

Monthly Climate Bulletin

November 2023



ISSN: 2617-3557

Photo Credit: Molly Powers (SPC) Samoa Tide Gauge





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Issued 12 December 2023

- El Niño continues in the tropical Pacific.
- The Madden Julian Oscillation (MJO) pulse is currently over the Maritime Continent and forecast to continue moving eastward into the western Pacific over the coming fortnight.
- An active ITCZ and active SPCZ merged in an anomalous convective centre near the equatorial Date Line - a sign of El Niño.
- Sea surface temperatures (SST) for November 2023 were warmer than average across almost all the equatorial Pacific Ocean.
- The Coral bleaching Outlook to 24 December shows patches of area of 'Alert 2' over Kiribati (western Gilbert Islands, Phoenix Islands and northern Line Islands) and northeastern Tuvalu.
- For December 2023-February 2024, the models agree on below normal rainfall being likely or very likely for Palau, FSM, central RMI, southern PNG, eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, much of Tonga, Wallis and Futuna, Samoa, Niue, parts of the southern Cook Islands, northeastern French Polynesia and Pitcairn Islands. In addition, there's model agreement on above normal rainfall being likely or very likely in near-equatorial regions from the northern PNG mainland and PNG'S Islands regions eastward to Nauru, northern and central Tuvalu, Kiribati (Gilbert, Phoenix, northern and central Line Islands), Tokelau and the far northern Cook Islands.
- The ACCESS-S weekly tropical cyclone outlook shows a significantly increased risk in the southwest Pacific between 13 December and 19 December around Solomon Islands, Tuvalu, Vanuatu, northern Fiji and New Caledonia.

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EL NIÑO–SOUTHERN OSCILLATION

El Niño continues; positive Indian Ocean Dipole likely past its peak

Click link to access [Climate Driver Update issued on 5 December 2023](#)

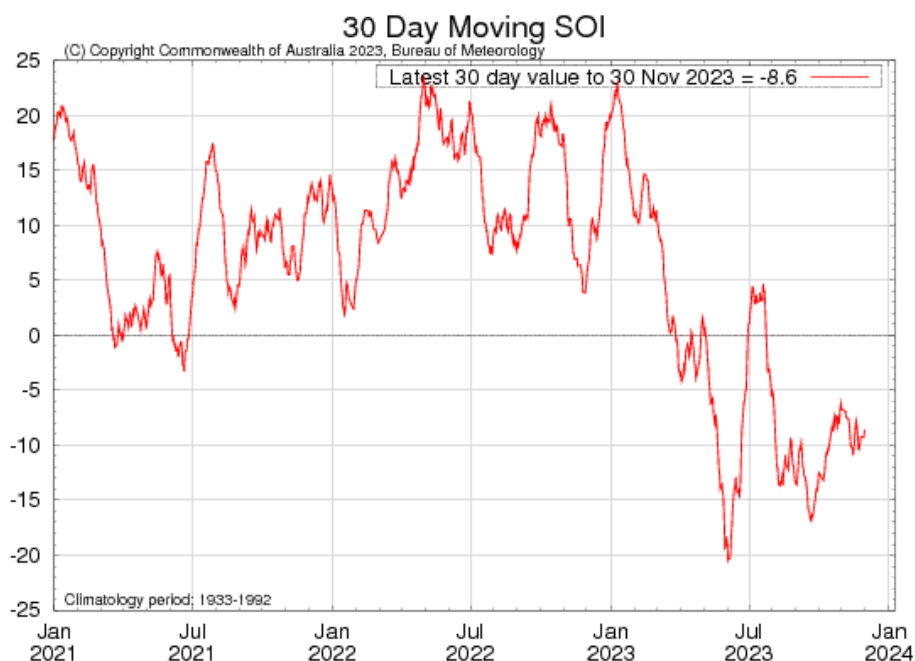
El Niño continues in the tropical Pacific. Indicators of the El Niño-Southern Oscillation (ENSO), including tropical Pacific Sea Surface Temperatures (SSTs), cloud, wind, and pressure patterns are consistent with El Niño. Climate model forecasts indicate some further warming of the central to eastern Pacific is possible, with SSTs remaining above El Niño thresholds early into the second quarter of 2024.

The influence of El Niño on Pacific Islands rainfall usually reduces during summer, especially in the western part of the region. Below median rainfall is, however, often observed in north Pacific over Marshall Islands and from PNG to Niue in the south Pacific. Additionally, high-impact rainfall events can occur during El Niño years, particularly during October to April over Nauru, Kiribati, Tuvalu and Tokelau.

The positive Indian Ocean Dipole (IOD) event continues. IOD index values have eased from their highest values in October and are unlikely to re-strengthen, meaning the positive IOD event is likely past its peak. All international climate models surveyed by the Bureau suggest the positive IOD is likely to ease in December.

The Southern Annular Mode (SAM) index is currently neutral. Forecasts suggest it is likely to remain mostly neutral over the coming fortnight.

The 30-, 60- and 90-day Southern Oscillation Index (SOI) for the period ending 3 December 2023 were -8, -7 and -9, respectively.



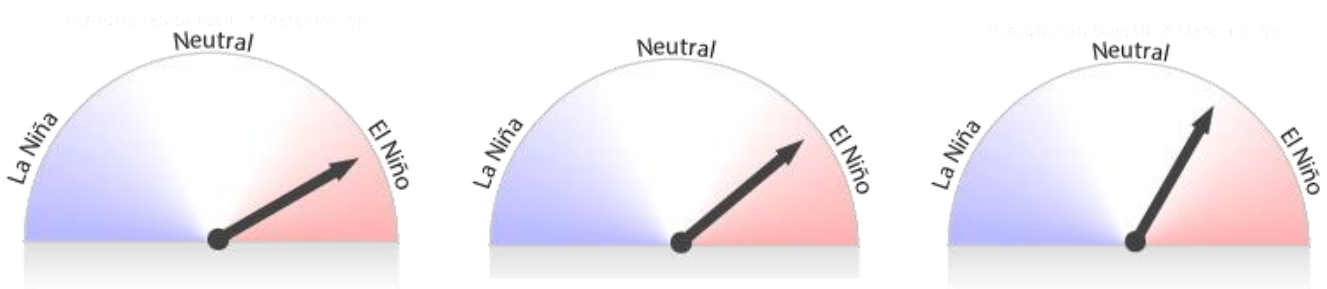


EL NIÑO–SOUTHERN OSCILLATION

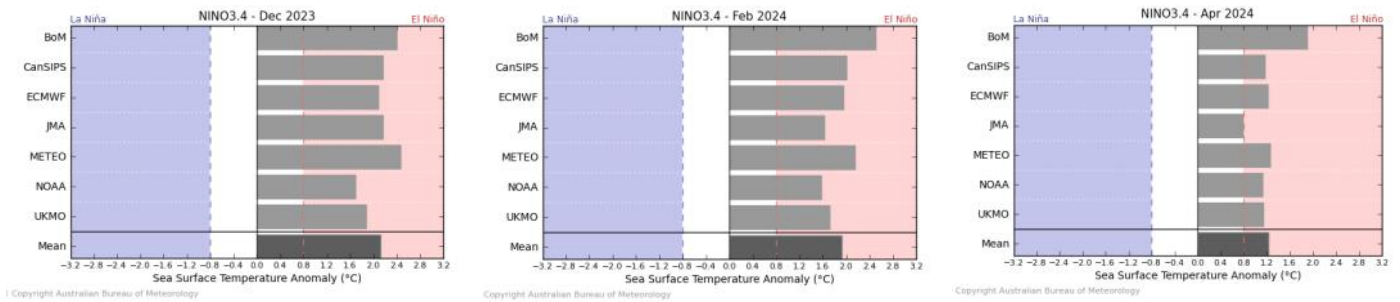
El Niño continues; positive Indian Ocean Dipole likely past its peak

Click link to access [Climate Driver Update issued on 5 December 2023](#)

