

Monthly Climate Bulletin

January 2023



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Photo Credit: Molly Powers (SPC) Samoa Tide Gauge



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- La Niña continues in the tropical Pacific, but oceanic indicators (sea surface temperatures, SSTs) have weakened since their peak during spring 2022.
- The Madden-Julian Oscillation (MJO) is currently moderate to strong and over the eastern Indian Ocean. Most models expect it to move across the Maritime Continent and towards the western Pacific in the coming week, with a possible decline in strength.
- The Intertropical Convergence Zone (ITCZ) was weaker than normal in January, but the South Pacific Convergence Zone (SPCZ) was strong and displaced to the southwest.
- Sea surface temperatures (SST) in January 2023 were cooler than average across much of the tropical Pacific Ocean, extending from around 160°E in a broadening wedge to the South American coastline.
- The Coral bleaching status for 1 February 2023 shows 'Alert Level 2' extending southeastward from southeast PNG, western Vanuatu and southern Fiji.
- For February-April 2023, the models unanimously agree on above normal rainfall for much of Palau, Guam, CNMI, most of FSM, most of RMI, eastern Solomon Islands, New Caledonia, Vanuatu, Fiji (except Rotuma), central and southern Tonga, and Niue. The models are also unanimous in showing that below normal rainfall is likely or very likely for northeast PNG EEZ, Nauru, southern halves of western, central and eastern Kiribati, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern Cook Islands, northern French Polynesia, and Pitcairn Island.
- The ACCESS-S weekly tropical cyclone forecast model shows a slight to moderately increased risk between 11 and 24 February around the eastern Australia and Coral Sea Region. The cyclone risk for the northwest Pacific for the same period is slightly below normal.



EL NIÑO–SOUTHERN OSCILLATION

La Niña continues to ease

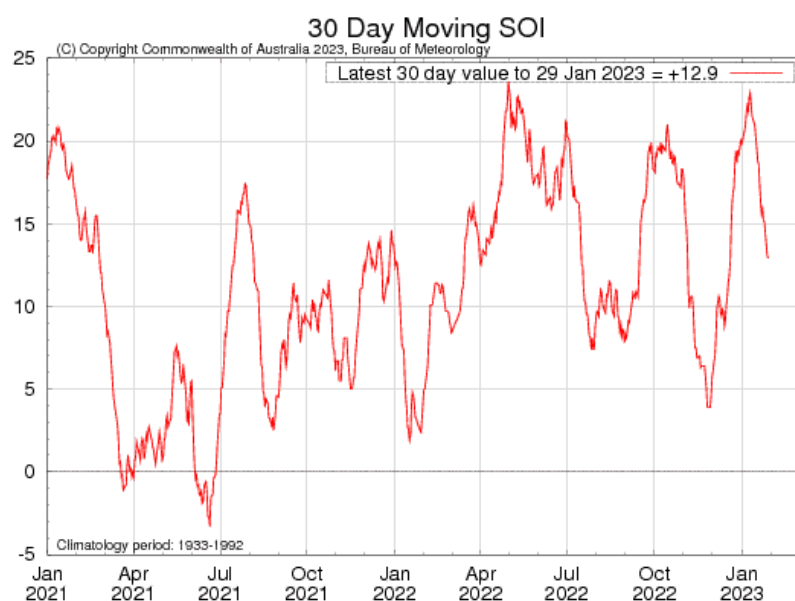
Click link to access [Climate Driver Update issued on 31 January 2023](#)

La Niña continues in the tropical Pacific, but oceanic indicators (sea surface temperatures, SSTs) have weakened since their peak during spring 2022. While ocean temperatures have eased from La Niña thresholds, the atmosphere has yet to respond, and remains La Niña-like. La Niña typically increases the chance of above-average rainfall for northern and eastern Australia during summer.

