

# Monthly Climate Bulletin

November 2022



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Photo Credit: Molly Powers (SPC) Samoa Tide Gauge



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## Issued 09 December 2022

- La Niña continues in the tropical Pacific with models suggest a return to ENSO-neutral in January or February 2023.
- The Indian Ocean Dipole (IOD) has returned to neutral.
- The Madden-Julian Oscillation (MJO) is weak and is expected to remain weak for much of the coming fortnight.
- The Intertropical Convergence Zone (ITCZ) was displaced north of its average November position, while the South Pacific Convergence Zone (SPCZ) was displaced south-west over Vanuatu, Fiji, and Tonga.
- Sea surface temperatures (SSTs) in November 2022 were cooler than average across the central and eastern tropical Pacific Ocean, extending from around 170°E to the South American coastline and across a large area south of the equator, particularly in the east of the basin.
- The Coral bleaching status for 3 December shows 'Alert Level 2' in the northern and northeastern PNG mainland. 'Alert Level 1' observed in other parts of PNG, Palau, FSM, Solomon Islands and western Vanuatu.
- For December 2022-February 2023, the models agree on above normal rainfall for much of Palau, Guam, CNMI, most of FSM, central RMI, southern and southeastern PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands, and southern French Polynesia. The models also agree that below normal rainfall is likely or very likely for northern PNG and PNG Islands, southeastern FSM, western and northern most Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Samoa, American Samoa, northern Cook Islands, northern French Polynesia and Pitcairn Island.
- The ACCESS-S weekly tropical cyclone forecast model shows significant increased risk between 11 and 24 December for the northwest Pacific including the Philippines. There is no cyclone risk for the southwest Pacific for the period 11 to 24 December.

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# EL NIÑO–SOUTHERN OSCILLATION

Indian Ocean Dipole returns to neutral; La Niña to continue into the summer

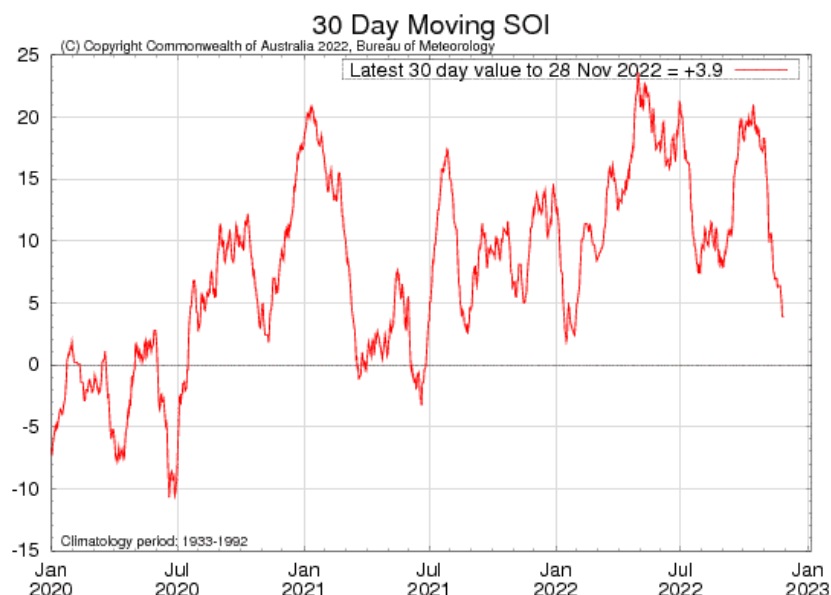
Click link to access [Climate Driver Update issued on 06 December 2022](#)

The Indian Ocean Dipole (IOD) has returned to neutral. Weekly values of the IOD index have been in the neutral range (between  $-0.4^{\circ}\text{C}$  and  $+0.4^{\circ}\text{C}$ ) for five consecutive weeks with the most recent value being  $-0.16^{\circ}\text{C}$ . The ending of the 2022 negative IOD event is consistent with the seasonal cycle of the IOD. The IOD has little influence on Australian climate while the monsoon trough is in the southern hemisphere (typically December to April). La Niña continues in the tropical Pacific. Atmospheric and oceanic indicators of the El Niño-Southern Oscillation (ENSO) reflect a mature La Niña.

Models suggest a return to ENSO-neutral in January or February 2023.

The Southern Annular Mode (SAM) is in a weakly positive phase and is likely to be neutral to positive through December.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 4 December was +7. The 90-day SOI value was +14.



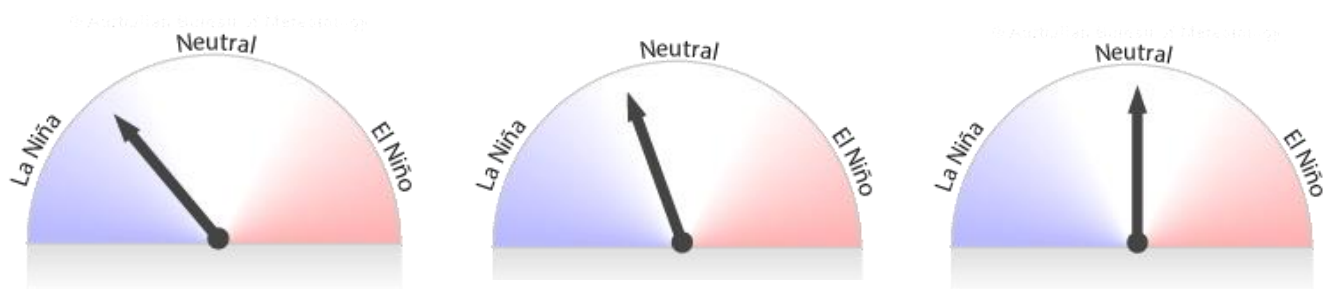


# EL NIÑO–SOUTHERN OSCILLATION

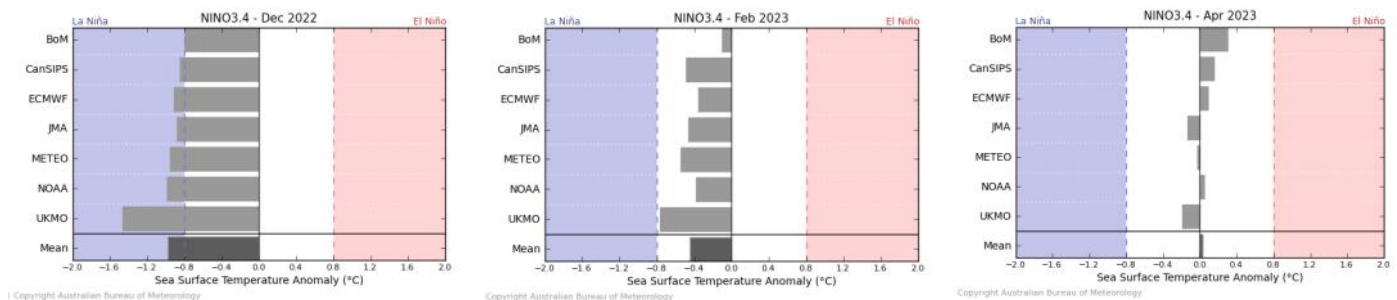
Indian Ocean Dipole returns to neutral; La Niña to continue into the summer

Click link to access [Climate Driver Update issued on 06 December 2022](#)

## Bureau of Meteorology NINO3.4 ENSO Model Outlooks for December, February and April



## 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>



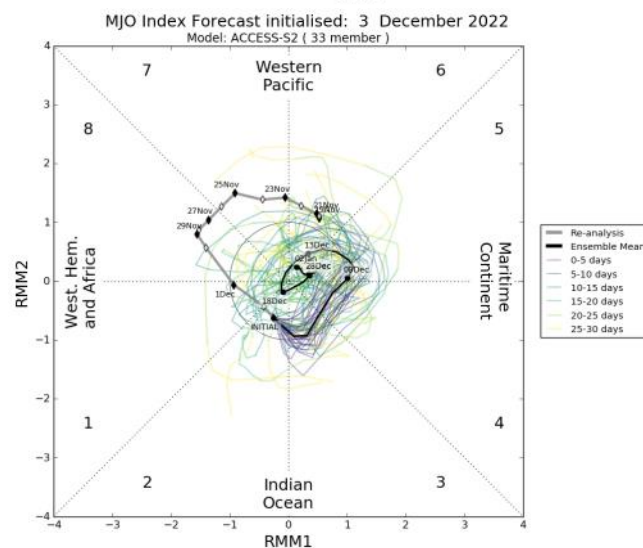
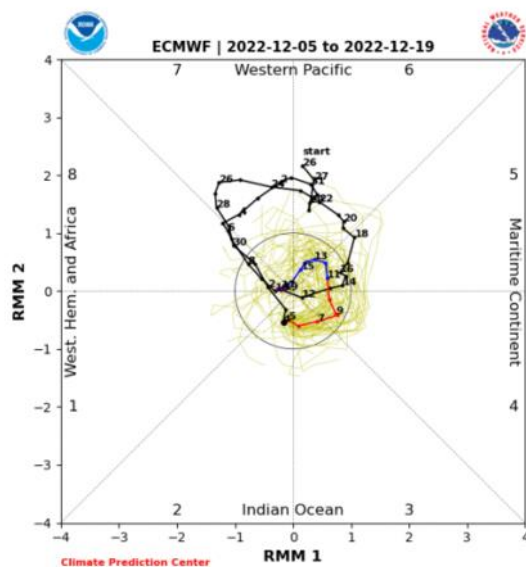
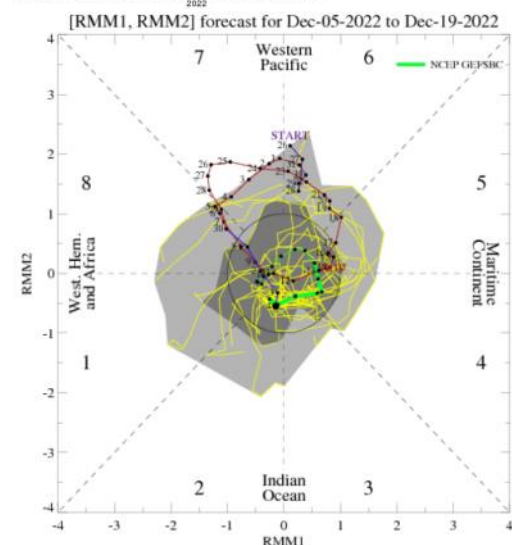
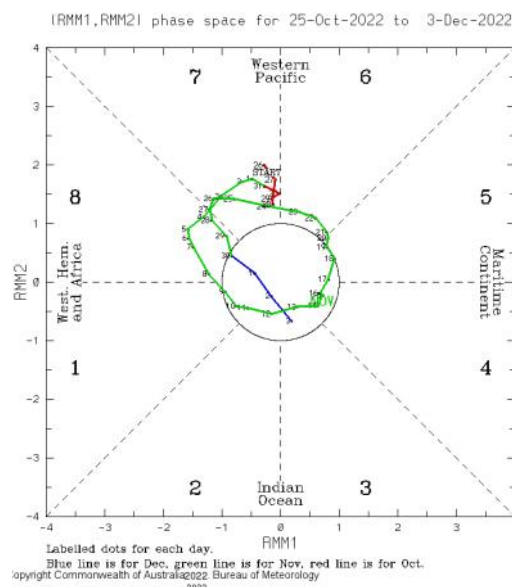
# MADDEN–JULIAN OSCILLATION