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>

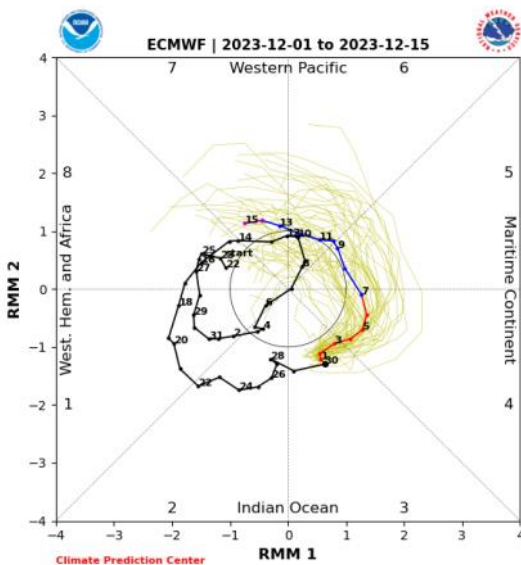
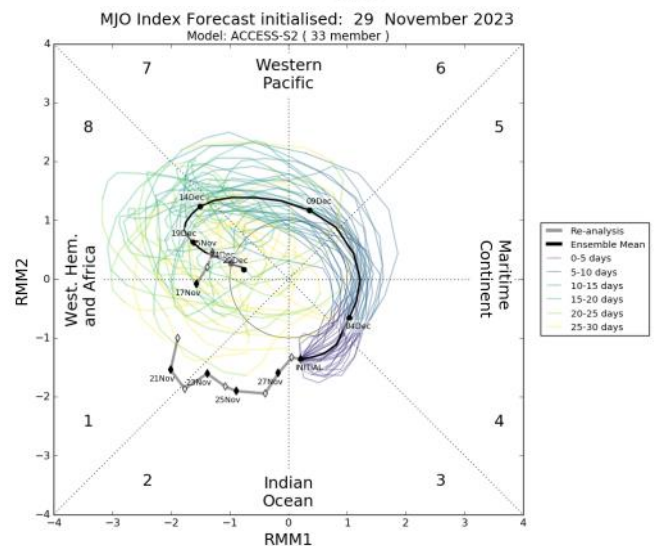
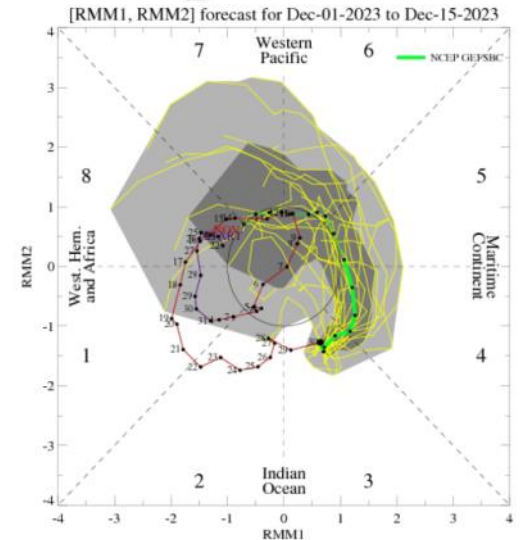
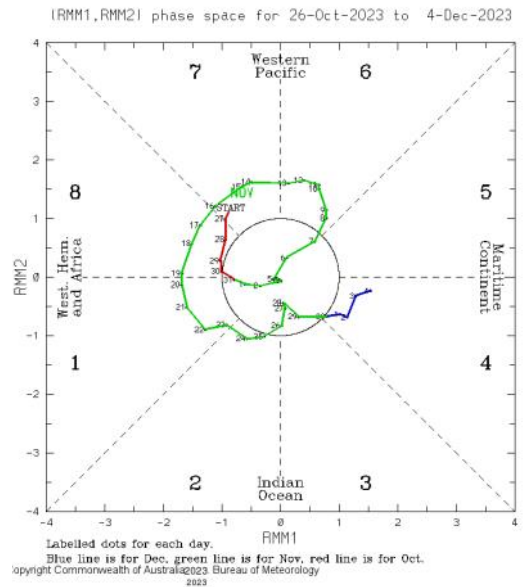
MADDEN–JULIAN OSCILLATION

Click link to access [Tropical Climate Update](#) [Issued on Tuesday 5 December 2023]

The Madden Julian Oscillation (MJO) was active from 8 to 26 November over the western Pacific, western hemisphere and Africa, to the Indian Ocean.

The MJO pulse is currently over the Maritime Continent. International climate models suggest it will move across the Maritime Continent and into the western Pacific over the coming fortnight. When the MJO is over the Maritime Continent, it typically increases rainfall over parts of western Pacific Island countries.

This is an abbreviated version of the Tropical Climate Update. Click on the *Weekly Tropical Update* for more information .



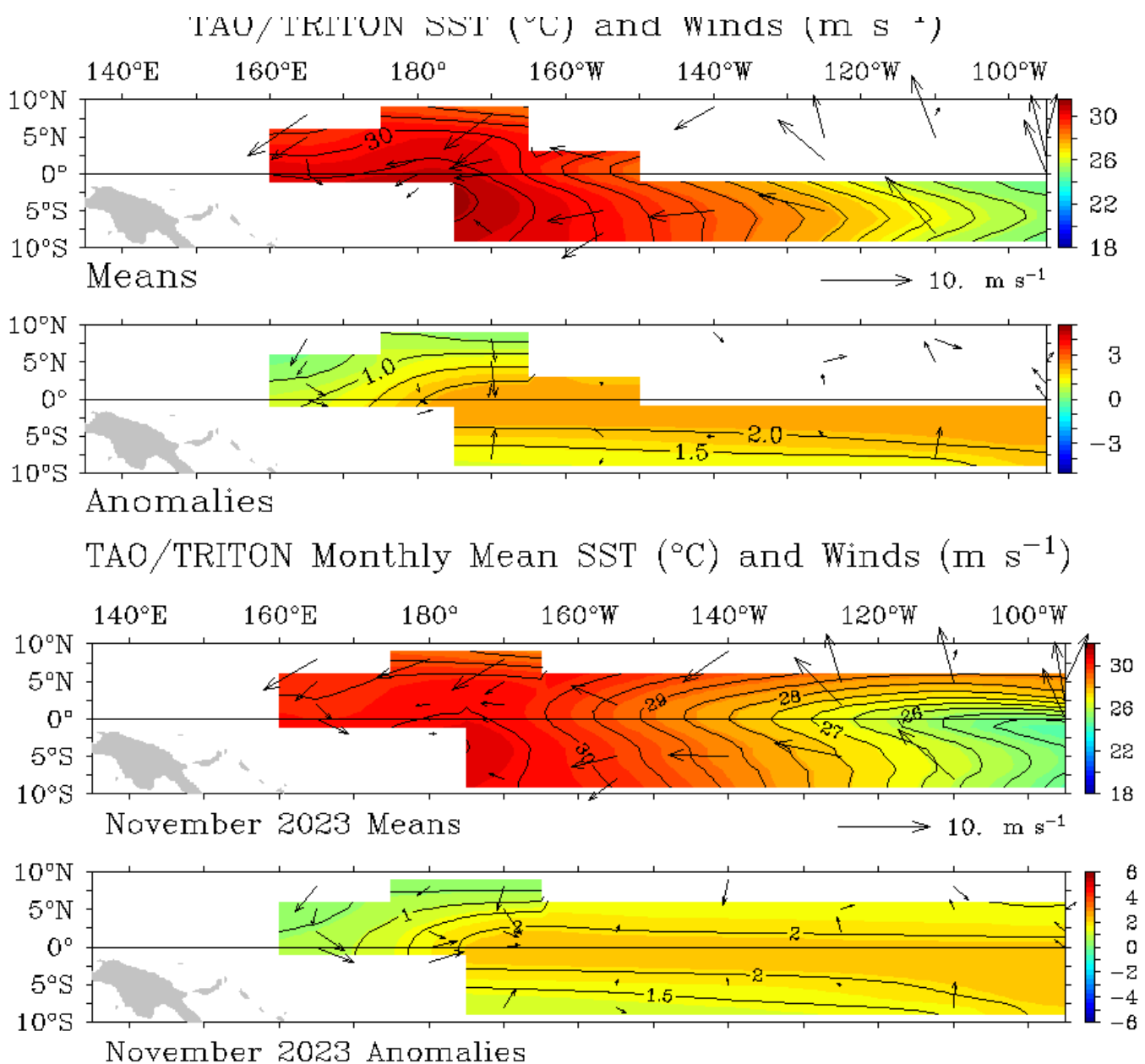
WIND



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

The November 30-day OLR anomaly map shows a region of low OLR (increased convection) along the equator centred over the Date Line. The ITCZ and SPCZ seemed to merge here, with anomalous convection extending to Solomon Islands in the west and northern Cook Islands in the east. The Intertropical Convergence Zone (ITCZ), which extended towards the central American coast, was shifted south of its normal location. High OLR (decreased convection) was evident over PNG, Palau, FSM and northern RMI. These areas were connected to a strong positive OLR region focussed over the central Indian Ocean. Another area of increased OLR was observed over New Caledonia, Vanuatu, Fiji, Samoa and Niue.

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

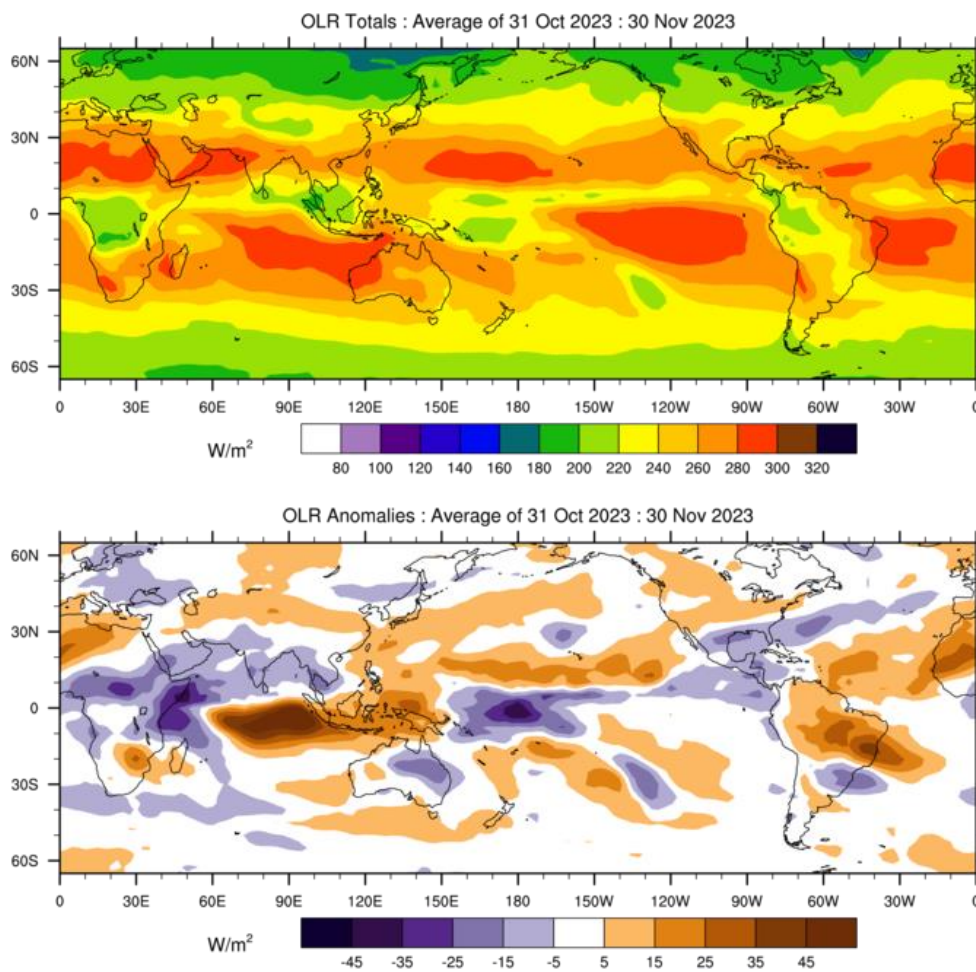
Click link to access [OLR](#)



The November image of anomalous precipitation closely matches the anomalous OLR, with increased convection being most significant over FSM, southern RMI, Solomon Islands, Nauru, Tuvalu, Kiribati, with a southeast extension to Tokelau and northern Cook Islands. Negative anomalies were observed over PNG, northern Marshall Islands, New Caledonia, Vanuatu, Samoa, Niue, and the southern Cook Islands.