All models anticipate SSTs in the central Pacific will return to neutral ENSO levels during February, with neutral conditions (neither La Niña nor El Niño) anticipated until at least mid-autumn. As accuracy is generally lower for long-range ENSO forecasts made during summer, ENSO outlooks that extend past autumn should be viewed with caution.

The Southern Annular Mode (SAM) is currently strongly positive, but is anticipated to ease over the coming fortnight and then remain neutral over the remainder of February.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 29 January 2023 was +12.9 while the 90-day SOI value was +12.9. The 30-day SOI has decreased over the last fortnight while the 90-day SOI has remained relatively similar.



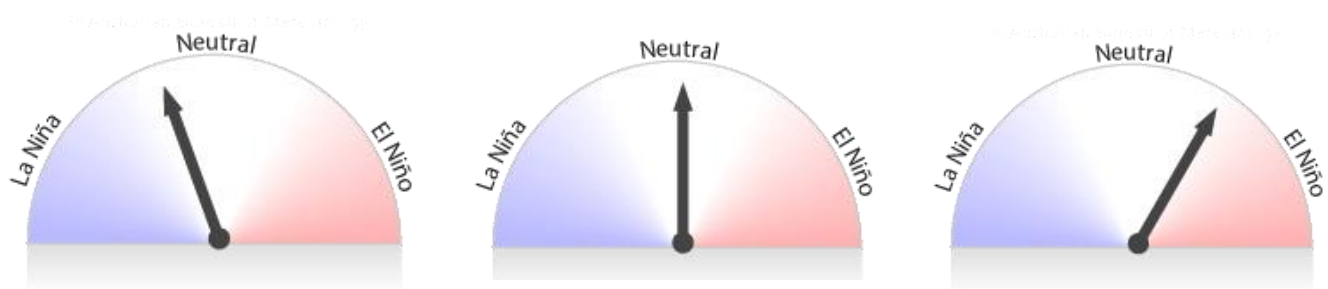


EL NIÑO–SOUTHERN OSCILLATION

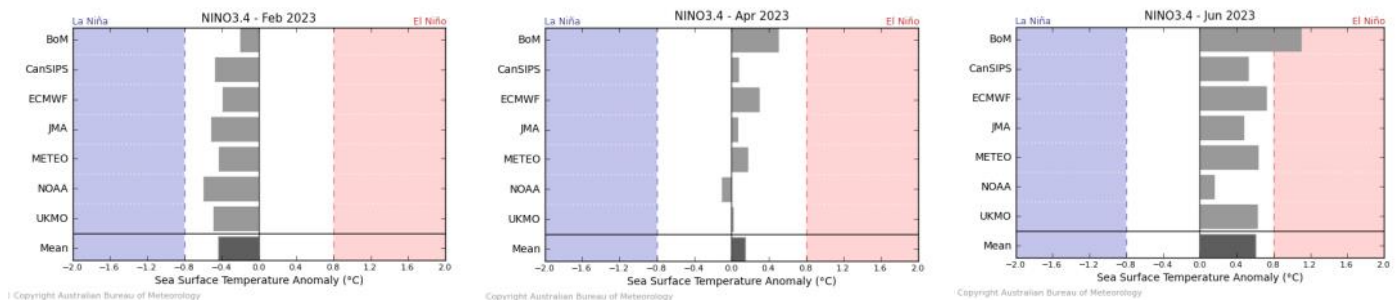
La Niña continues to ease

Click link to access [Climate Driver Update issued on 31 January 2023](#)