Click link to access [Tropical Climate Update](#) [Issued on Tuesday 29 November 2022]

A moderate pulse of the Madden-Julian Oscillation (MJO) propagated over the far western Pacific and western hemisphere during the first week of November before becoming weak or indiscernible during the second and third weeks of the month. In the last ten days of November, however, a moderate MJO pulse emerged over the western Pacific.

The Madden-Julian Oscillation (MJO) is currently weak and is expected to remain weak for much of the coming fortnight. Its influence on Australian and western Pacific rainfall over the coming week is expected to be small.

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



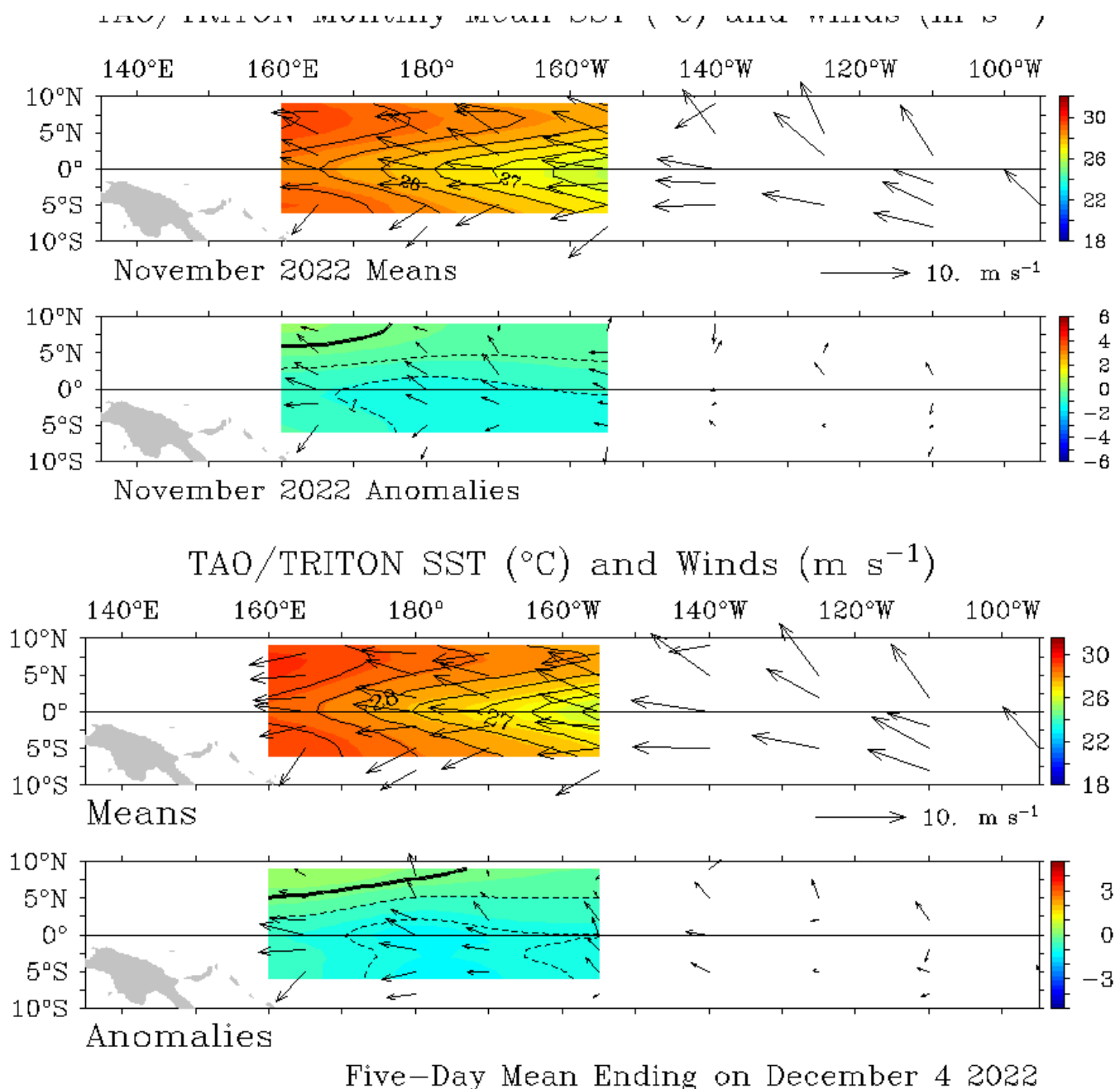
# WIND



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

The trade winds were stronger than normal in the western and central equatorial Pacific over the five days ending 4 December. Similarly, they were stronger than normal in the western and central equatorial Pacific in November, in keeping with the mature La Niña affecting the Pacific Basin.

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



# CLOUD AND RAINFALL

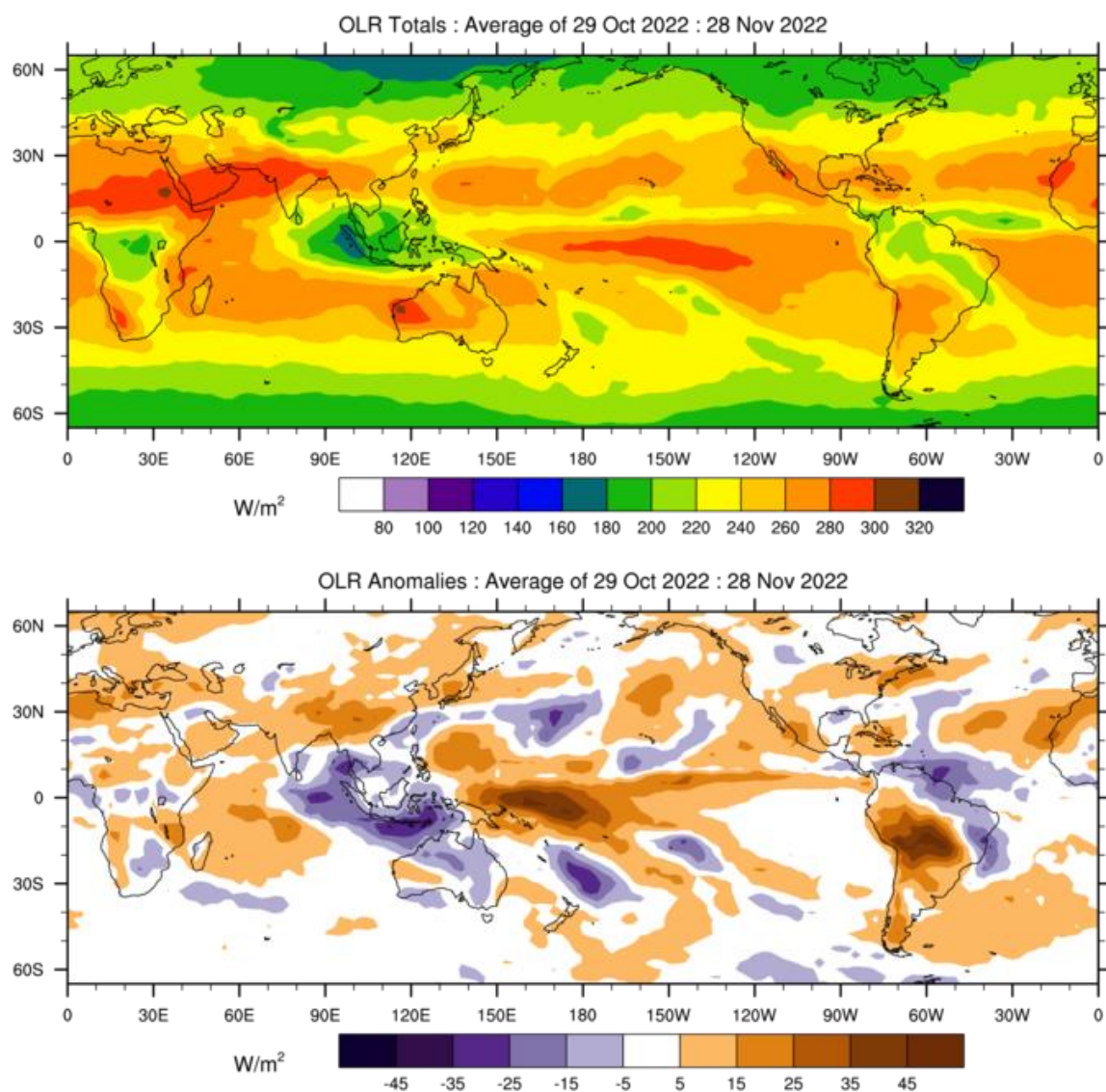
Click link to access [OLR](#)



The main feature of the November 30-day OLR total and anomaly maps was the dipole pattern across the Indo-Pacific indicating a mature La Niña. The centre of low OLR (increased convection) was situated over the Maritime Continent, with extensions to the southeast across Australia, and to the northwest towards the Bay of Bengal. In contrast, the centre of high OLR (reduced convection) was located on and just south of the equator west of the Date Line, with its main extension reaching across the Pacific Basin suggesting the Intertropical Convergence Zone (ITCZ) was less active than normal. Another extension to the southeast was adjacent to a small region of increased convection northeast of New Zealand, indicating a southwest displacement of the South Pacific Convergence Zone (SPCZ).