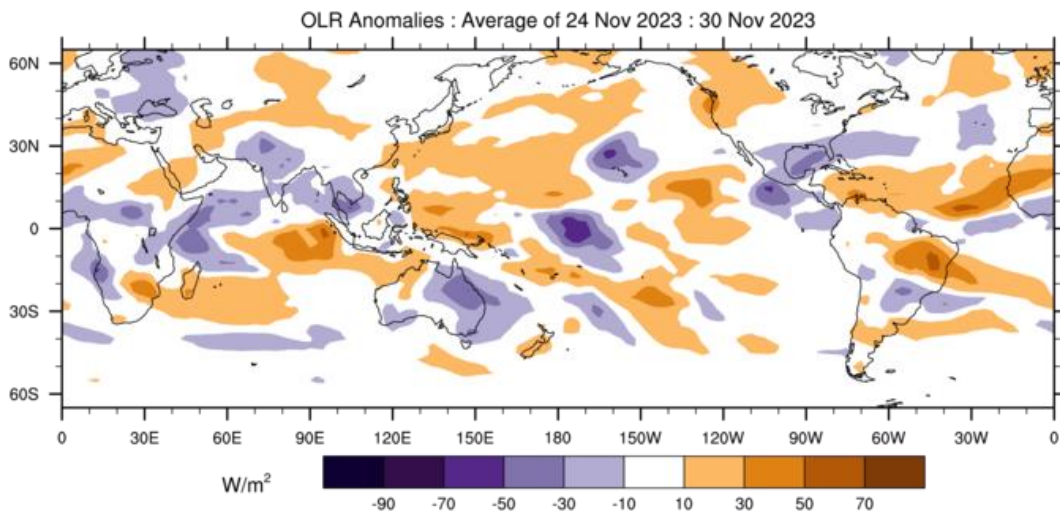
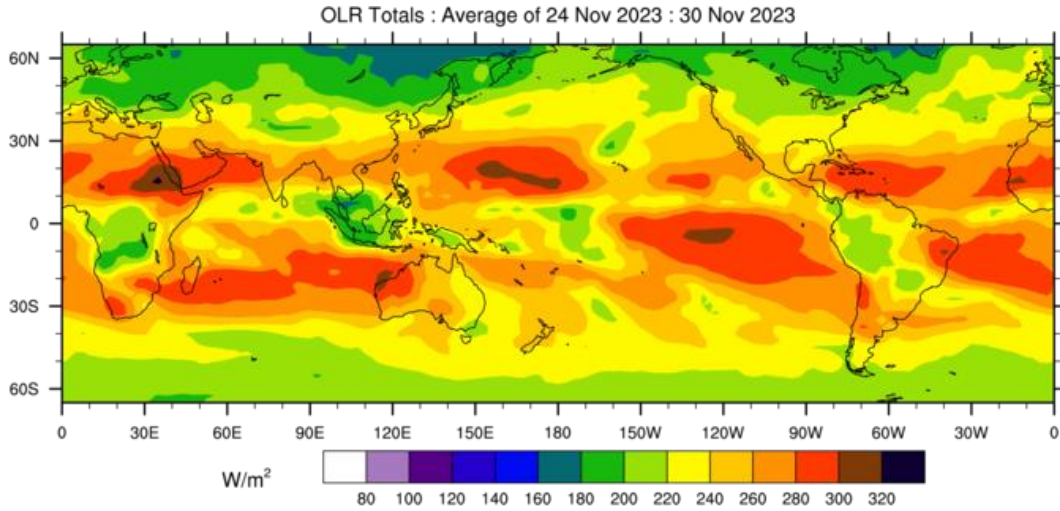
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