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



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>

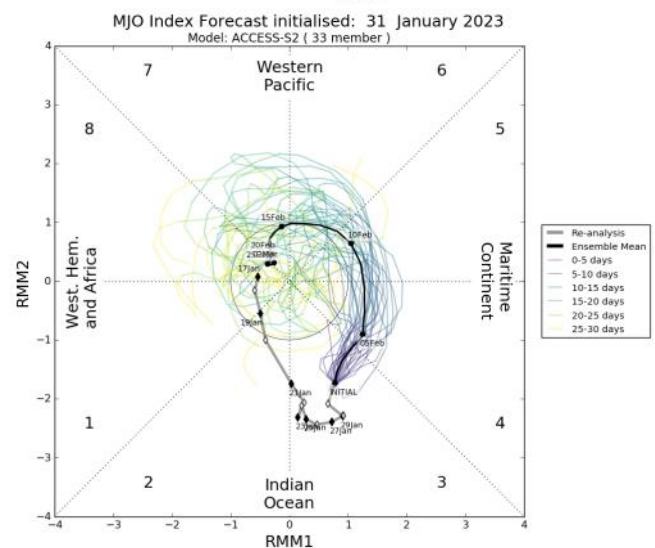
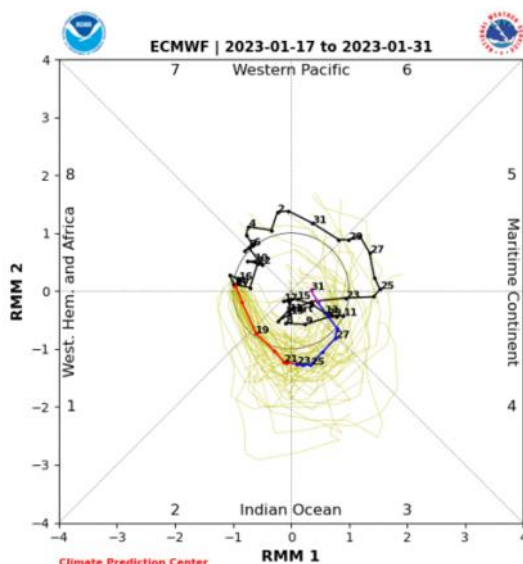
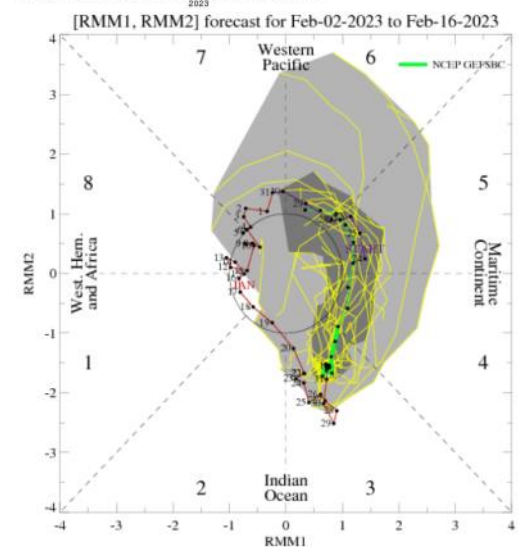
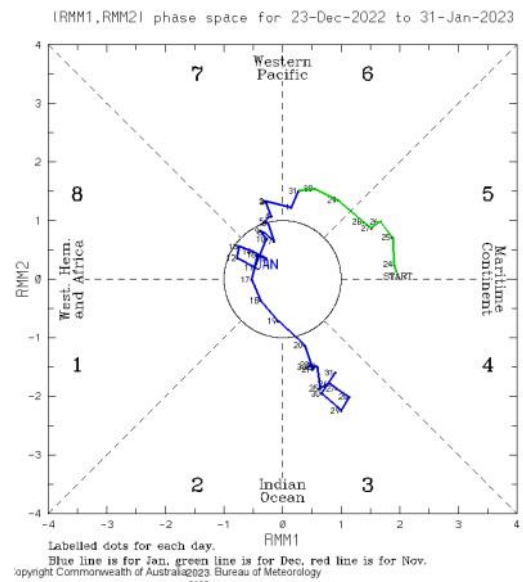
MADDEN–JULIAN OSCILLATION

Click link to access [Tropical Climate Update](#) [Issued on Wednesday 7 February 2023]

A weak to moderate pulse of the Madden-Julian Oscillation (MJO) propagated over the Indian Ocean towards the end of January. It has shown signs of weakening in recent days in the Maritime Continent.

