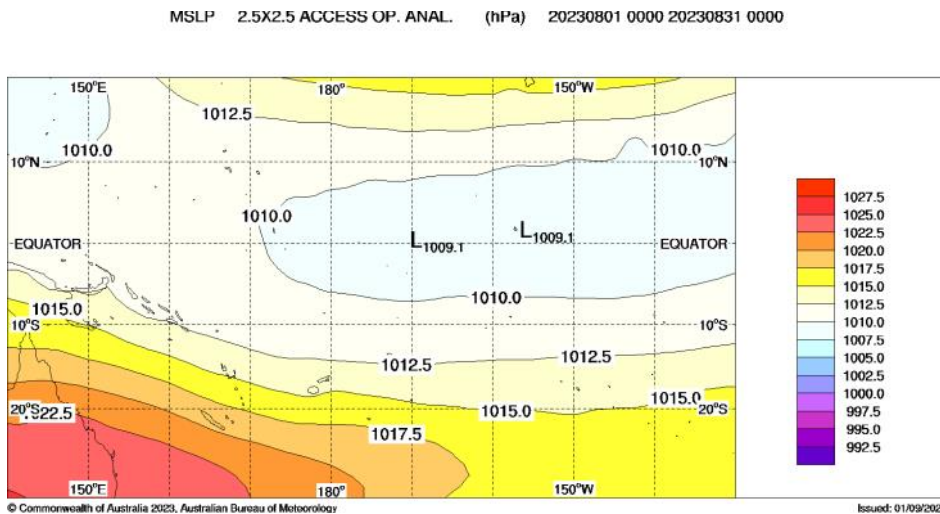
AVISO Ssalto/Duacs SLA

# MEAN SEA LEVEL PRESSURE

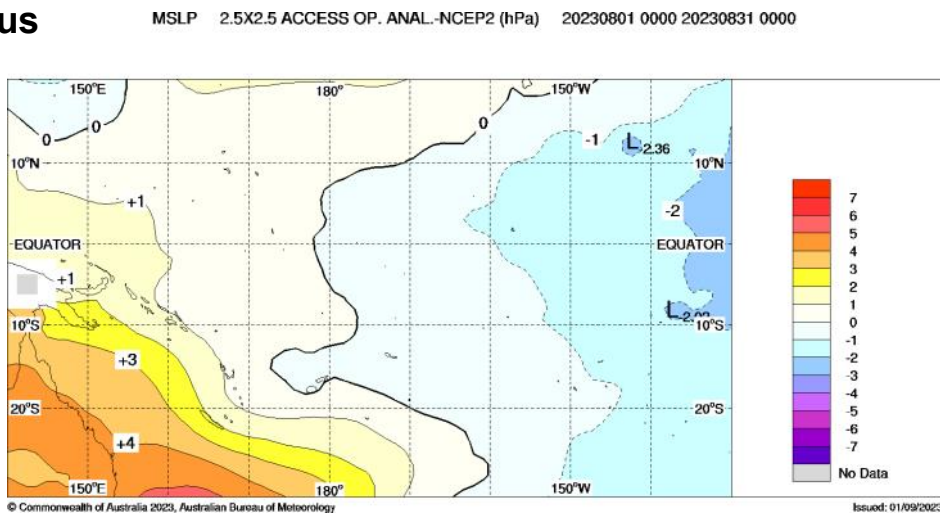
The August mean sea level pressure (MSLP) anomaly map shows mostly positive anomalies of 1 hPa or greater west of Vanuatu. Negative anomalies of +1 hPa or greater were evident west of 160° W, especially over Hawaii and French Polynesia.