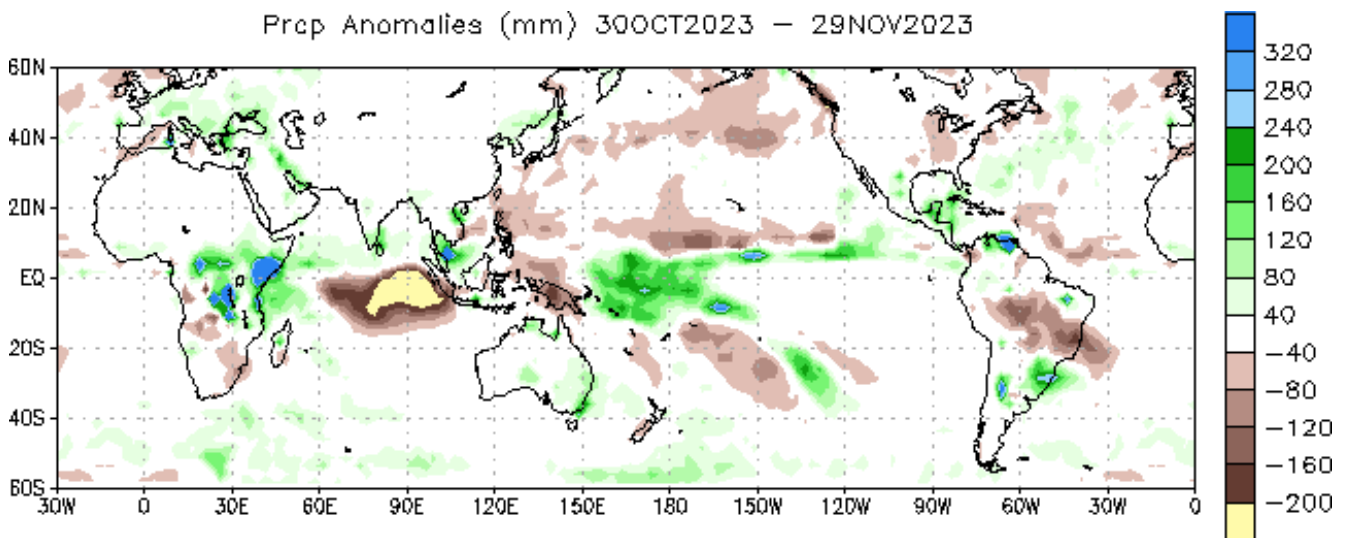


(C) Copyright Commonwealth of Australia 2023. Bureau of Meteorology

OLR Total and Anomalies, 7 Day OLR

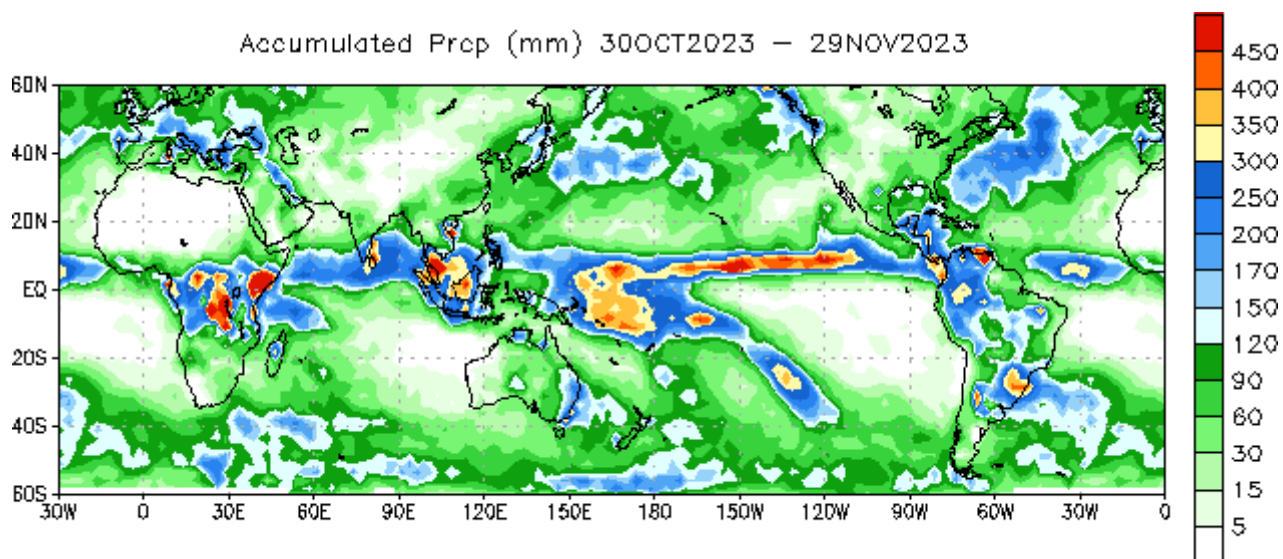


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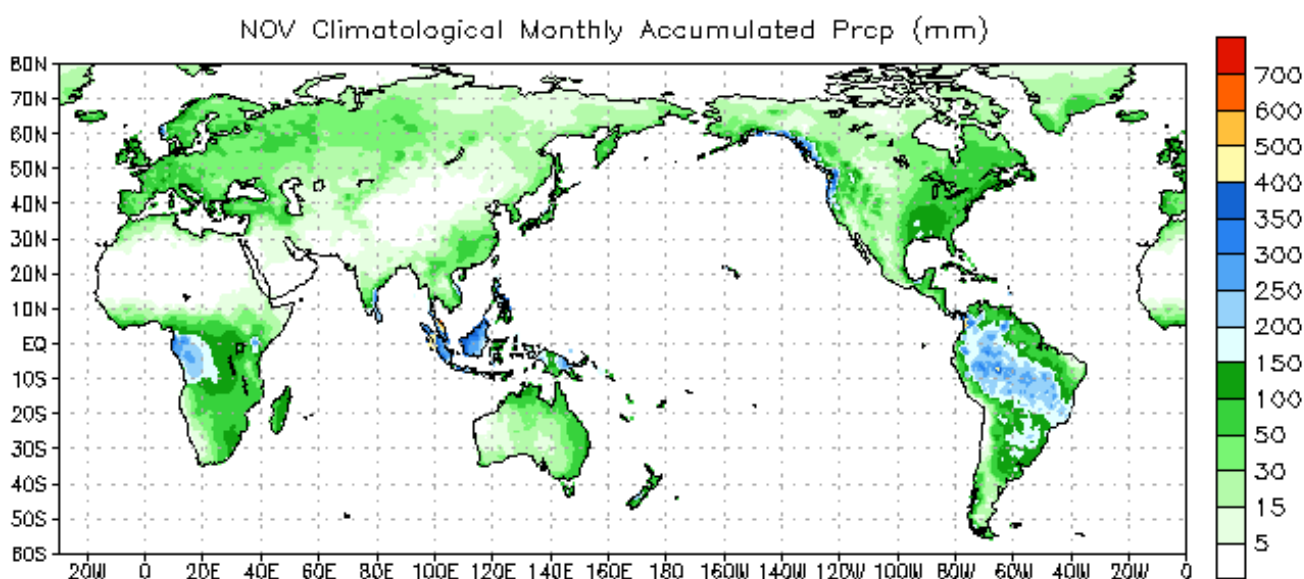


Data Source: NCEP CMAP Precipitation
Climatology (1991-2020)

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://ww.cpc.ncep.noaa.gov/products/Global_Monsoons/Global-Monsoon.shtml

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE



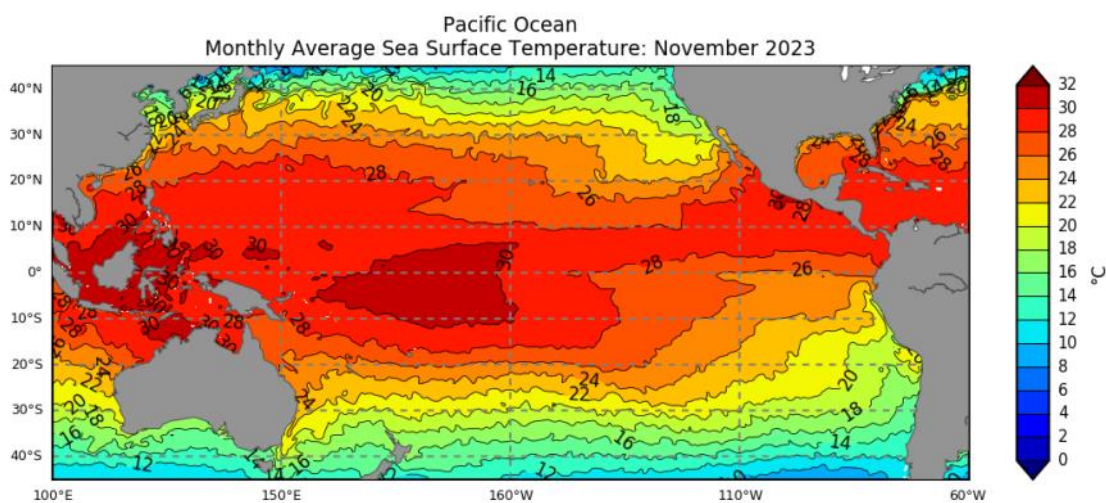
Click link to access [Pacific Community COSPPac Ocean Portal](#)

Sea surface temperatures (SST) for November 2023 were warmer than average across almost all the equatorial Pacific Ocean. Across much of the tropical Pacific between 10°S and 10°N, SST anomalies were more than 0.8 °C warmer than the long term average, increasing to up to 3 °C warmer than the long term average east of the Date Line.

Cool anomalies off the west coast of Java, Indonesia have also decreased in magnitude compared to October.

Record-high November SSTs occurred in parts of Kiribati (southwest Gilbert, Phoenix and northern Line Islands), eastern half of Tuvalu's EEZ, Tokelau, northern Cook Islands and parts of Wallis and Futuna, Samoa, and American Samoa. The SST in decile 10 (very much above average) stretched from western Kiribati in southeast direction to northern Niue in the south and eastwards towards the south American coast. There were also areas of decile 10 over Palau, northeastern FSM and northern RMI. Above average (8-9) decile are observed for majority of the Pacific Island Countries, spanning southeastward from western FSM, central and southern RMI, Nauru to eastern French Polynesia, and along the islands located near the equatorial region of the Pacific. Average SSTs (4-7) for November were observed in parts of southeastern FSM, northern PNG, most of Solomon Islands, Vanuatu, western Fiji, southern Tonga, Niue, central Cook Islands and parts of central French Polynesia. Patches of decile 2-3 (below average) were observed in parts of southeastern PNG, New Caledonia, and southern Cook Islands.

Mean Sea Surface Temperature



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Australian Bureau of Meteorology, COSPPac

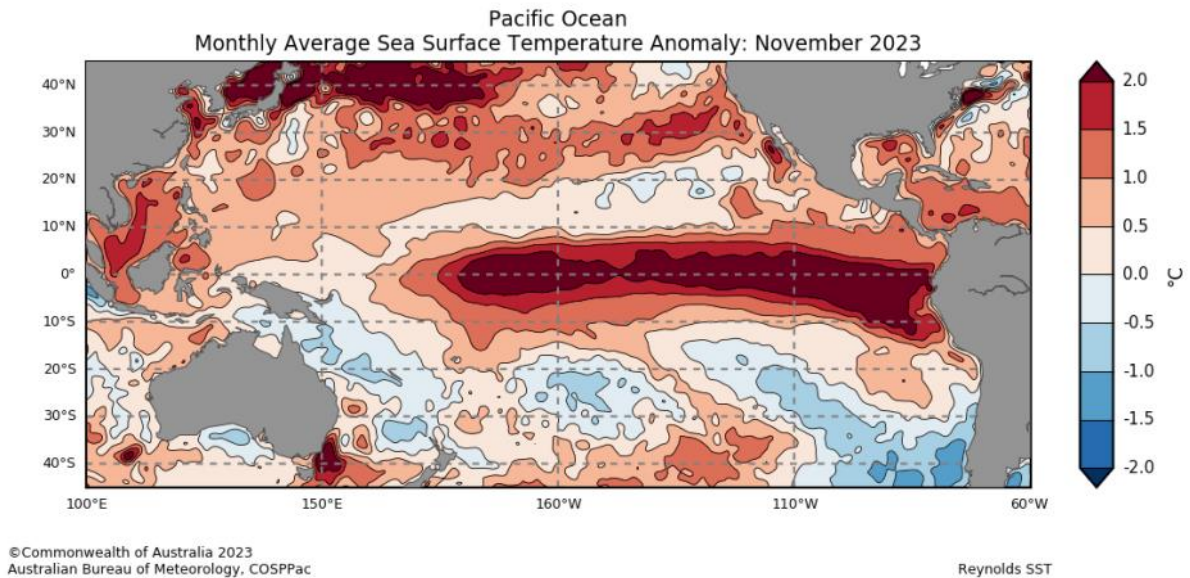
Reynolds SST

OCEAN CONDITIONS

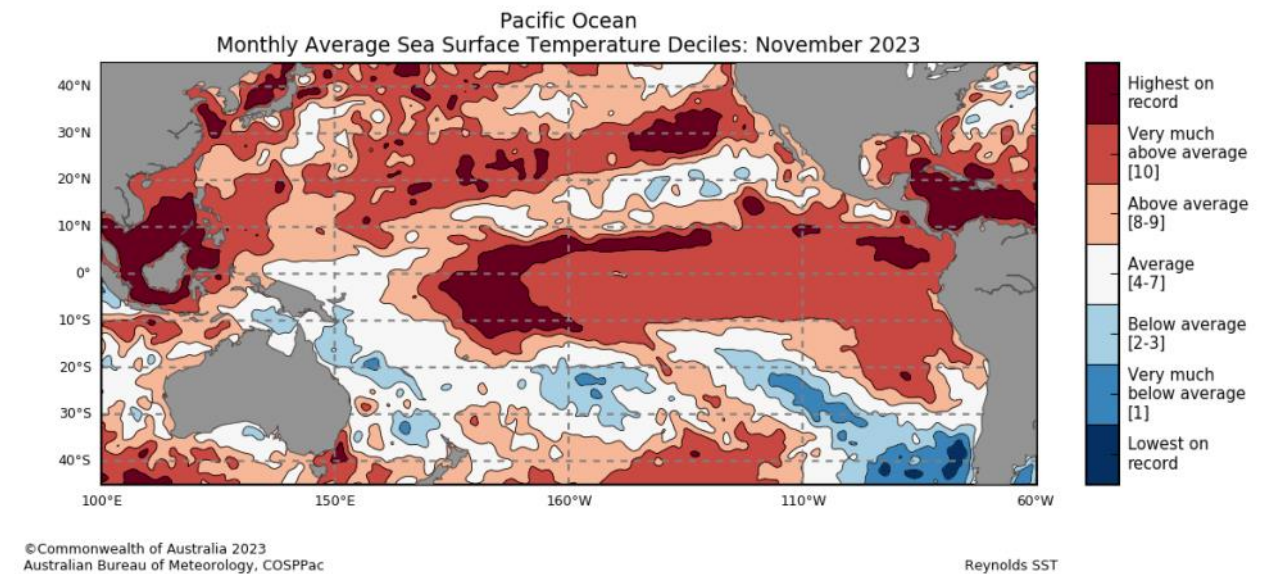
Click link to access [SEA SURFACE TEMPERATURE](#)



Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles



OCEAN CONDITIONS

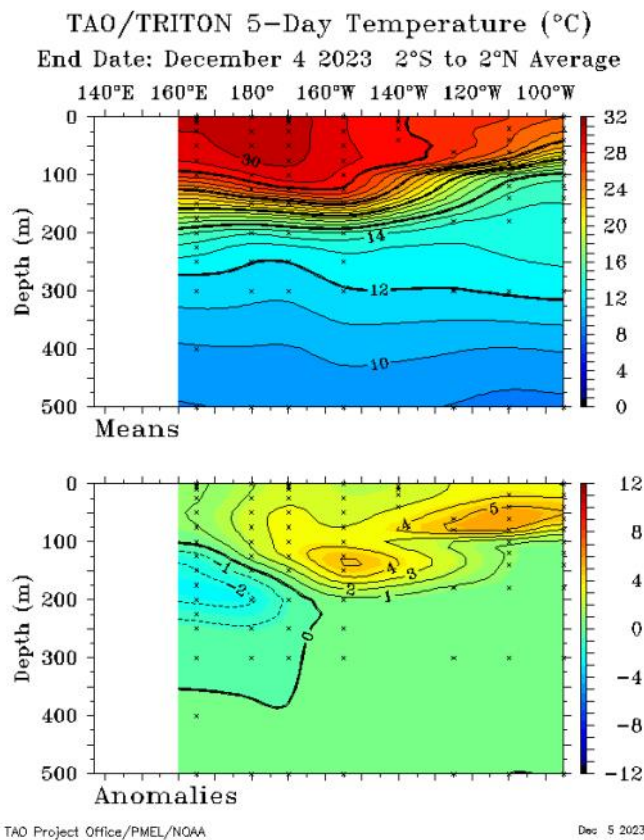
SUB SURFACE



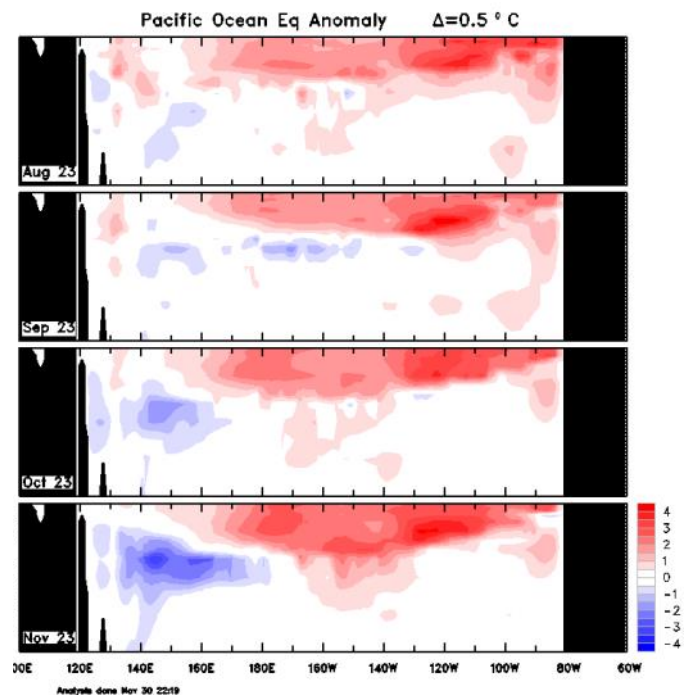
The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 30 November 2023) shows warm anomalies across most of the top 100 m of the equatorial Pacific band, with the exception of the western Pacific. Anomalies increase in magnitude eastwards across the equatorial Pacific band with the central Pacific up to 2.5 °C warmer than average, and the eastern Pacific more than 2.5 °C warmer than average.

Warm anomalies have persisted in the central and eastern Pacific between the surface and 200 m depth. Compared to September, the depth of warm anomalies above 1 °C in the central Pacific have increased to depths of 200 m. The depth of warm anomalies in the eastern Pacific has decreased over the past 4 months. West of the Date Line, cool anomalies continue to strengthen between 100 and 300 m depth, undercutting warm anomalies above them in the central Pacific.

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

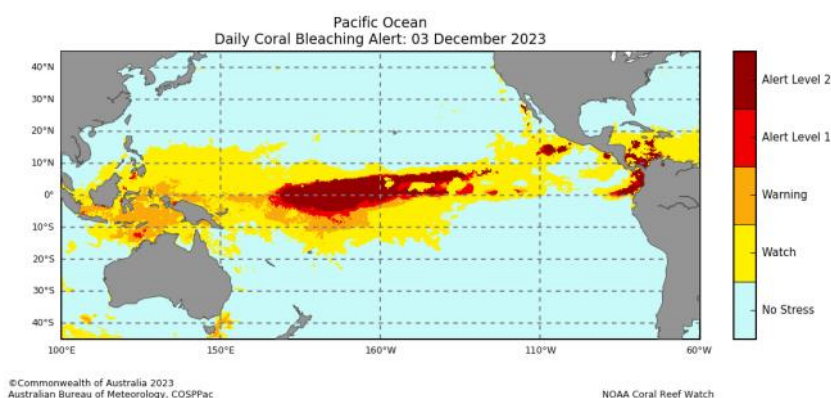
CORAL BLEACHING



The daily Coral Bleaching Alert status for 03 December 2023 shows an area of 'Alert Level 2' over Kiribati (Gilbert, northern Phoenix Islands and northern Line Islands). 'Alert Level 1' over eastern Nauru, northern Tuvalu and patches over Tokelau. 'Warning' over rest of Tuvalu and Tokelau, while patches over southern Palau, southeastern FSM, PNG, northern Solomon Islands, Nauru and northeastern Cook Islands. The four-week Coral Bleaching Outlook to 24 December shows patches of area of 'Alert 2' over Kiribati (western Gilbert Islands, Phoenix Islands and northern Line Islands) and northeastern Tuvalu. 'Alert Level 1' rating over similar areas to Alert Level 2 but extend further south over Tokelau and northern Cook Islands. 'Watch to Warning' ratings from southern Palau, southern FSM, southern RMI, most of PNG, northern Solomon Islands, northern Fiji, Tuvalu, Kiribati (southern Line Islands), Wallis and Futuna, northern Samoa, northern American Samoa, and northern Cook Islands.

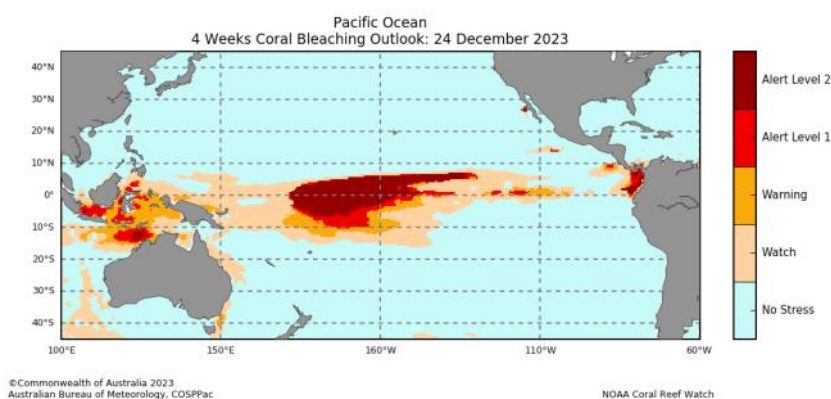
Daily Coral Bleaching Alert

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



4 Weeks Coral Bleaching Outlook

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



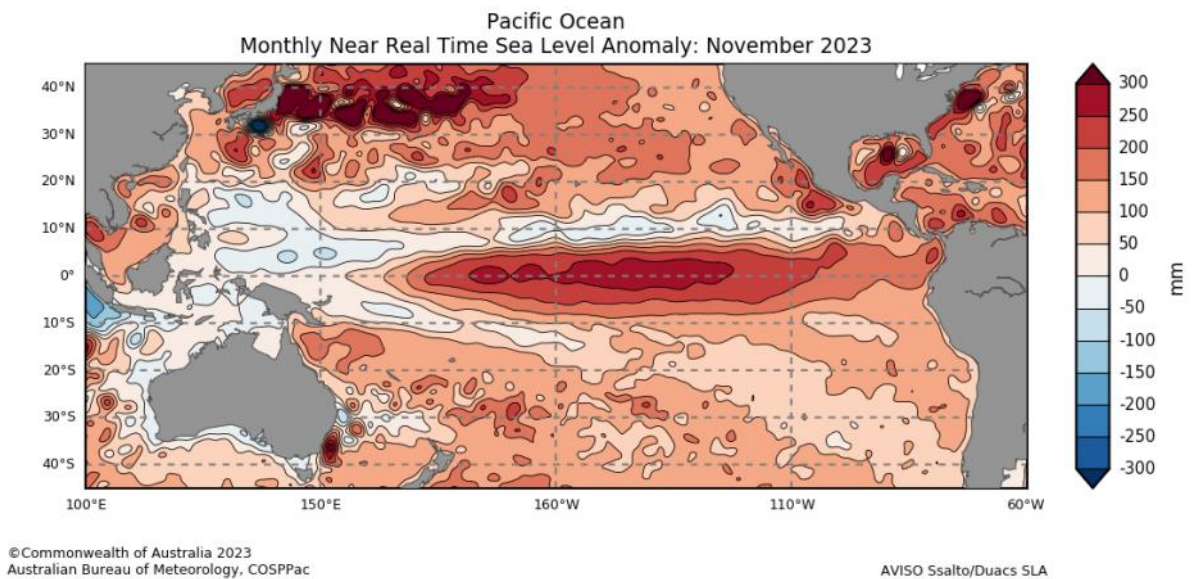
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea level in November was above normal over COSPPac countries. Anomalies from +150 to above +250 mm were observed in Kiribati (northern Phoenix and Line Islands) with patches of +150 over southeast PNG, southern Solomon Islands, New Caledonia, Vanuatu, northern Tuvalu, Tokelau, Fiji, Tonga, Niue, Cook Islands and French Polynesia. Areas of +50 to +100 were observe other COSPPac countries apart from patches of below normal sea level anomalies observed in central FSM, southern RMI, eastern PNG, northeastern Solomon Islands and, patches over eastern Australia and southern New Caledonia.