The Madden-Julian Oscillation (MJO) is currently moderate to strong and over the eastern Indian Ocean. Most models expect it to move across the Maritime Continent and towards the western Pacific in the coming week, with a possible decline in strength.

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



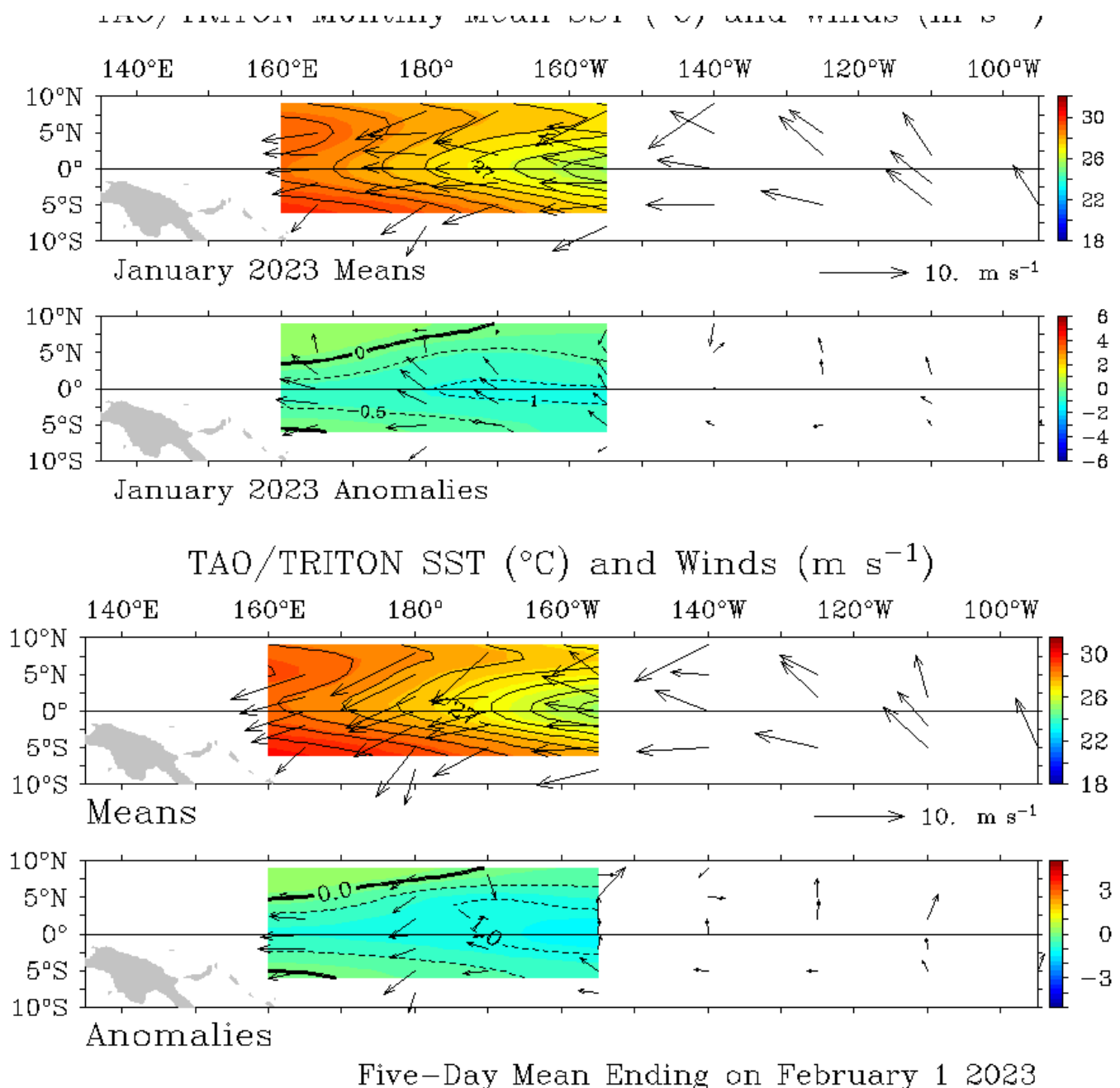
WIND



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

For the five days ending 01 February 2023, the trade winds were stronger than normal in western and central longitudes of the near-equatorial Pacific, particularly in western and central longitudes. Similarly, they were stronger than normal in the western and