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

## Mean



## Anomalous



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

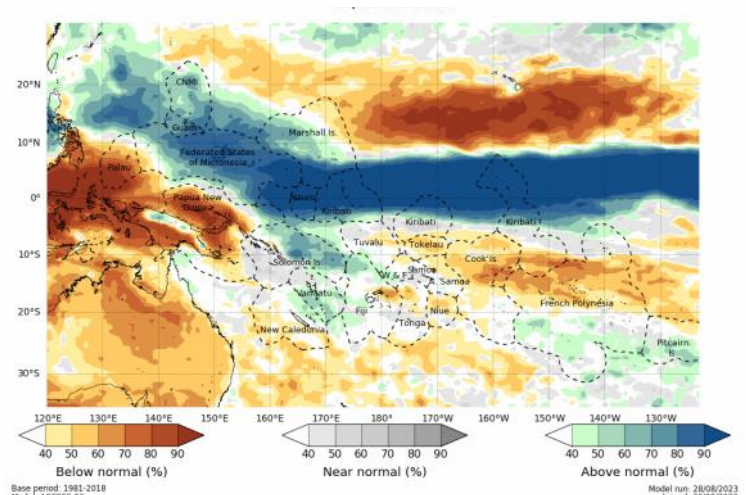
## September—November 2023



The ACCESS-S model forecast for September 2023, shows below normal rainfall is likely or very likely for Palau, parts of PNG's mainland and Islands regions, northeast RMI, Tokelau, Cook Islands and northern French Polynesia. Small patches of below normal rainfall likely to be observed in western Solomon Islands, southern New Caledonia, eastern Fiji, Kiribati (southern Phoenix and Line Islands), central Tonga, eastern Tuvalu, American Samoa, and Niue. Above normal rainfall is likely or very likely for CNMI, Guam, FSM, central and southern RMI, Nauru, northern PNG's mainland, eastern Solomon Islands, eastern New Caledonia, Vanuatu, northern and western Fiji, most of Kiribati, Wallis and Futuna, south French Polynesia, and Pitcairn Islands.

The three-month rainfall outlook (September-November 2023) is very similar to the September outlook, with below normal rainfall region intensifying over the southern hemisphere and above normal rainfall region also intensifying from CNMI to Kiribati including Solomon Islands and Tuvalu.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for September-November 2023 favours above normal rainfall for FSM, southern and central RMI, much of the PNG Islands, Solomon Islands, Nauru, Tuvalu, and Kiribati (Gilbert, Phoenix and Line Islands). Below normal rainfall is likely or very likely for CNMI, Guam, eastern RMI, most of PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue, American Samoa, central and northern Cook Island, French Polynesia and Pitcairn Islands.

The APEC Climate Centre multi-model outlook is similar to the Copernicus multi-model model.