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 ( $\text{W/m}^2$ ) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in  $\text{W/m}^2$ . In the bottom panel, negative values (blue shading) represent above normal cloudiness

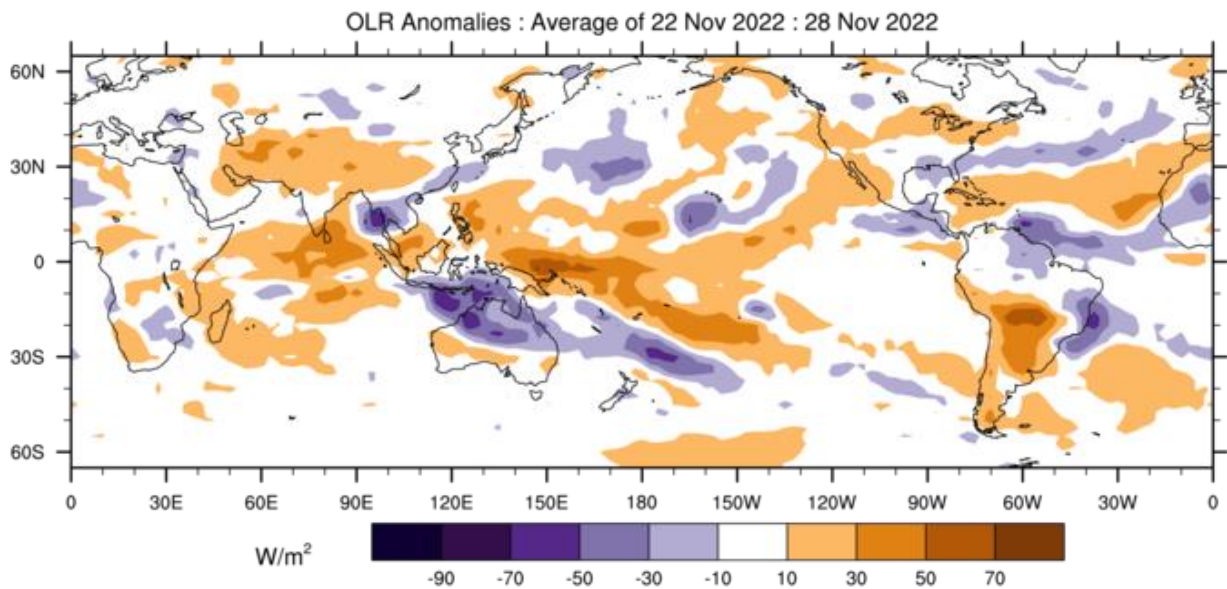
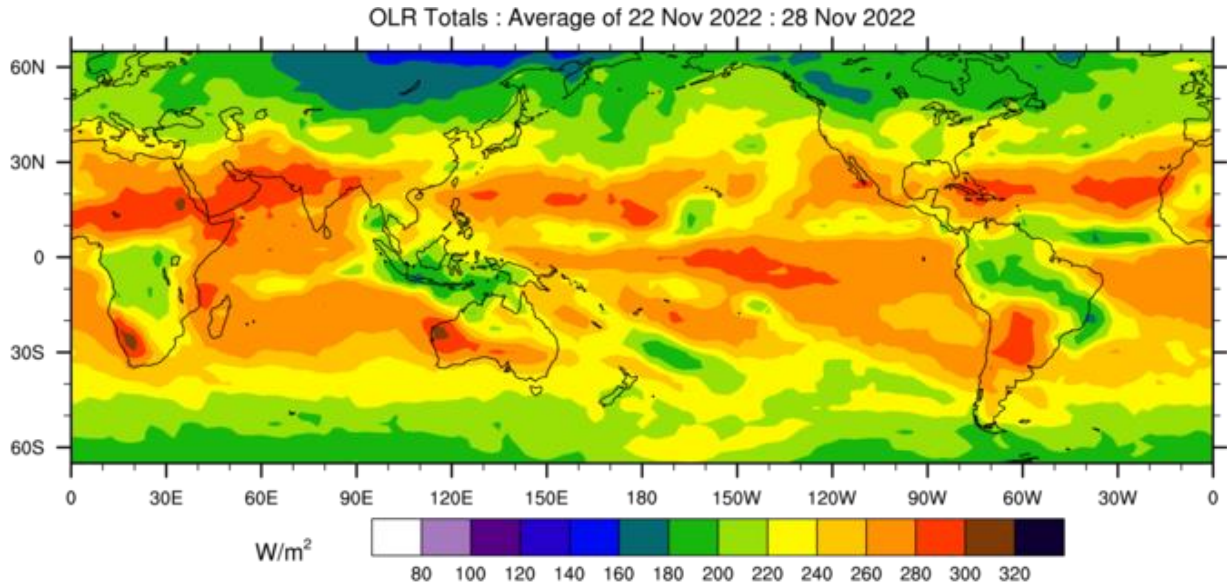
## OLR Total and Anomalies, 30 Day OLR



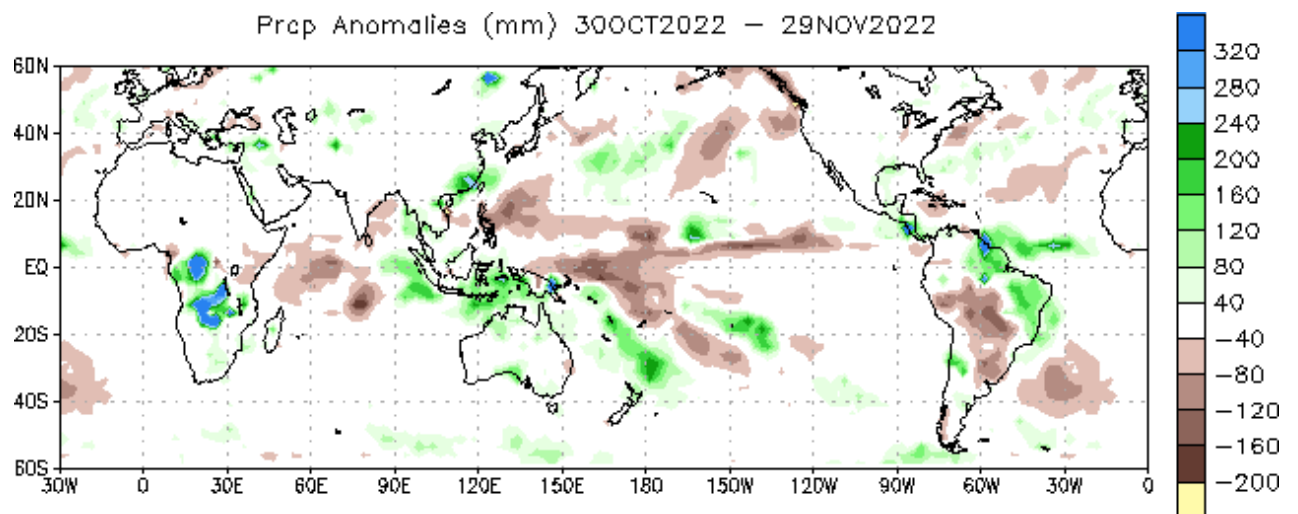
(C) Copyright Commonwealth of Australia 2022. Bureau of Meteorology