central equatorial Pacific in January, in keeping with the 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](#)



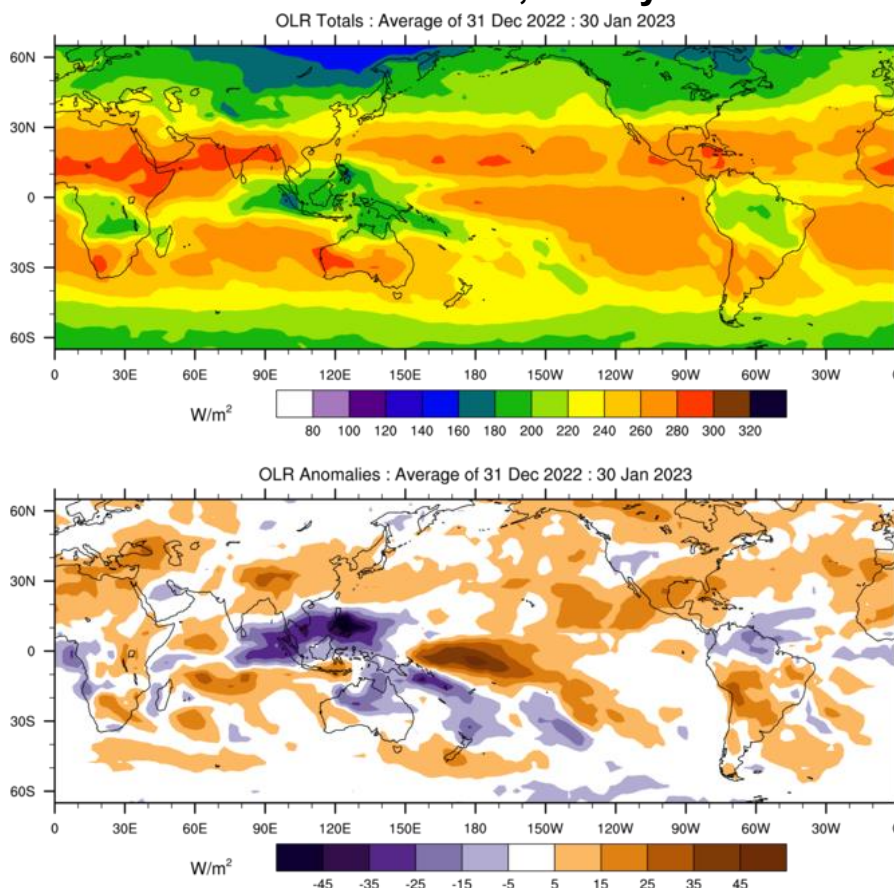
The main feature of the January 30-day OLR total and anomaly maps was similar to December where the dipole pattern was prominent across the Indo-Pacific, indicating the La Niña event. The centre of low OLR (increased convection) was situated to the north and west of Indonesia, while a secondary centre was located over southern Solomon Islands. A spur to the southeast extended from the secondary centre, indicating an active South Pacific Convergence Zone (SPCZ), which was displaced southwest of its normal location.