Monthly Sea Level Anomalies

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

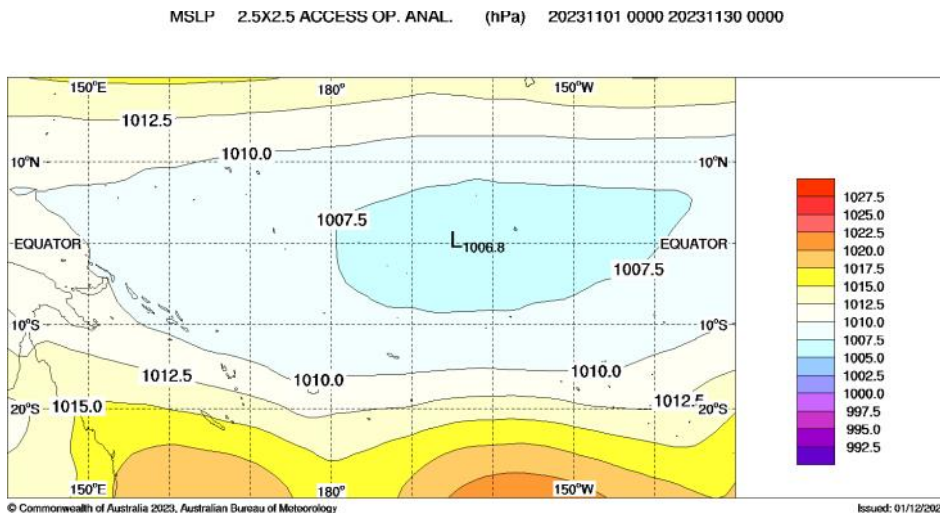


MEAN SEA LEVEL PRESSURE

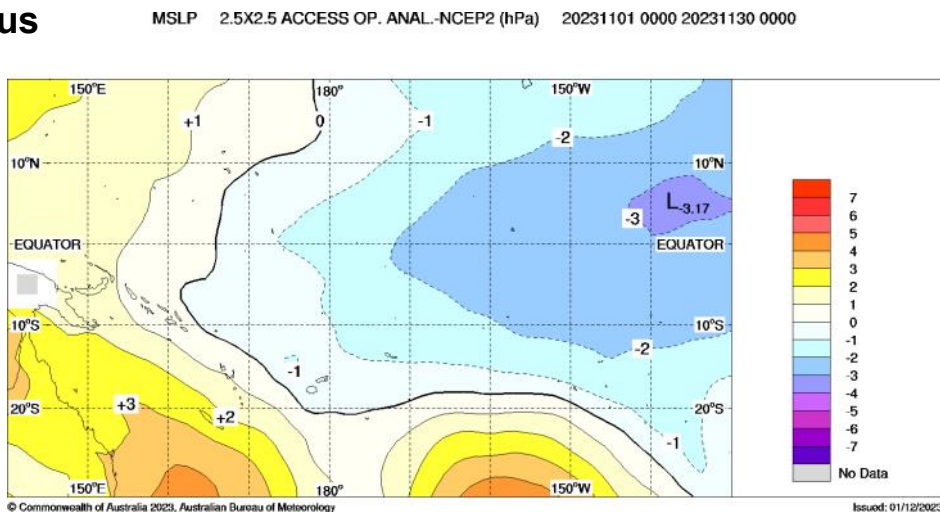
The November mean sea level pressure (MSLP) anomaly map shows positive anomalies of 1 hPa or greater west of Vanuatu towards Australia, and south of Niue towards New Zealand. Negative anomalies of 1 hPa or greater were evident west of the Date Line within 10° latitude of the equator.

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

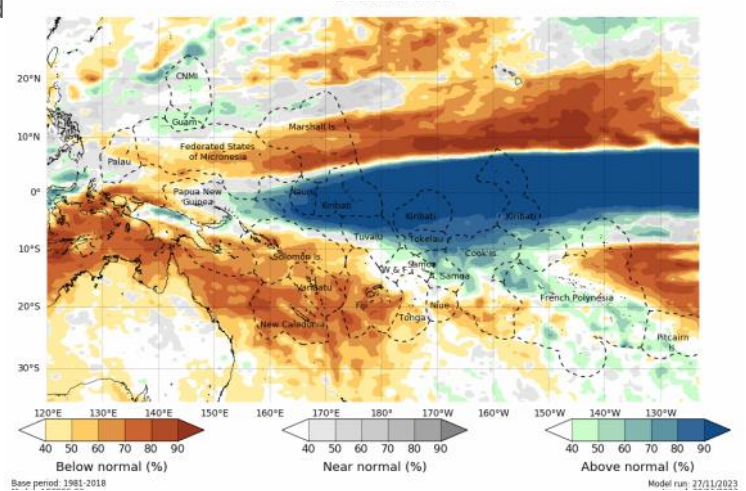
December 2023—February 2024



The ACCESS-S model forecast for December 2023, shows below normal rainfall is likely or very likely for Palau, central and southern FSM, much of RMI, PNG's northern mainland, southern PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji, central and southern Tonga, Niue, southern Cook Islands, northeastern French Polynesia and eastern Pitcairn Islands. Above normal rainfall is likely or very likely for CNMI, Guam, PNG's northern mainland, some of the PNG Islands and the northeast of its EEZ, Nauru, Kiribati, most of Tuvalu, northern Wallis and Futuna, Tokelau, American Samoa, parts of Samoa, northern Cook Islands, central French Polynesia, and western Pitcairn Islands.

The three-month rainfall outlook (December 2023-February 2024) is very similar to the December outlook, but with the below normal rainfall region being stronger over Palau, FSM, RMI, and in the southern hemisphere from northeastern French Polynesia extending eastwards. The above normal rainfall region also more intense from PNG northern mainland across the Islands to the northeast of its EEZ. In contrast, the above normal region is less intense and extensive over American Samoa northern Cook Islands, and French Polynesia.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for December 2023-February 2024 is very similar to the ACCESS outlook, the main differences being a stronger dry signal in Copernicus over CNMI, Tonga, Niue, Samoa, southern Cook Is, and southern French Polynesia. In addition, Copernicus has a stronger wet signal in the northwest Solomon Islands.

The APEC Climate Centre multi-model outlook (December 2023 - February 2024) is also very similar to the other two, especially Copernicus, the main difference from that model being a much weaker equatorial wet signal from the Line Islands eastward.