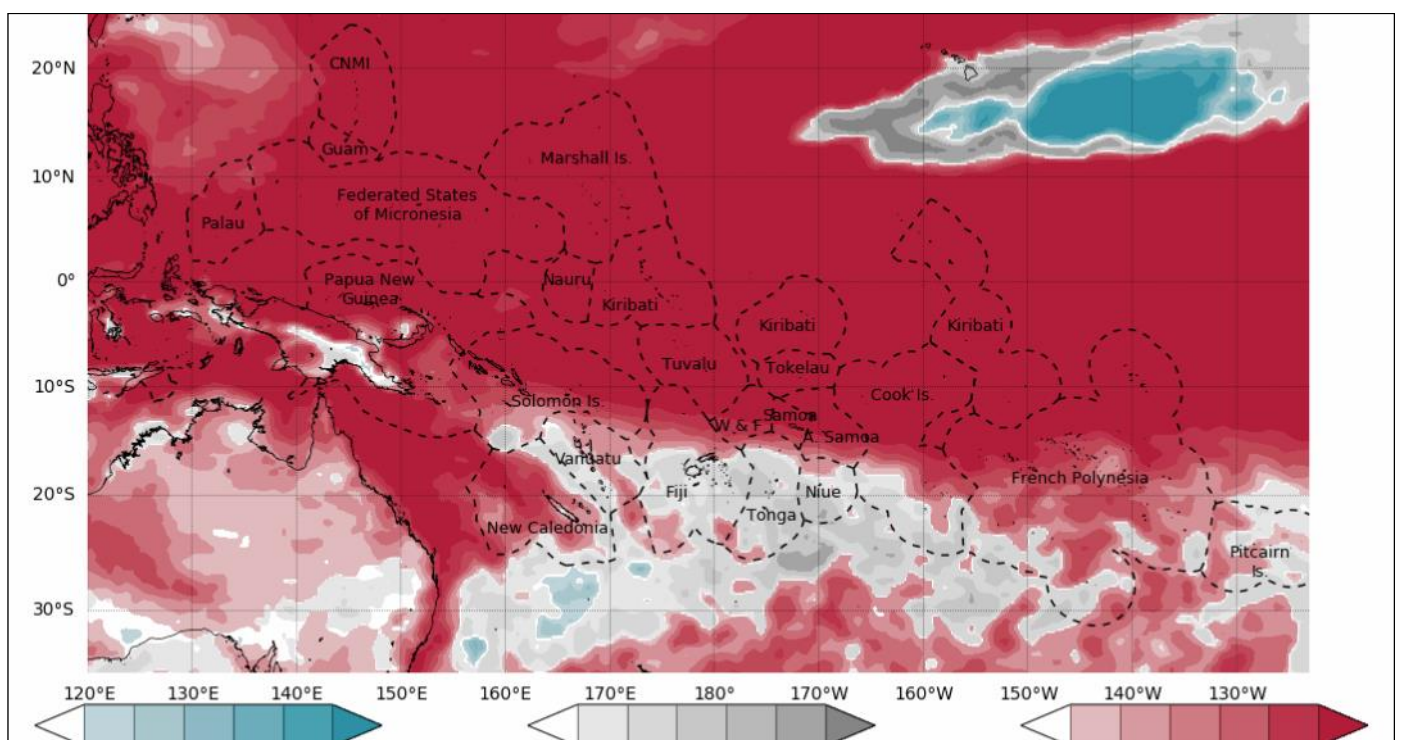
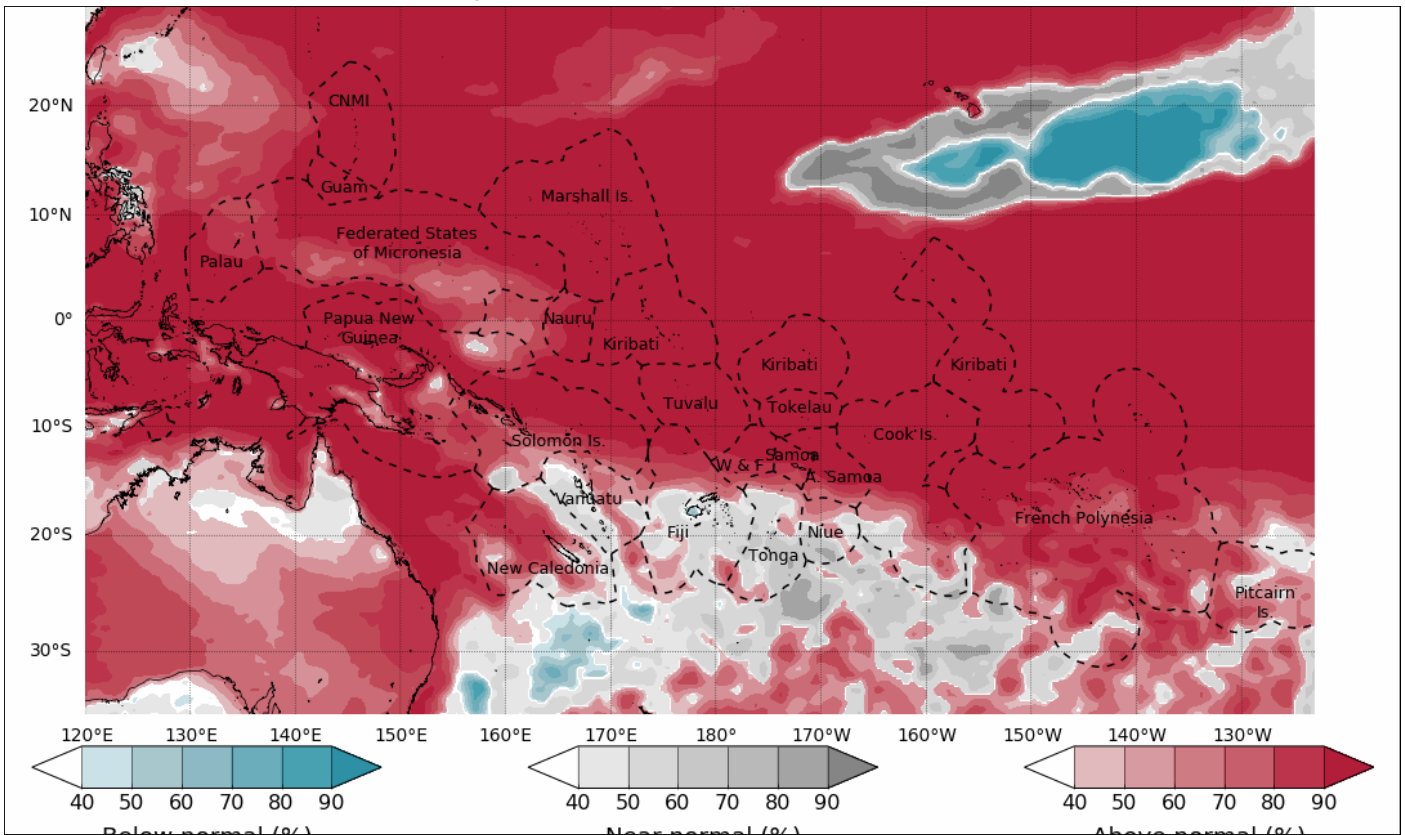
For September - November 2023, the models agree on above normal rainfall being likely or very likely from FSM, southern and central RMI, much of the PNG Islands, Solomon Islands, Nauru, Tuvalu, and Kiribati (Gilbert, Phoenix and Line Islands). Below normal rainfall is likely or very likely for CNMI, Guam, eastern RMI, most of PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue, American Samoa, central and northern Cook Island, French Polynesia and Pitcairn Islands.