## OLR Total and Anomalies, 7 Day OLR

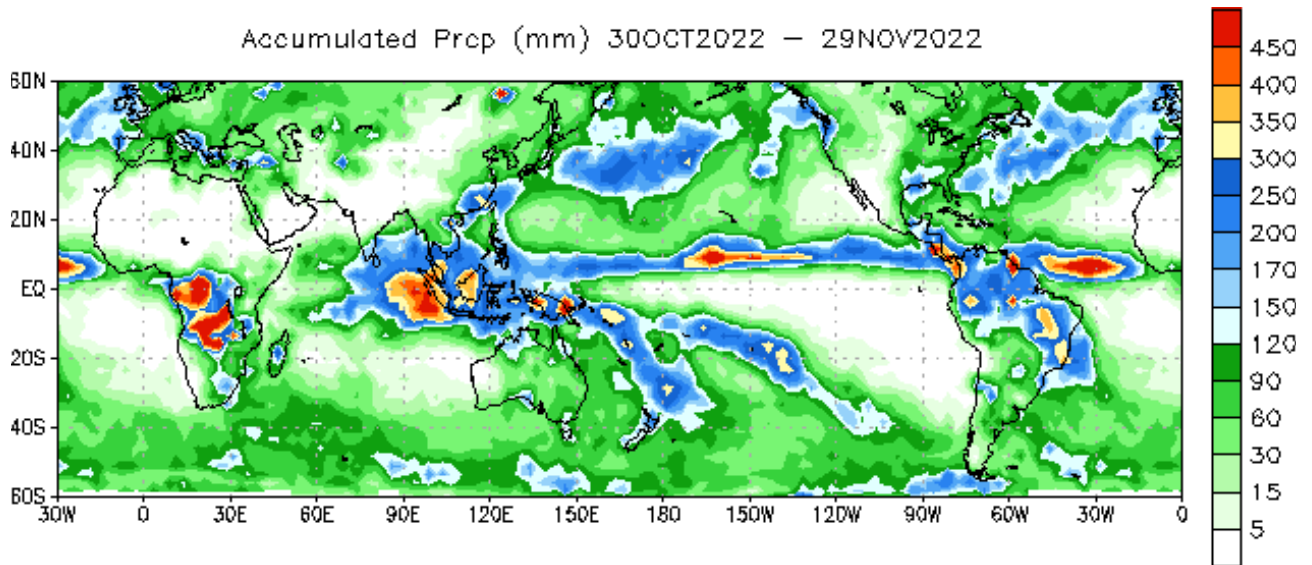


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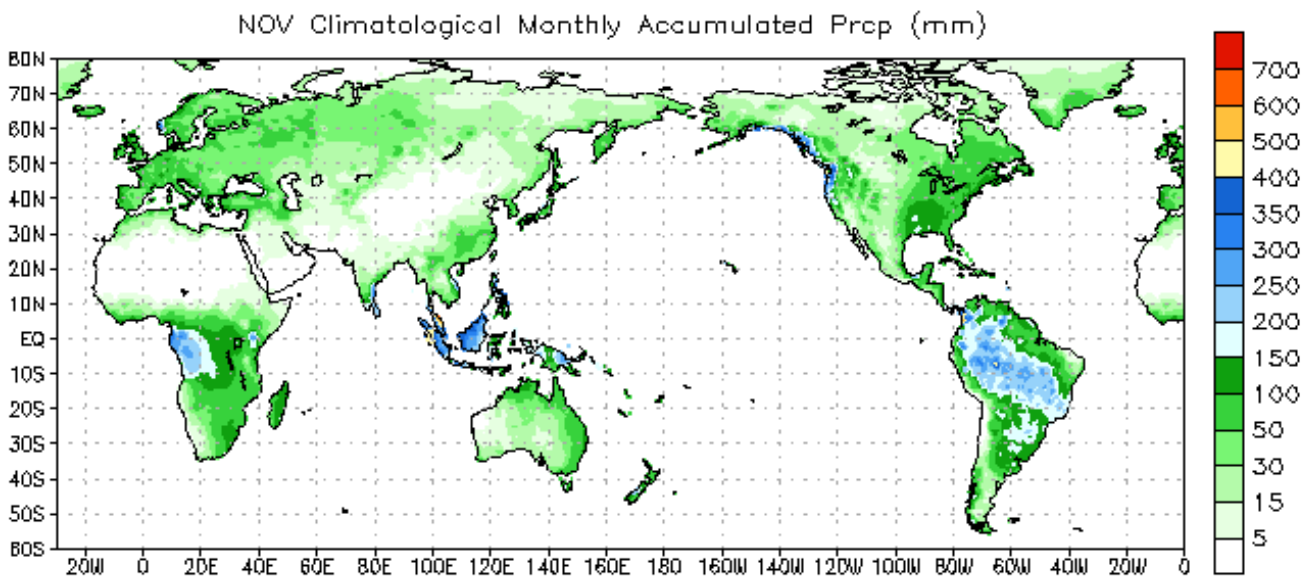


Data Source: NCEP CMAP Precipitation  
Climatology (1991–2020)

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

# OCEAN CONDITIONS

## SEA SURFACE TEMPERATURE

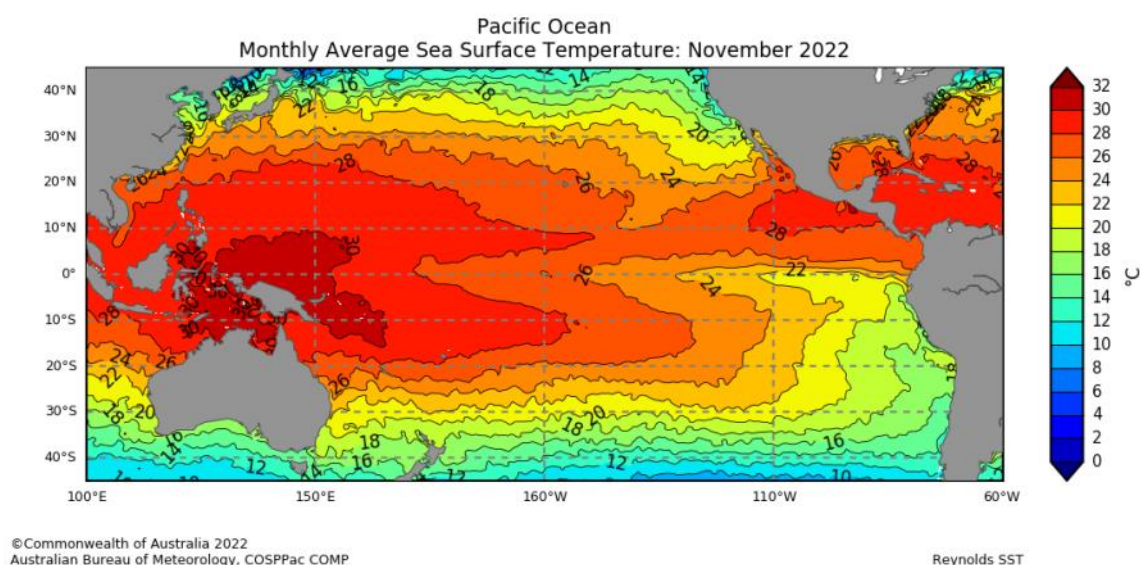


Click link to access [Pacific Community COSPPac Ocean Portal](#)

Sea surface temperatures (SST) in November 2022 were cooler than average across the central and eastern tropical Pacific Ocean, extending from around 170°E to the South American coastline and also across a large area south of the equator, particularly in the east of the basin. Cool anomalies for November reduced in strength and extent compared to those in October and in September. Warm anomalies to the west and north of Australia, apart from the Coral Sea and Great Barrier Reef, have also reduced in strength.

Highest SSTs on record for the month of November were observed in most of Papua New Guinea, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, and southern Tonga. Regions of very much above average (deciles 10) SST were present in parts of Palau's EEZ, western and central FSM, northwest RMI, northern Solomon Islands, parts of central and southern Tonga. Regions of above average (deciles 8-9) SST for November were observed across most of the COSPPac countries from central FSM, central RMI to eastern Tonga. Average (4-7) to very much below average (decile 1) SSTs were observed over far eastern FSM, southern RMI, Nauru, Kiribati, northern Tuvalu, Tokelau, Samoa, parts of Niue, northern Cook Islands and central and northern French Polynesia. The lowest on record SSTs were observed over southern Phoenix Islands.

### Mean Sea Surface Temperature



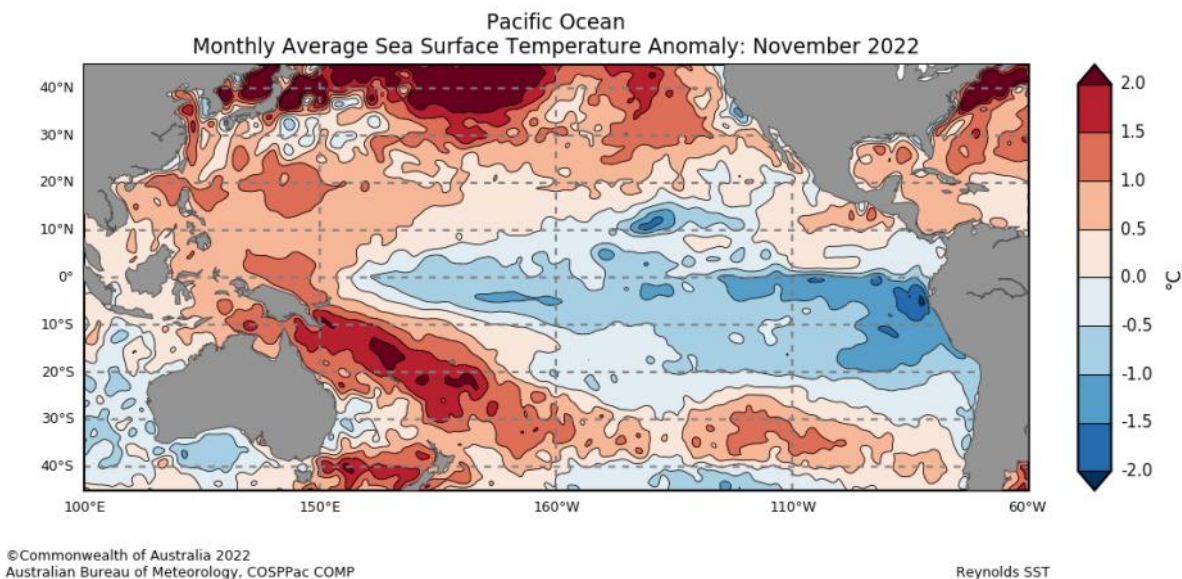


# OCEAN CONDITIONS

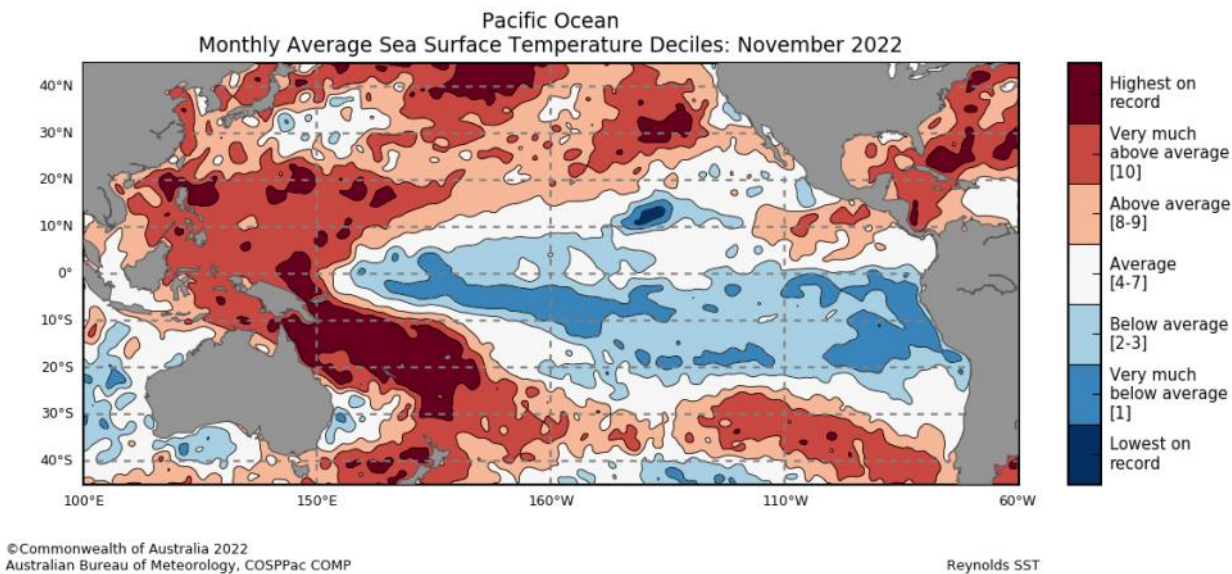
Click link to access [SEA SURFACE TEMPERATURE](#)