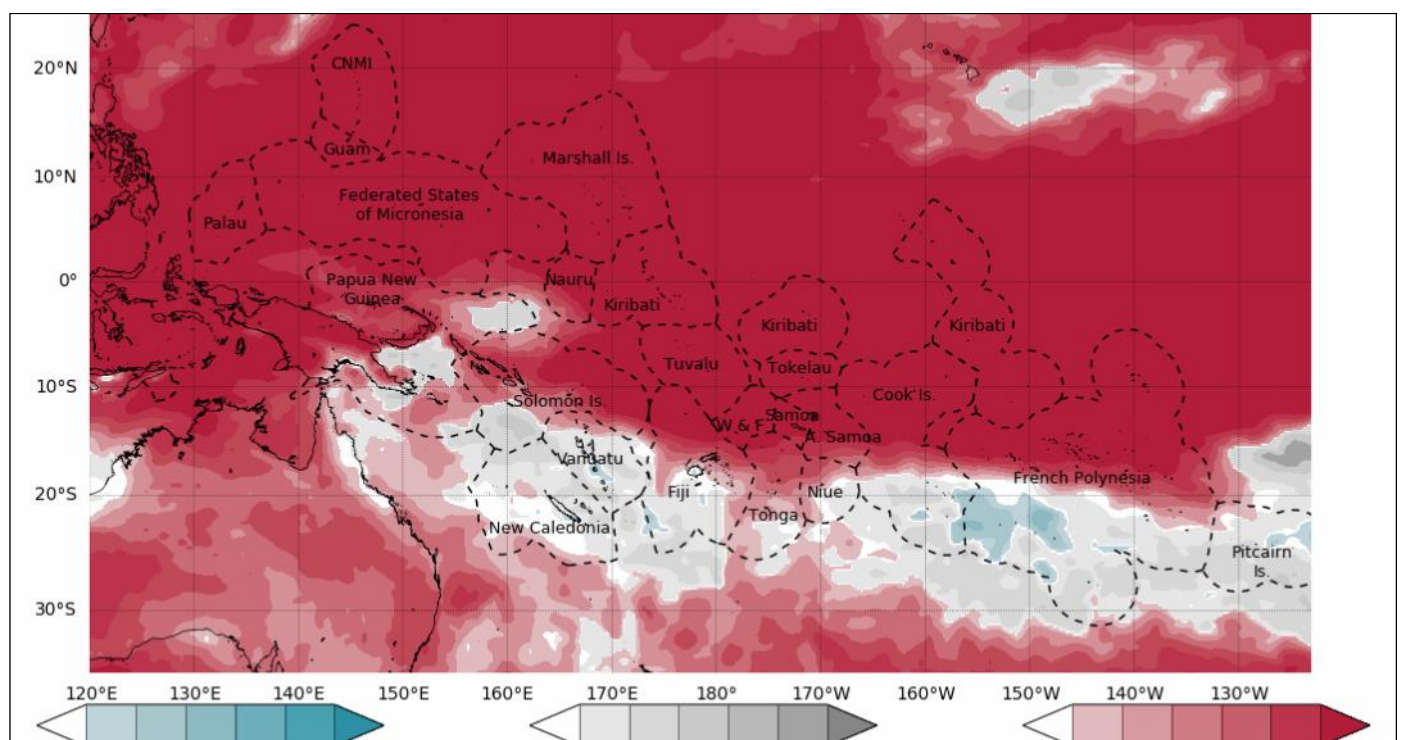
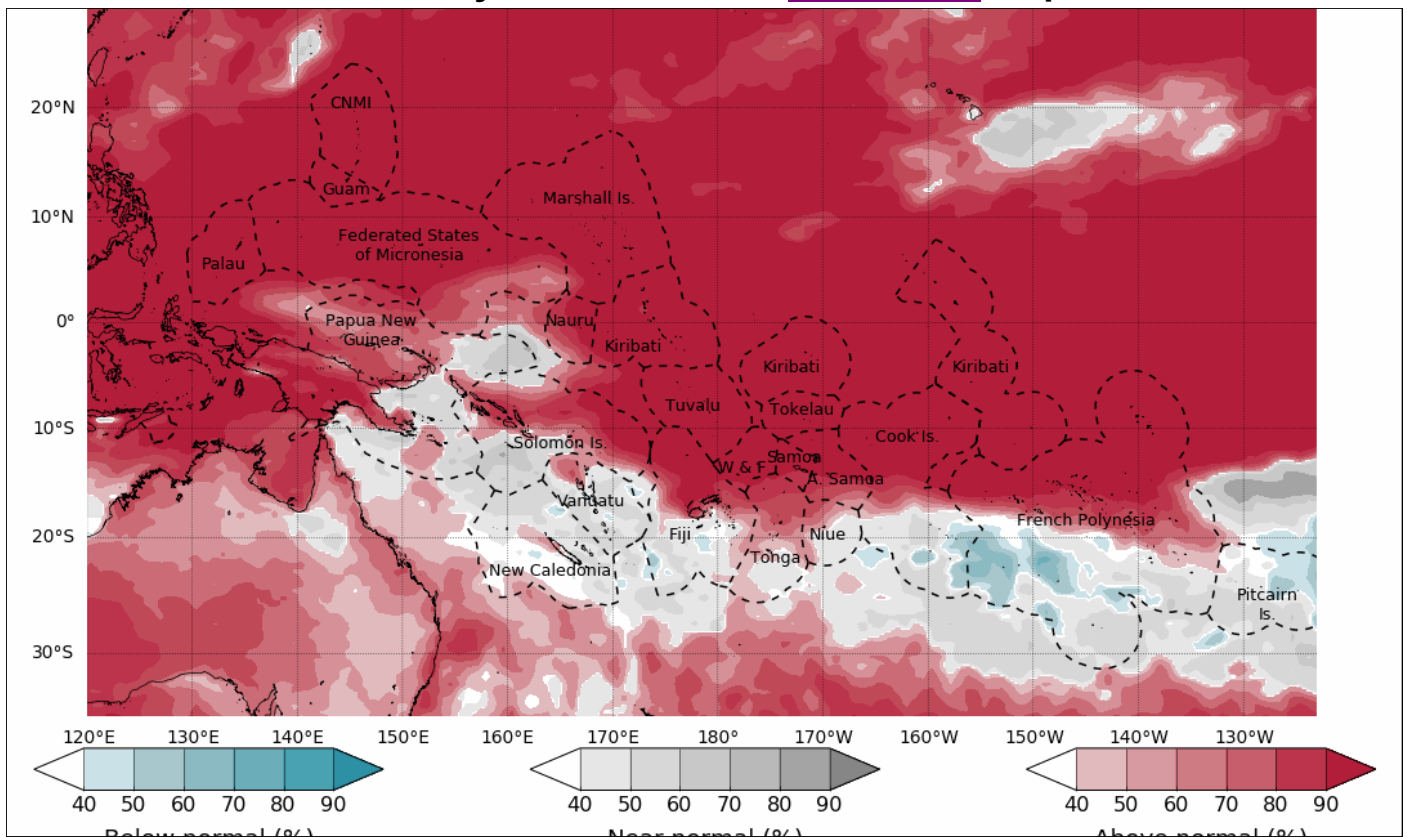
For December 2023-February 2024, the models agree on below normal rainfall being likely or very likely for Palau, FSM, central RMI, southern PNG, eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, much of Tonga, Wallis and Futuna, Samoa, Niue, parts of southern Cook Islands, northeastern French Polynesia and Pitcairn Islands. In addition, there's model agreement on above normal rainfall being likely or very likely in near-equatorial regions from the northern PNG mainland and, PNG'S Islands regions eastward to Nauru, northern and central Tuvalu, Kiribati (Gilbert, Phoenix, northern and central Line Islands), Tokelau and the far northern Cook Islands.

SEASONAL TEMPERATURE OUTLOOK

December 2023—February 2024



Monthly Tmax and Tmin ACCESS-S Maps



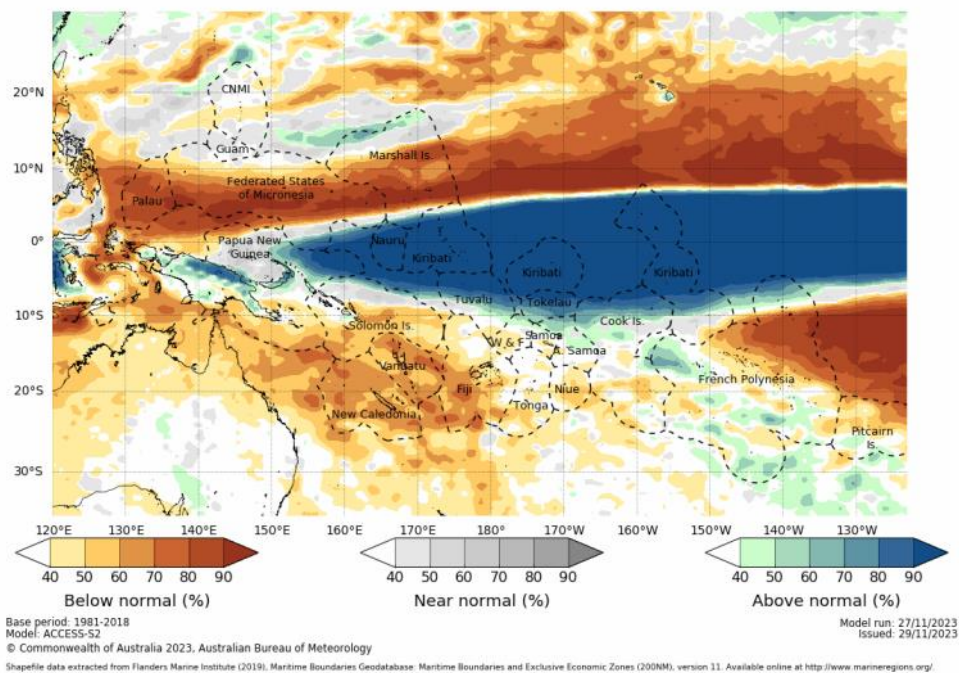
SEASONAL RAINFALL OUTLOOK

December 2023—February 2024

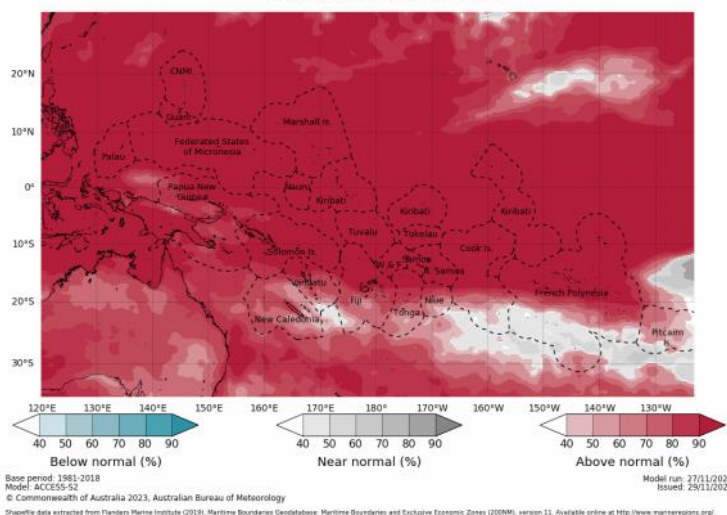


Seasonal ACCESS-S maps

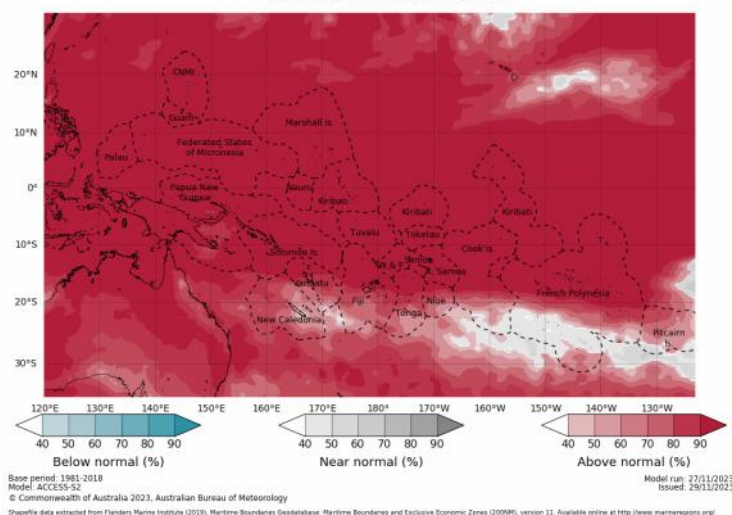
Tercile rainfall probabilities for December 2023 to February 2024