In contrast, the centre of high OLR (reduced convection) was centred on the equator near and west of the Date Line, with one main extension reaching east-northeast across the Pacific Basin suggesting the Intertropical Convergence Zone (ITCZ) was less active than normal. Another extension of anomalously high OLR to the southeast, indicated reduced cloudiness in the normal location of the SPCZ.

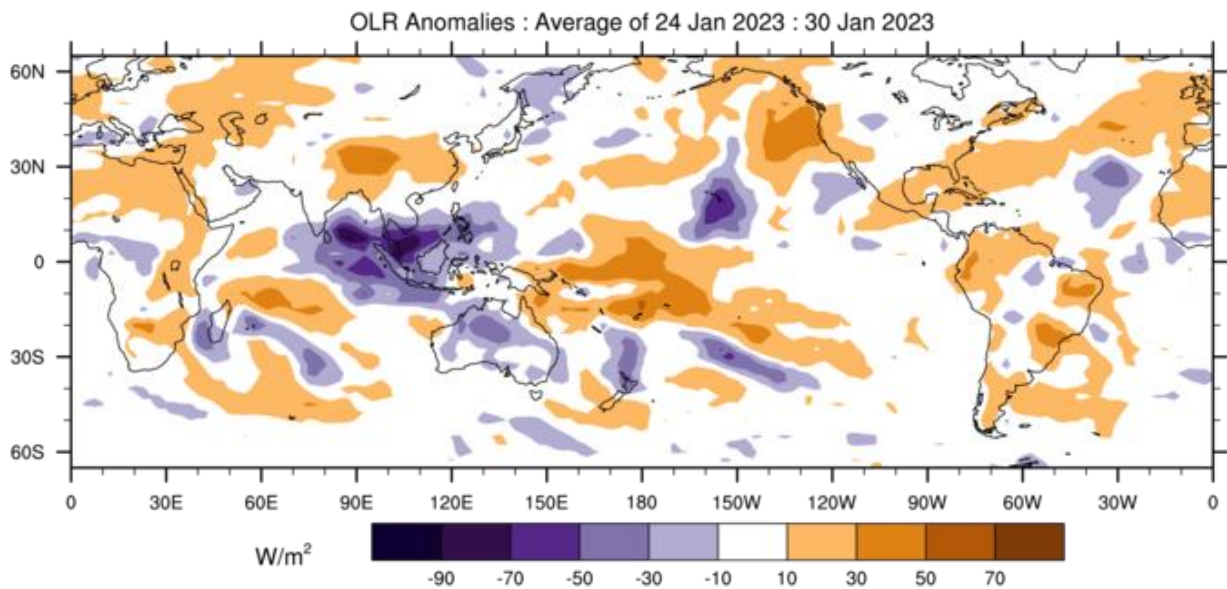
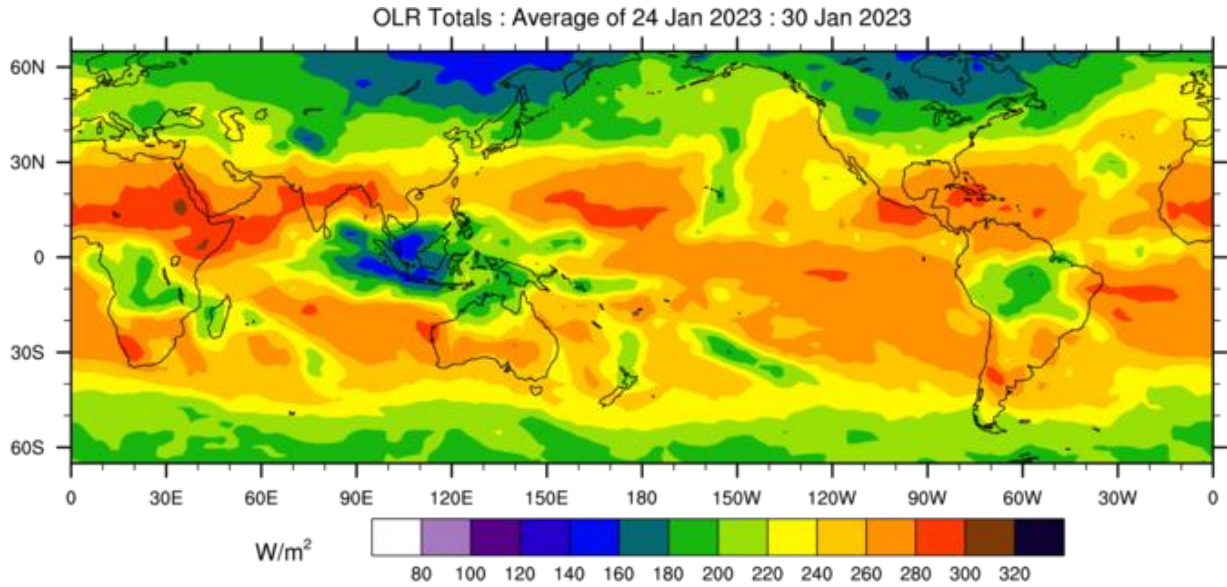
The weekly OLR to 30 January showed active convection over the northeast Indian Ocean and Maritime Continent, with an extension to the east of the Philippines.