## Anomalous Sea Surface Temperature



## Sea Surface Temperatures Deciles



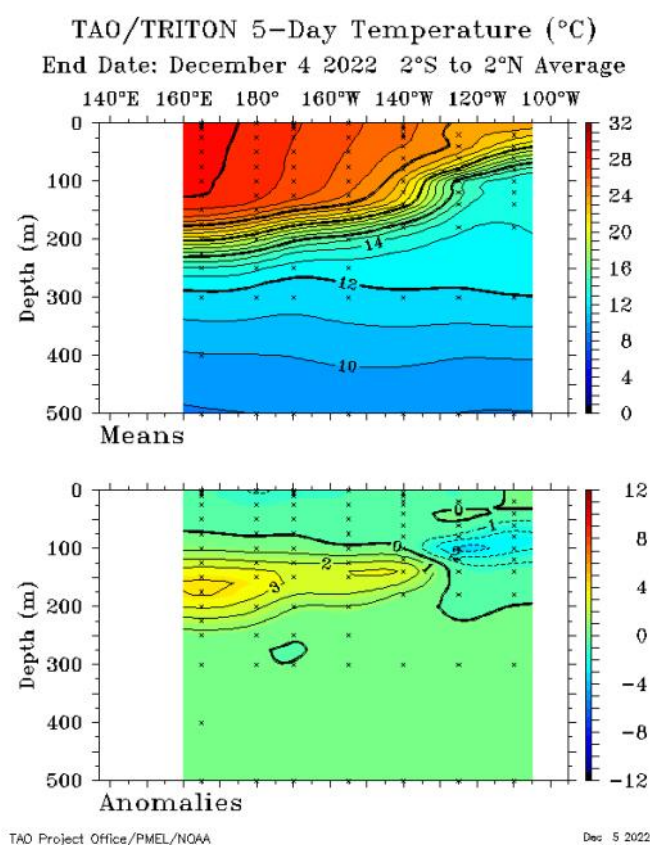
# OCEAN CONDITIONS

## SUB SURFACE

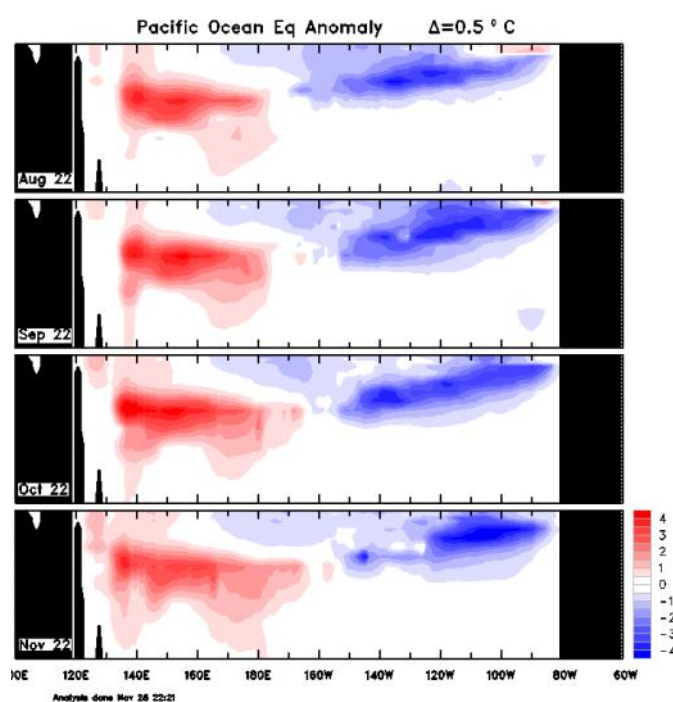


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 1 December 2022) shows cool anomalies from the surface to around 150 m depth in the eastern half of the equatorial Pacific. Anomalies reached more than 2 degrees cooler than average across much of the region east of 130°W. Warm anomalies persist between around 100 and 250 m depth west of 160°W. Anomalies reached more than 2 degrees warmer than average across much of this region. Compared to October, warm anomalies in November have extended farther into the central Pacific while cool anomalies have contracted slightly towards the east.

### 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

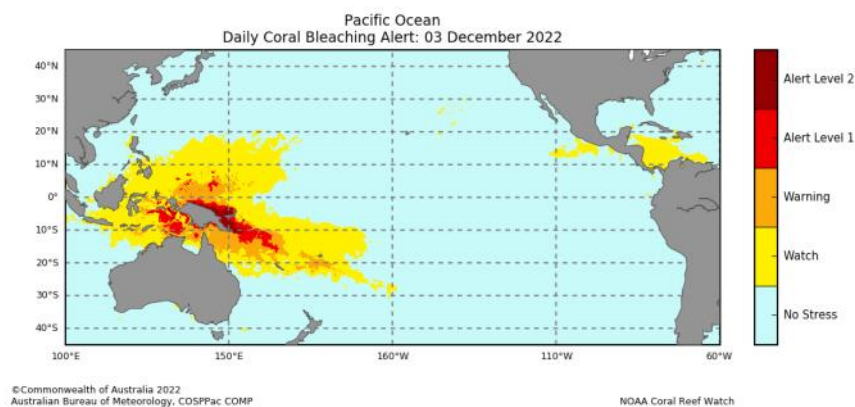
## CORAL BLEACHING



The daily Coral Bleaching Alert status for 3 December 2022 shows 'Alert Level 2' in the northern and north-eastern PNG mainland. 'Alert Level 1' observed in other parts of PNG, Palau, FSM, Solomon Islands and western Vanuatu. Patches of 'Warning' were present in southern FSM, northern and southern most part of PNG, southern Solomon Islands, northern New Caledonia, northwest Vanuatu and southern Fiji. The four weeks Coral Bleaching Outlook to 25 December shows 'Alert Level 2' for northern PNG, southern Solomon Islands and parts of western Vanuatu. 'Alert Level 1' for parts of FSM, parts of northern and southeastern PNG and southern Solomon Islands. The 'Warning' alert is present for central FSM, northern most PNG, most of Solomon Islands, northern New Caledonia, central and northern Vanuatu and parts of Fiji.

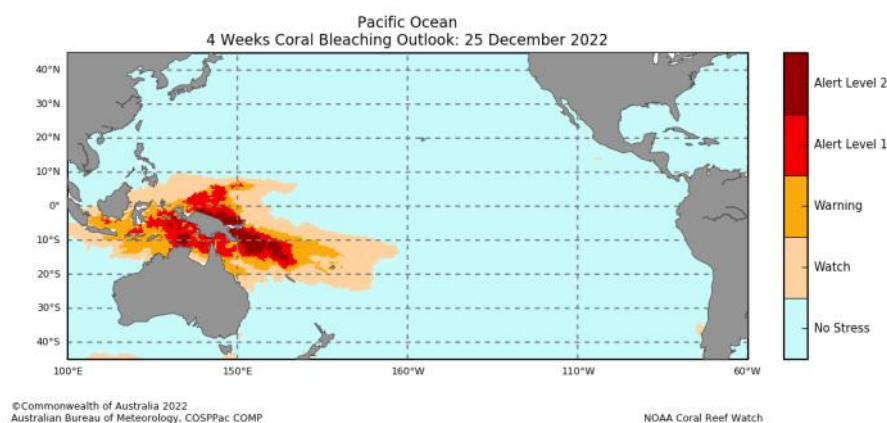
### Daily Coral Bleaching Alert

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



### 4 Weeks Coral Bleaching Outlook

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



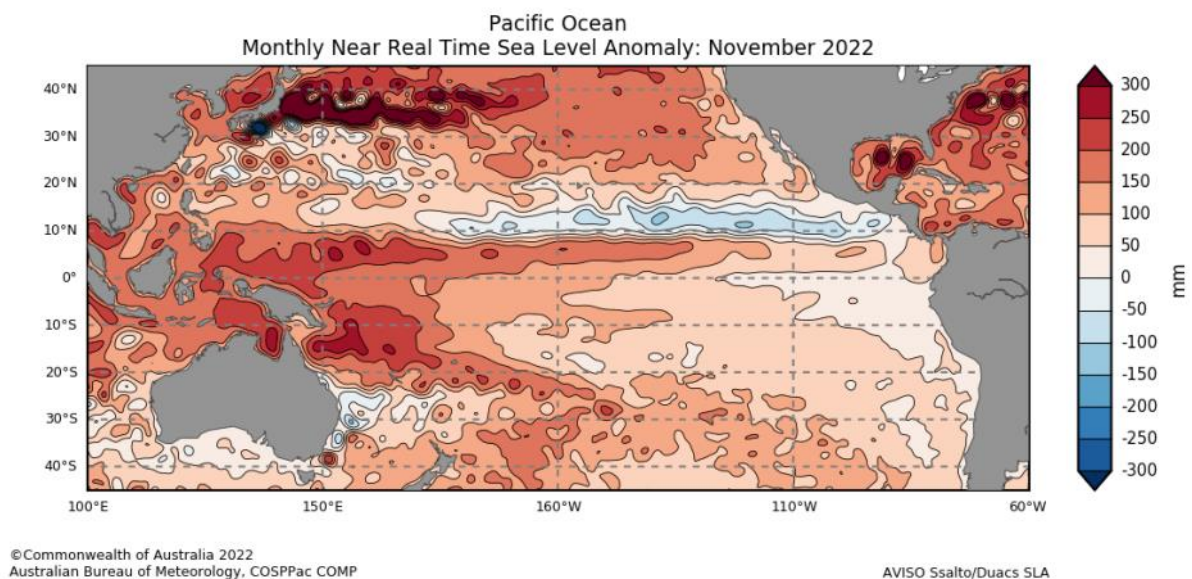
# OCEAN CONDITIONS

## OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea level was above normal for most of the COSPPac countries. Anomalies above 250mm were observed in southeastern PNG, Coral Sea region, and patched over eastern FSM. Anomalies of 200-250mm were observed in parts of Palau, central FSM, central RMI, southern Solomon Islands, Vanuatu, and patches in Fiji, Tonga and Niue. Patches of anomalies 150-200mm were observed in parts of Palau, FSM, southern RMI, northern PNG, Nauru, western Kiribati, most of Fiji, Tonga, Niue and southern Cook Islands.