# SEASONAL TEMPERATURE OUTLOOK

September—November 2023



## Monthly Tmax and Tmin ACCESS-S Maps



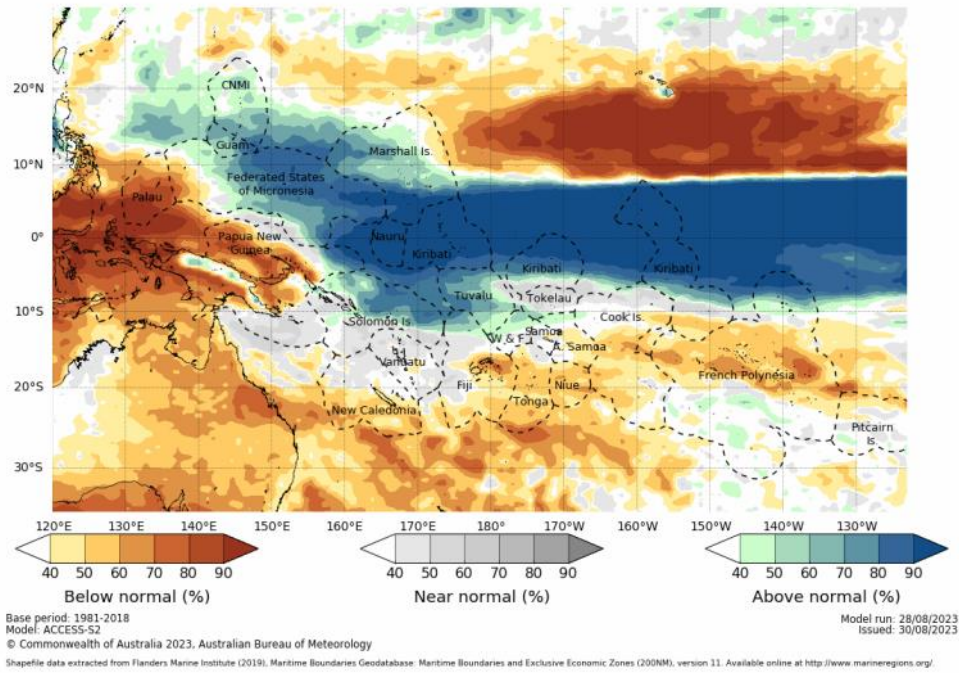
# SEASONAL RAINFALL OUTLOOK

September—November 2023

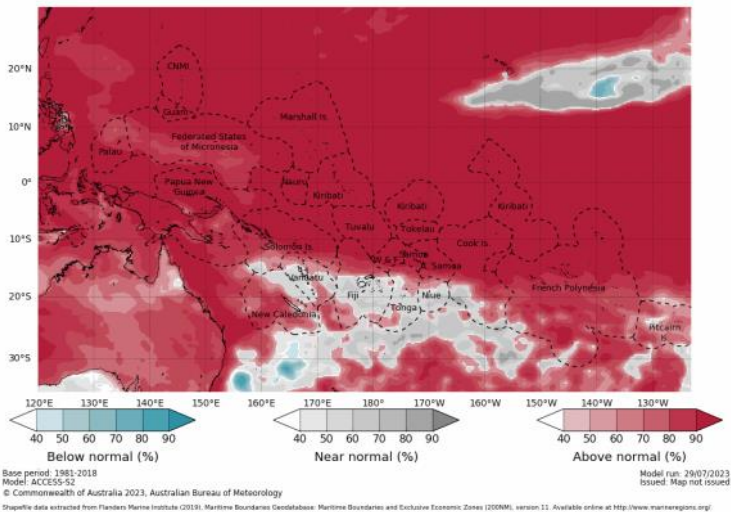


## Seasonal ACCESS-S maps

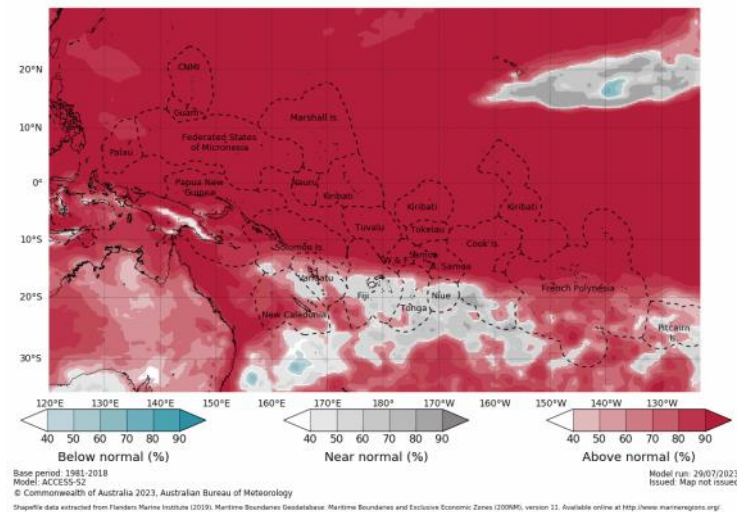
Tercile rainfall probabilities for September to November 2023