Tercile maximum temperature probabilities for December 2023 to February 2024



Tercile minimum temperature probabilities for December 2023 to February 2024



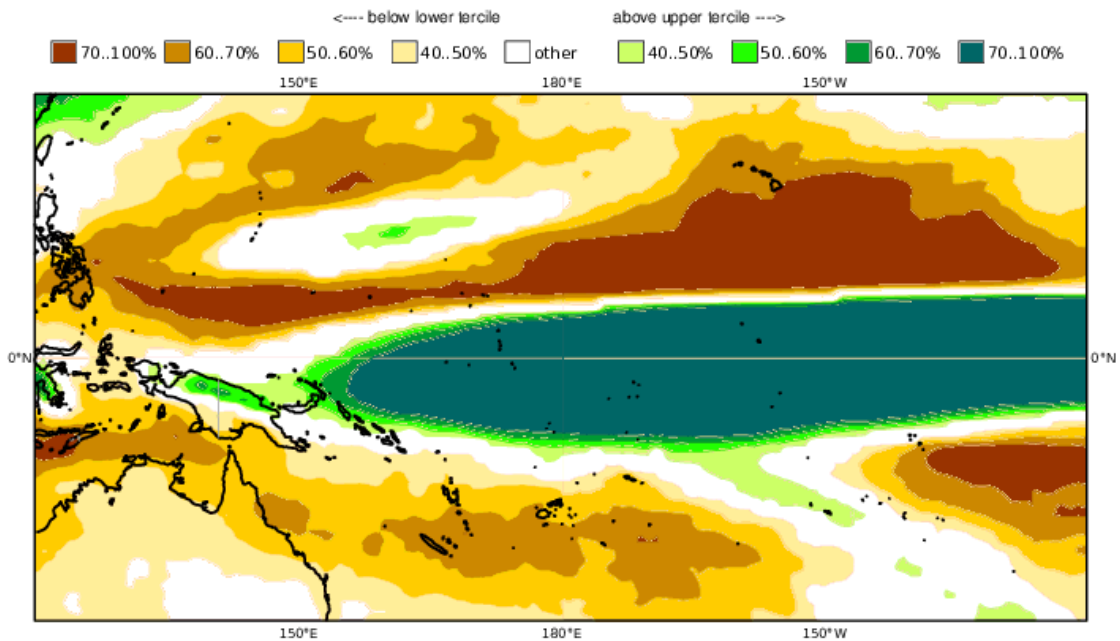
About ACCESS-S <http://access-s.clide.cloud/>

SEASONAL RAINFALL OUTLOOK

December 2023—February 2024

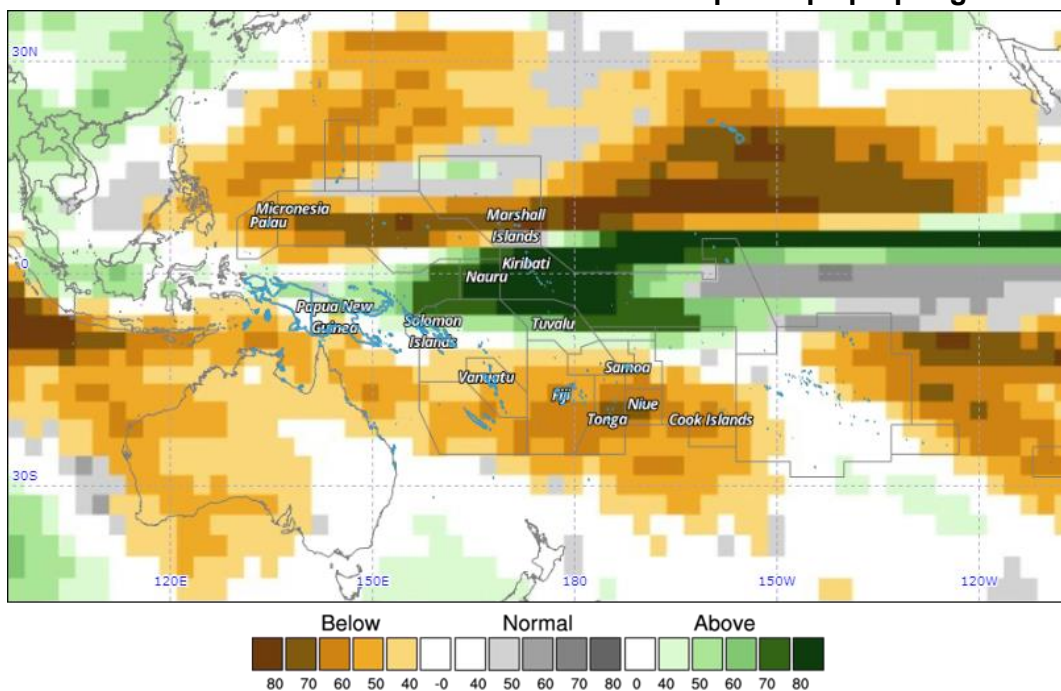


Copernicus (C3S multi-system)-Rainfall
 Prob(most likely category of precipitation) DJF 2023/24
 Nominal forecast start: 01/11/23
 Unweighted mean



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

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



Year: 2023, Season: DJF, Lead Month: 3, Method: GAUS
 Model: APCC, BOM, CMCC, MSC, NASA, NCEP, PNU
 Generated using CLIK® (2023-12-5)

© APEC Climate Center

TROPICAL CYCLONE

2023/2024 Season



The northwest Pacific tropical cyclone season is year round, with most cyclones occurring between May and October. Sixteen named TCs have occurred as of 20 October. In the southwest Pacific, the 2023-24 tropical cyclone season started on 1 November 2023. The outlook for the season favoured normal-to-enhanced risk for TC activity in the eastern part of the basin and normal-to-reduced TC activity in the western part of the basin. Several severe TCs are possible anywhere in the basin.

There were three tropical cyclones that have occurred in the south Pacific with TC Lola formed earlier than normal on 22 October, followed by TC Mal affecting Fiji, and currently TC Jasper affecting the Solomon Islands and tracking southwest towards Queensland, Australia.

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 southwest Pacific between 9 December and 15 December around Solomon Islands, Tuvalu, Vanuatu, northern Fiji and New Caledonia.

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>

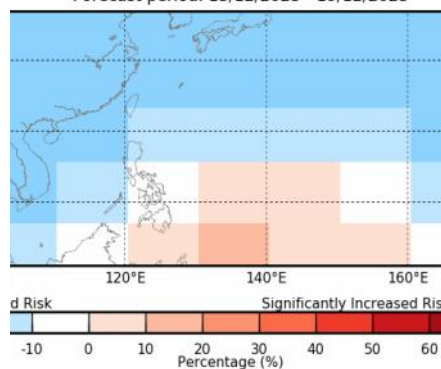
NASA GMAO GEOS-5: <http://gmao.gsfc.nasa.gov/research/ocean/>

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

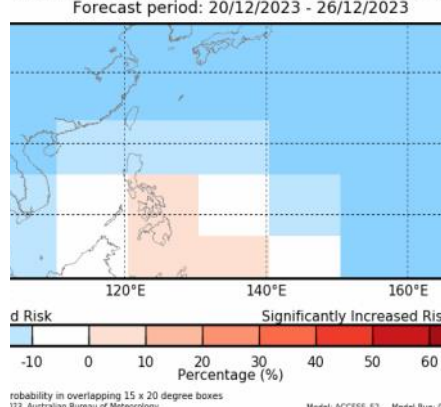
IRI for Climate and Society: <http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/>

ACCESS-S Weekly Forecasts –Northwest Pacific

Difference from normal chance of Tropical Cyclone's in the Northwest Pacific
Forecast period: 13/12/2023 - 19/12/2023

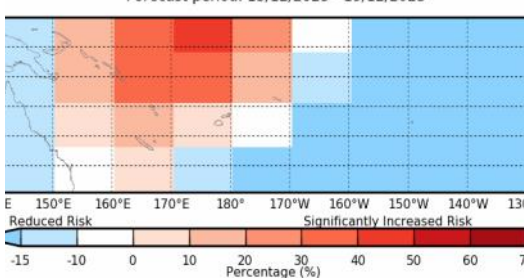


Difference from normal chance of Tropical Cyclone's in the Northwest Pacific
Forecast period: 20/12/2023 - 26/12/2023

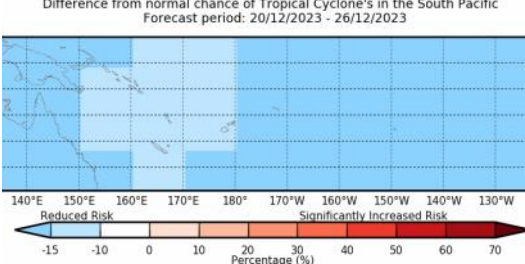


ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the Southwest Pacific
Forecast period: 13/12/2023 - 19/12/2023



Difference from normal chance of Tropical Cyclone's in the Southwest Pacific
Forecast period: 20/12/2023 - 26/12/2023



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.

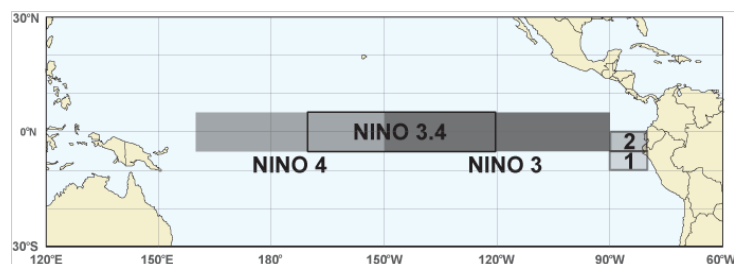
20 degrees Celsius Isotherm Depth

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