### Monthly Sea Level Anomalies

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

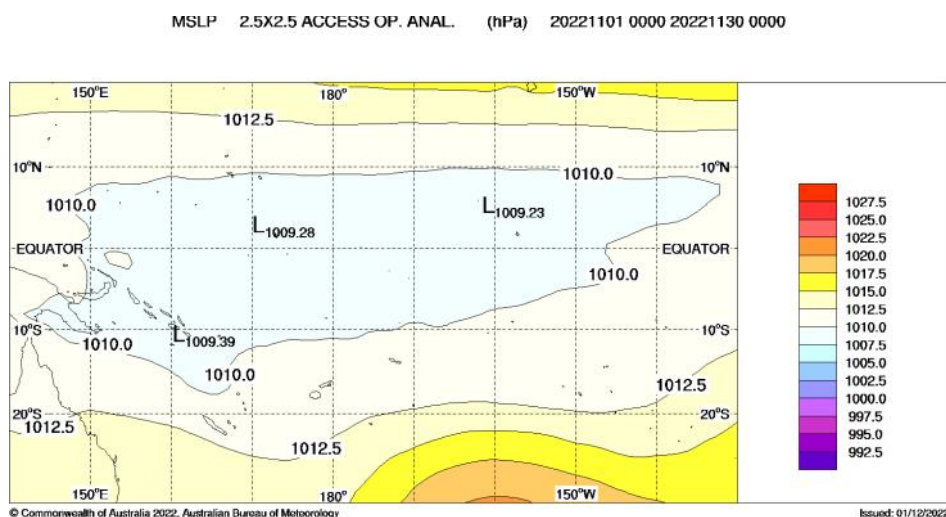


# MEAN SEA LEVEL PRESSURE

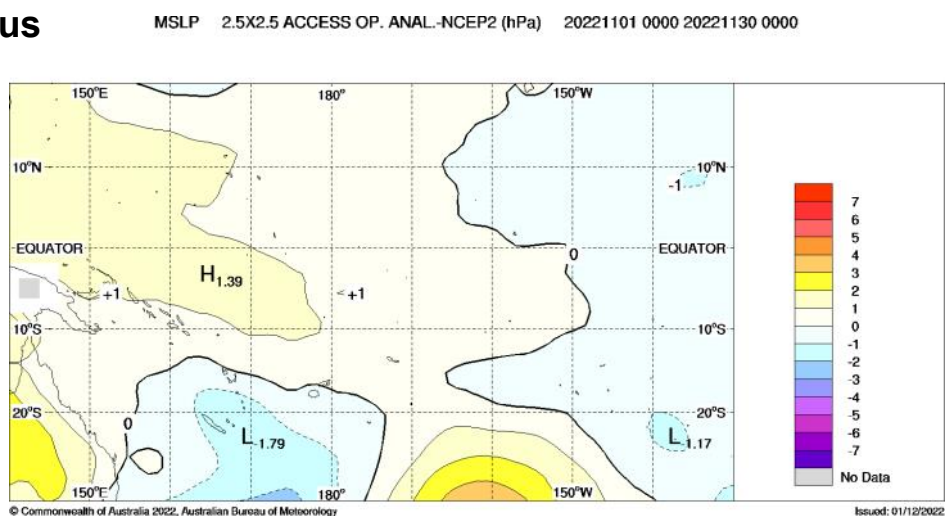
The November mean sea level pressure (MSLP) anomaly map shows mostly negative anomalies of -1hPa or greater over southern Vanuatu, New Caledonia and towards New Zealand. Positive anomalies of +1hPa or greater were analysed over northern Solomon Islands and northern PNG towards FSM, Guam and CNMI.

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

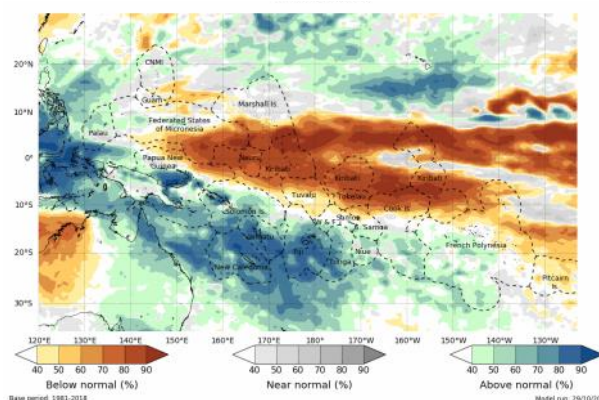
## December 2022—February 2023



The ACCESS-S model forecast for December 2022, favours below normal rainfall for southeastern FSM, PNG Islands, far southern RMI, northern Solomon Islands EEZ, Nauru, western, central and the south of eastern Kiribati, Tuvalu, Rotuma (Fiji), Tokelau, Wallis and Futuna, Samoa, American Samoa, northern and central Cook Islands, northern and central French Polynesia and Pitcairn Island. Above normal rainfall is likely or very likely for Palau, Guam, CNMI, most of FSM, much of RMI, most of PNG, most of Solomon Islands, New Caledonia, Vanuatu, most of Fiji, central and southern Tonga, southern Niue, southern Cook Islands and patches of southern French Polynesia.

The three-month rainfall outlook (December 2022-February 2023) is very similar to the December outlook as it indicates favours below normal rainfall is likely or very likely for northern PNG, PNGS's Momase region and the PNG Islands, south-eastern FSM, far southern RMI, western Solomon Islands and the far north of its EEZ, Nauru, most of Kiribati, Tuvalu, Wallis and Futuna, Tokelau, Samoa, American Samoa, northern and central Cook Islands, northern and central French Polynesia and Pitcairn Island. Above normal rainfall is likely or very likely for Palau, CNMI, Guam, most of FSM, northern and central RMI, the south-east of PNG's EEZ, much of Solomon Islands, New Caledonia, Vanuatu, Fiji, southern and central Tonga, southern Niue, and the southern Cook Islands and patches in far southern French Polynesia.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for December 2022-February 2023 differs from the ACCESS-S model in only some minor details, the main ones being a stronger wet signal over the southern Cook Islands, Niue, and the southern PNG mainland.

The APEC Climate Centre multi-model for December 2022-February 2023 is also very similar to the ACCESS-S model. The main differences are an increased wet signal for Rotuma, Niue, the southern PNG mainland, central Solomon Islands, and northern Tonga.

For December 2022-February 2023, the models unanimously agree on above normal rainfall for much of Palau, Guam, CNMI, western and central FSM, central RMI, New Caledonia, Vanuatu, Fiji (except Rotuma), central and southern Tonga, and southern French Polynesia. The models are also unanimous in showing that below normal rainfall is likely or very likely for northern PNG and PNG Islands, south-eastern FSM, northern-most Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Samoa, American Samoa, northern Cook Islands, northern French Polynesia and Pitcairn Island.