Tercile maximum temperature probabilities for August to October 2023



Tercile minimum temperature probabilities for August to October 2023



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

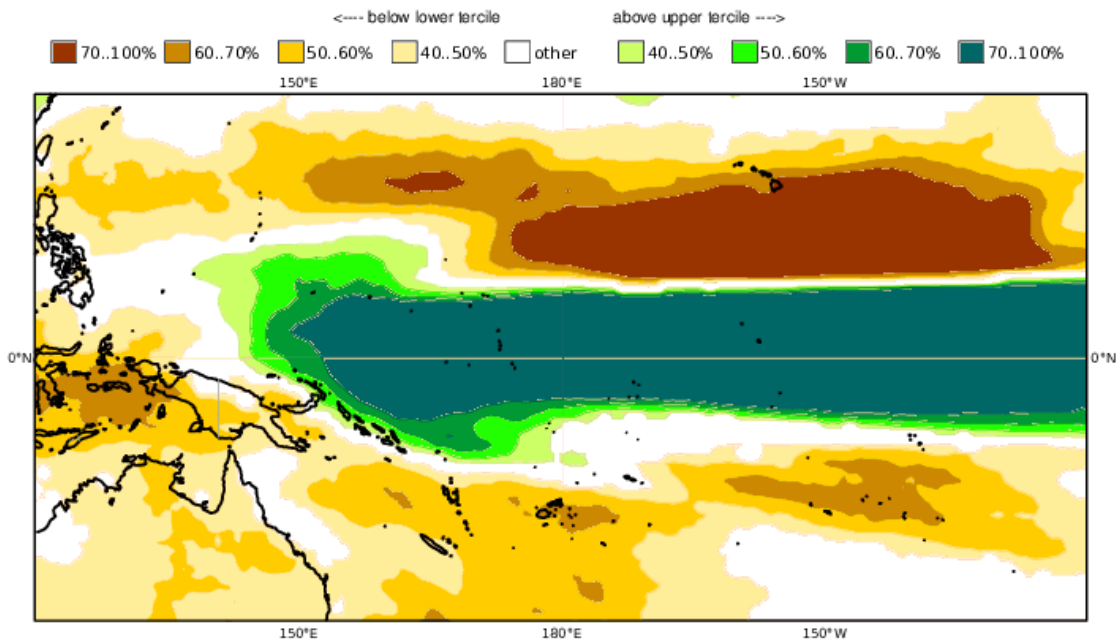
# SEASONAL RAINFALL OUTLOOK

September—November 2023



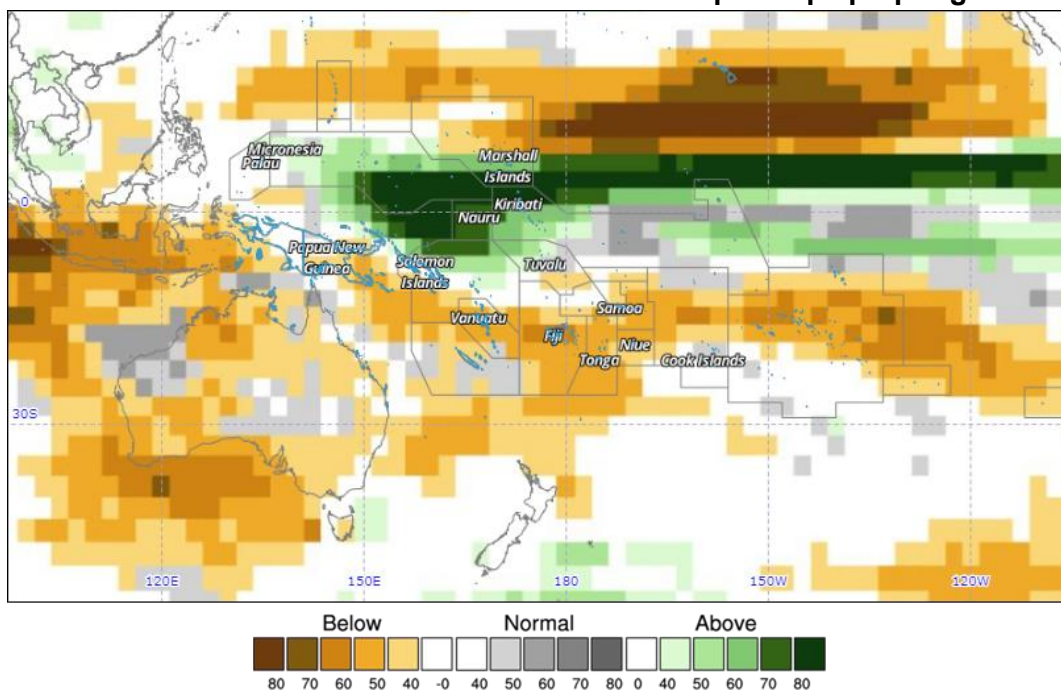
**Copernicus (C3S multi-system)-Rainfall**  
 Prob(most likely category of precipitation)  
 Nominal forecast start: 01/08/23  
 Unweighted mean

SUN 2023



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

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



Year: 2023, Season: SON, Lead Month: 3, Method: GAUS  
 Model: APCC, BOM, MSC, NASA, NCEP, PNU  
 Generated using CLIK® (2023-9-5)

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# TROPICAL CYCLONE

## 2022/2023 Season

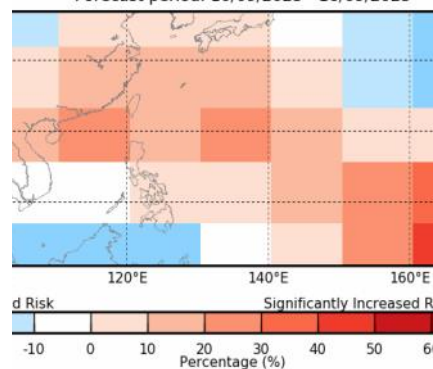


In the southwest Pacific, the 2022-23 tropical cyclone ended on 30th April 2023. The outlook for the season favoured enhanced risk for tropical cyclone activity in the western part of the basin. In the central part of the region, cyclone risks were considered to be generally near-normal to below normal. There were five cyclones (Hale, Irene, Gabrielle, Judy, Kevin) over the southwest Pacific, with three (Gabrielle, Judy and Kevin) reaching severe status, affecting Australia, New Caledonia, Vanuatu, Fiji and New Zealand. TC activity in the western north Pacific occurs year around and with the possible development of El Niño, an increase in TC activity is supported, as stated in the PICOF 12 regional statement.