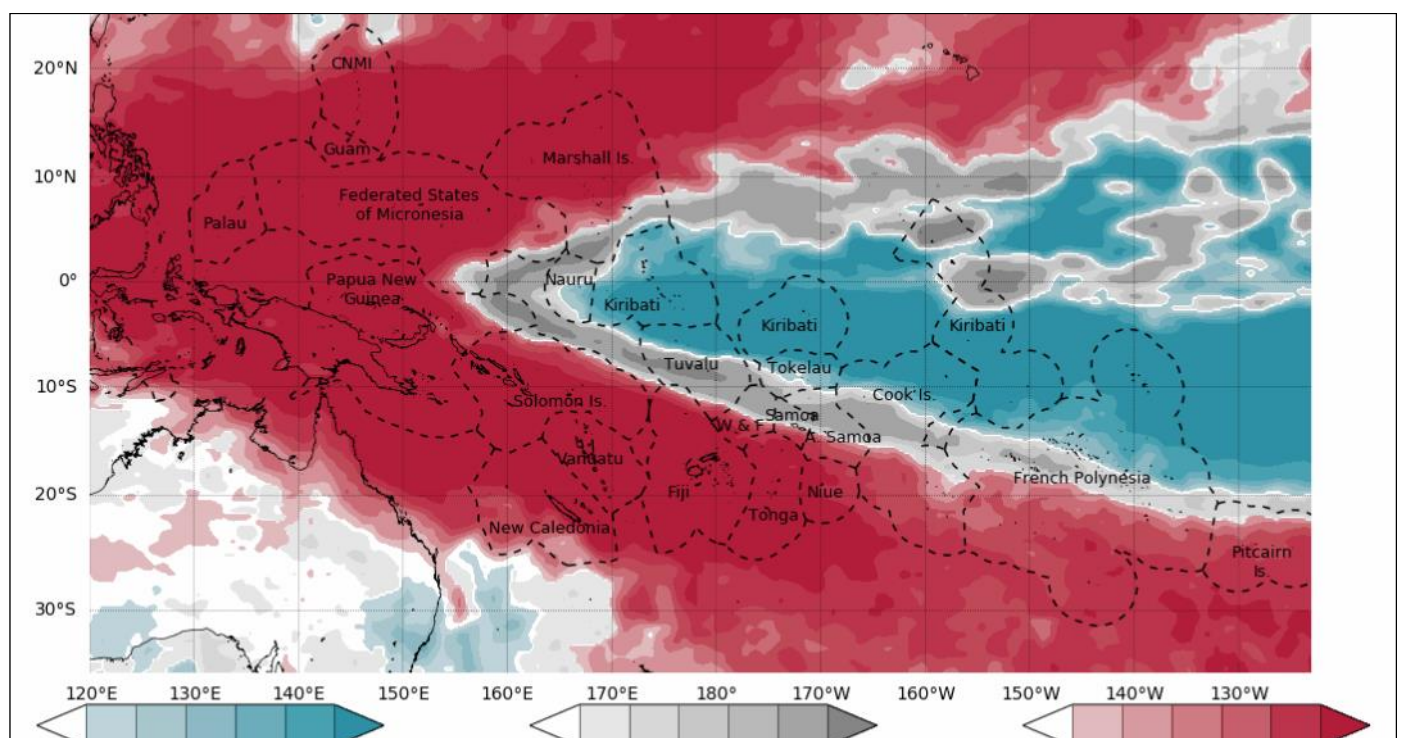
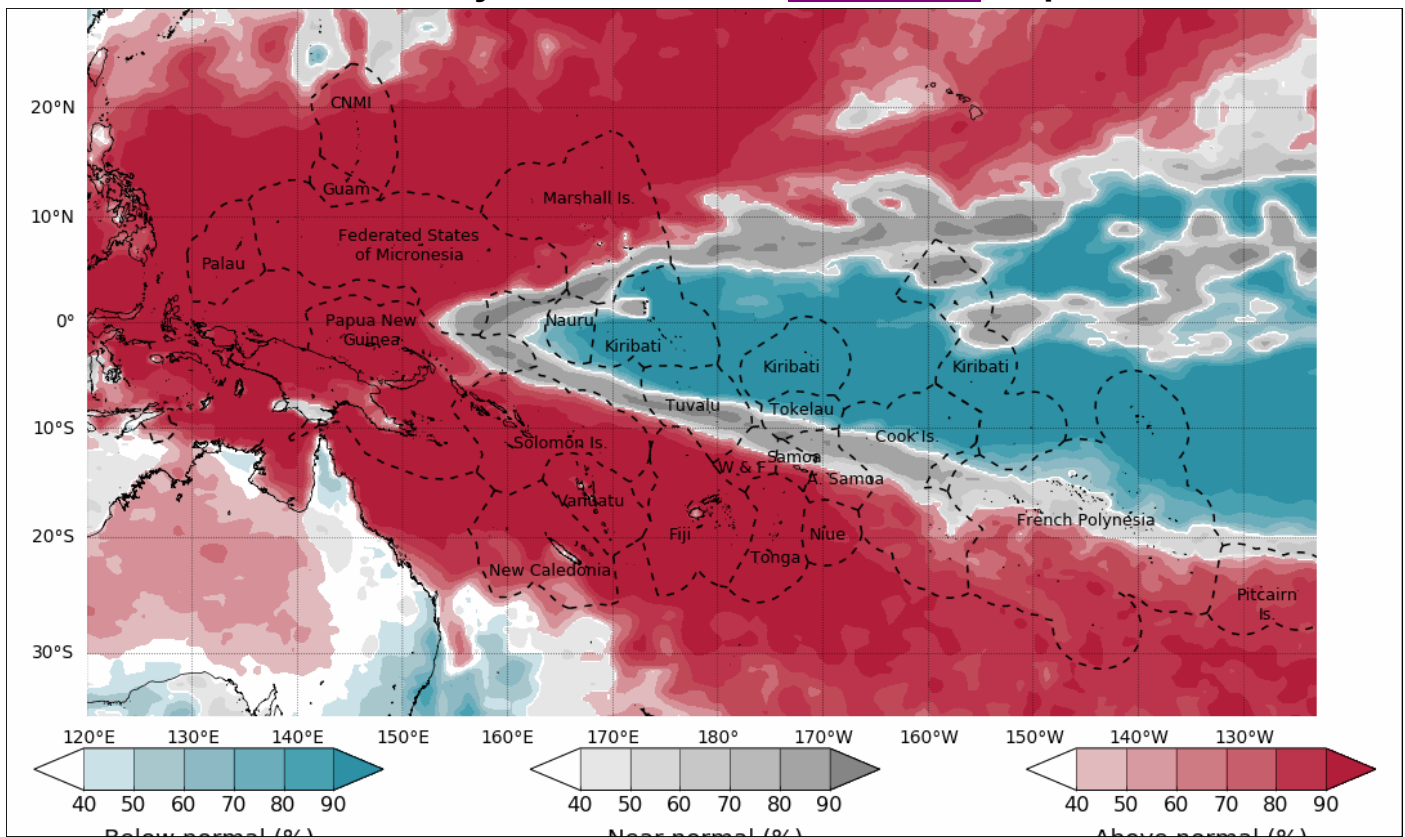


# SEASONAL TEMPERATURE OUTLOOK

December 2022—February 2023



Monthly Tmax and Tmin [ACCESS-S](#) Maps





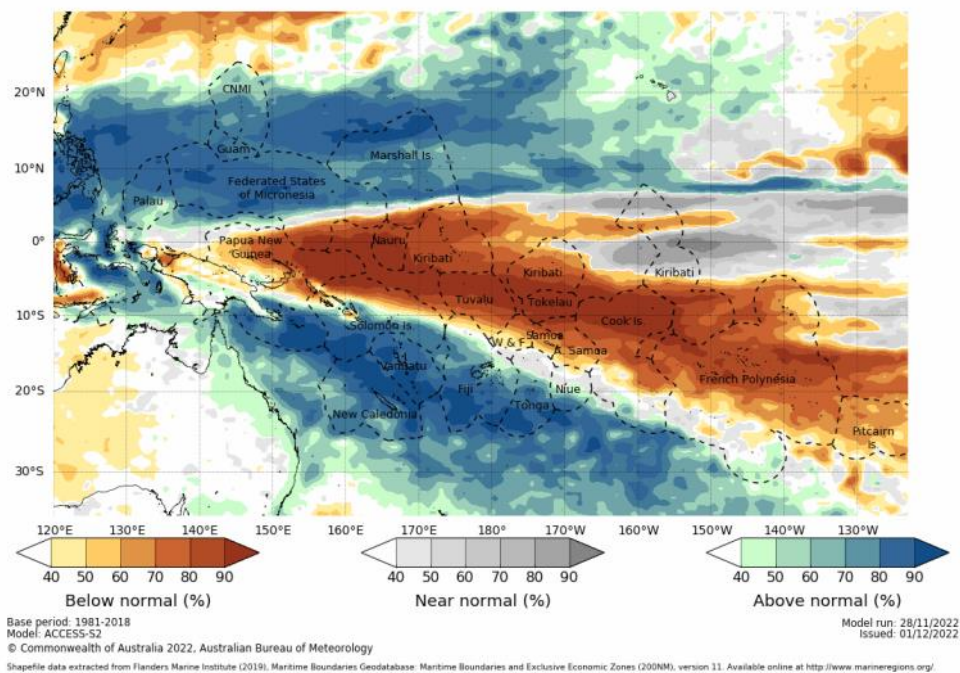
# SEASONAL RAINFALL OUTLOOK

December 2022—February 2023

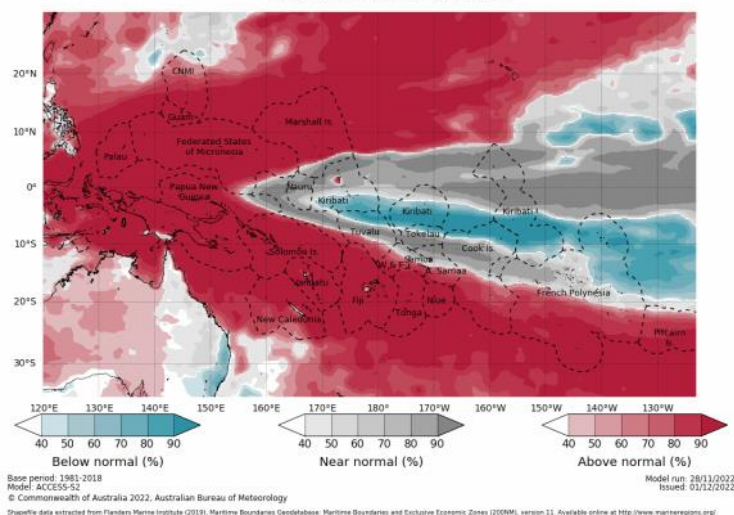


## Seasonal ACCESS-S maps

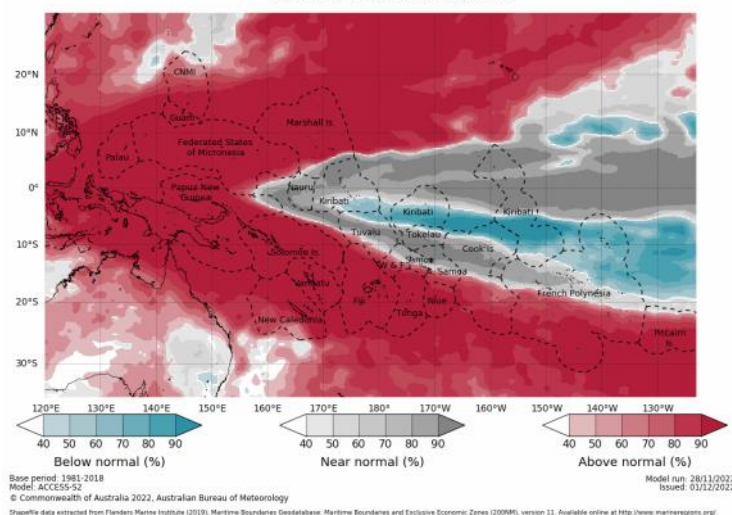
Tercile rainfall probabilities for  
December 2022 to February 2023



Tercile maximum temperature probabilities for  
December 2022 to February 2023



Tercile minimum temperature probabilities for  
December 2022 to February 2023



'About ACCESS-S <http://access-s.climatecloud/>

# SEASONAL RAINFALL OUTLOOK

December 2022—February 2023



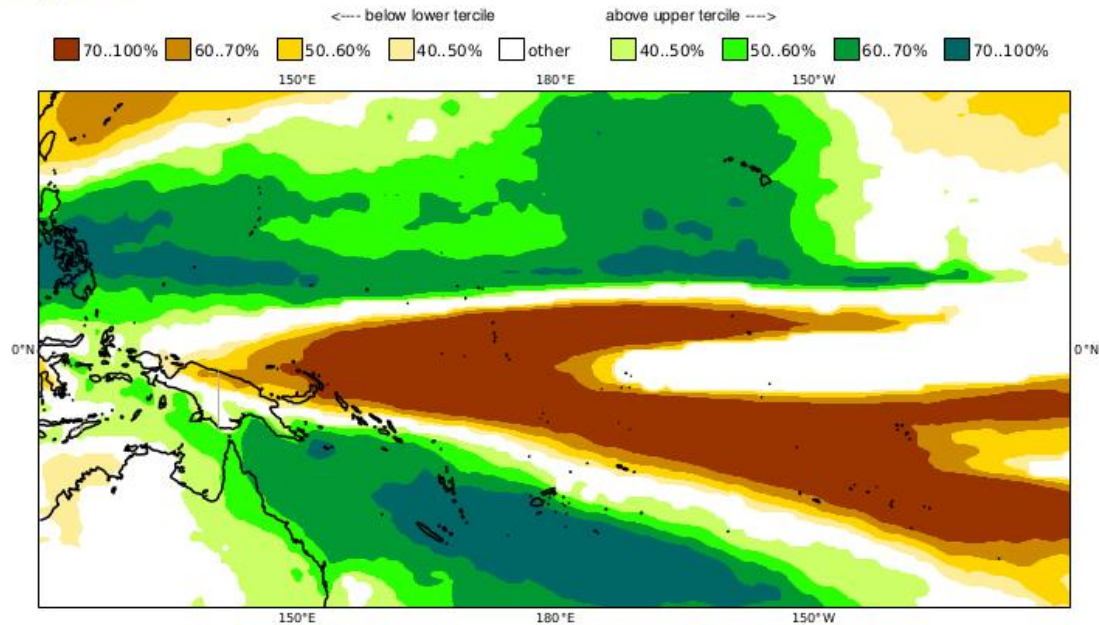
## Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

DJF 2022/23

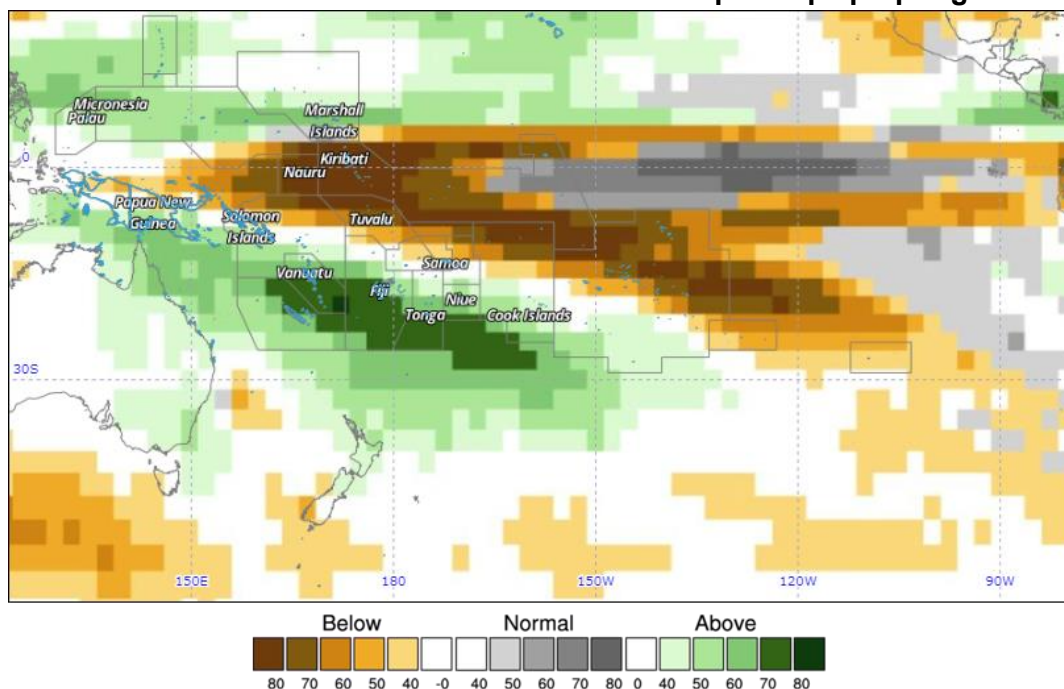
Nominal forecast start: 01/11/22

Unweighted mean



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

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



Year: 2022, Season: DJF, Lead Month: 3, Method: GAUS

Model: APCC, BOM, CMCC, CWB, MSC, NASA, NCEP, PNU

Generated using CLIK® (2022-12-2)

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# TROPICAL CYCLONE

## 2022/2023 Season



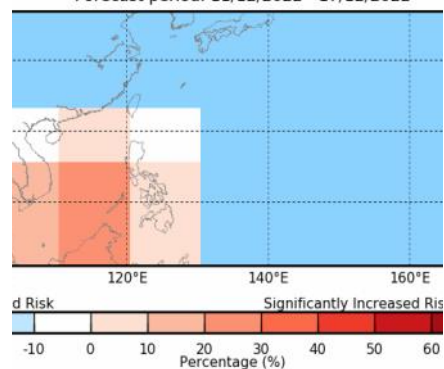
The northwest Pacific, 2021-22 tropical cyclone season is year around, with most cyclones occurring between May and October. Twenty-four named TCs have occurred as of 31 October with four reaching super typhoon intensity. Most TCs in the southwest Pacific occur between November to April. Associated with the existing La Niña, models favour slightly enhanced TC risk in the western Pacific. In the central part of south Pacific, TC risks are generally near normal to below normal. These forecasts are part of the PICO-11 Regional Statement.

It's important to remember that 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. Communities should remain vigilant, and follow forecast information provided by their National Meteorological and Hydrological Service (NMHS).

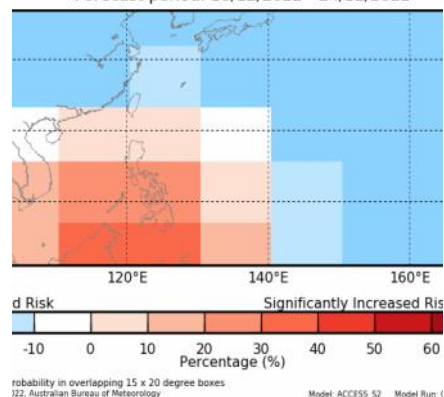
The weekly tropical cyclone forecast from the ACCESS-S model shows a modest to significantly increased risk between 11 and 24 December for the northwest Pacific including the Philippines and Palau. The cyclone risk for the southwest Pacific for the period 11 to 24 December is close to normal.

### ACCESS-S Weekly Forecasts –Northwest Pacific

from normal chance of Tropical Cyclone's in the North Pacific  
Forecast period: 11/12/2022 - 17/12/2022

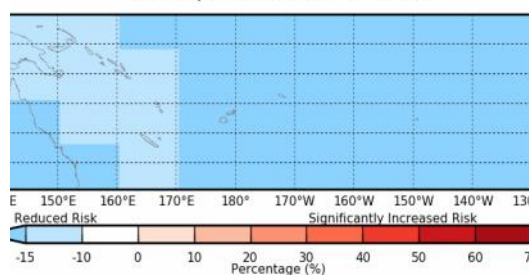


from normal chance of Tropical Cyclone's in the North Pacific  
Forecast period: 18/12/2022 - 24/12/2022

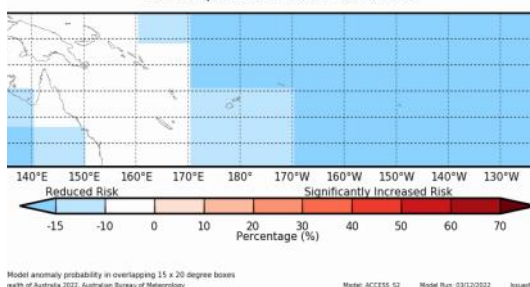


### ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the South Pacific  
Forecast period: 11/12/2022 - 17/12/2022



Difference from normal chance of Tropical Cyclone's in the South Pacific  
Forecast period: 18/12/2022 - 24/12/2022



### 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.

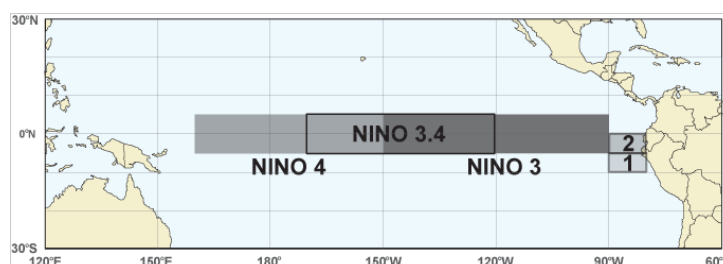
## 20 degrees Celsius Isotherm Depth

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