It's important to remember that history showed that TC 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).

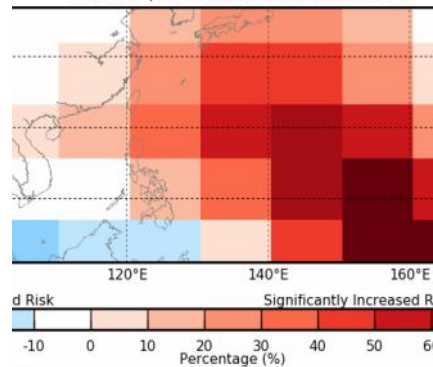
The weekly tropical cyclone forecast from the ACCESS-S model shows a significantly increased risk in the northwest Pacific between 10 September and 23 September around, Palau, FSM, Guam, CNMI, Philippines, China and Japan.

**ACCESS-S Weekly Forecasts –Northwest Pacific**  
 Difference from normal chance of Tropical Cyclone's in the North Pacific  
 Forecast period: 10/09/2023 - 16/09/2023



Model probability in overlapping 15 x 20 degree boxes  
 123. Australian Bureau of Meteorology Model: ACCESS\_S2 Model Run: 02/09/2023

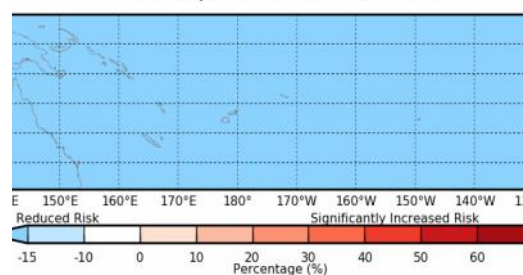
**ACCESS-S Weekly Forecasts –Northwest Pacific**  
 Difference from normal chance of Tropical Cyclone's in the North Pacific  
 Forecast period: 17/09/2023 - 23/09/2023



Model probability in overlapping 15 x 20 degree boxes  
 123. Australian Bureau of Meteorology Model: ACCESS\_S2 Model Run: 02/09/2023

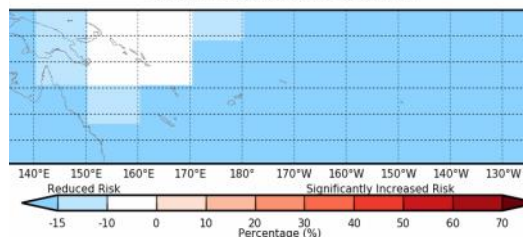
**ACCESS-S Weekly Forecasts –Southwest Pacific**

Difference from normal chance of Tropical Cyclone's in the South Pacific  
 Forecast period: 10/09/2023 - 16/09/2023



Model probability in overlapping 15 x 20 degree boxes  
 123. Australian Bureau of Meteorology Model: ACCESS\_S2 Model Run: 02/09/2023

Difference from normal chance of Tropical Cyclone's in the South Pacific  
 Forecast period: 17/09/2023 - 23/09/2023



Model probability in overlapping 15 x 20 degree boxes  
 south of Australia 2023. Australian Bureau of Meteorology Model: ACCESS\_S2 Model Run: 02/09/2023 Issue:

### Individual Model Links

UKMO Global long-range model probability maps: <http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/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/ps/japcc030703.jsp>

NASA GMAO GEOS-5: <http://gmao.gsfc.nasa.gov/research/ocean/>

NOAA CFSv2: <http://www.cpc.ncep.noaa.gov/products/CFSv2/CFSv2seasonal.shtml>

IRI for Climate and Society: <http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/>

# 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.

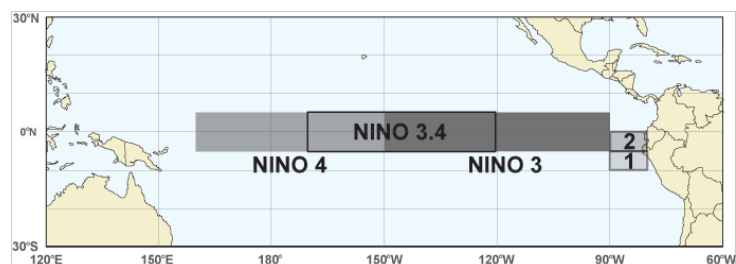
## 20 degrees Celsius Isotherm Depth

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