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.

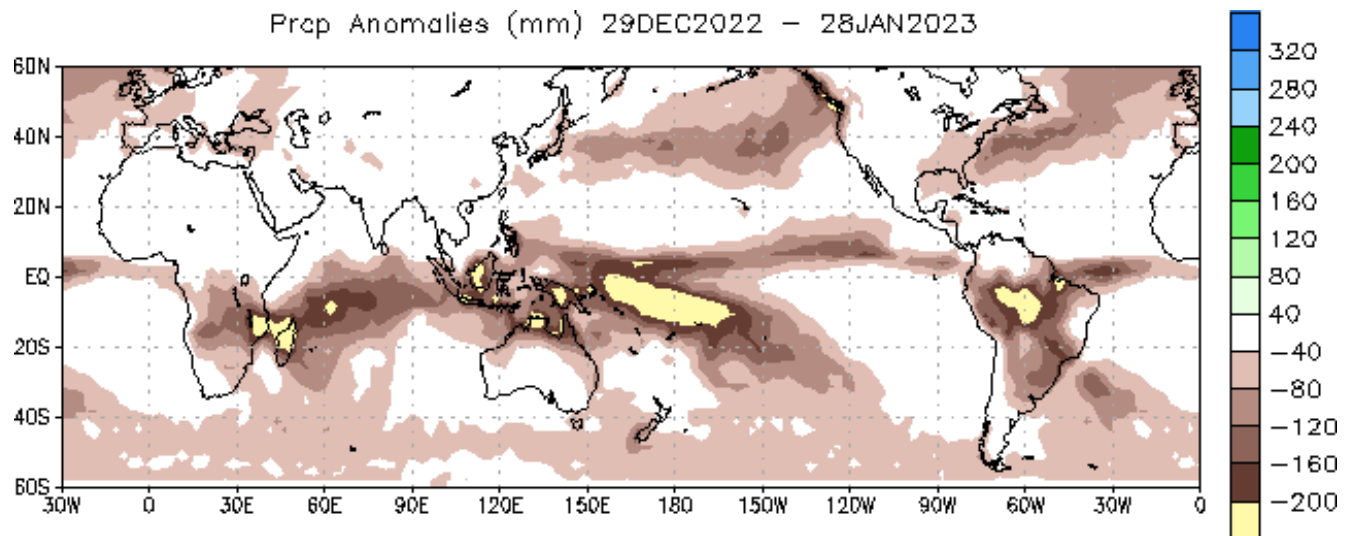
OLR Total and Anomalies, 30 Day OLR



OLR Total and Anomalies, 7 Day OLR

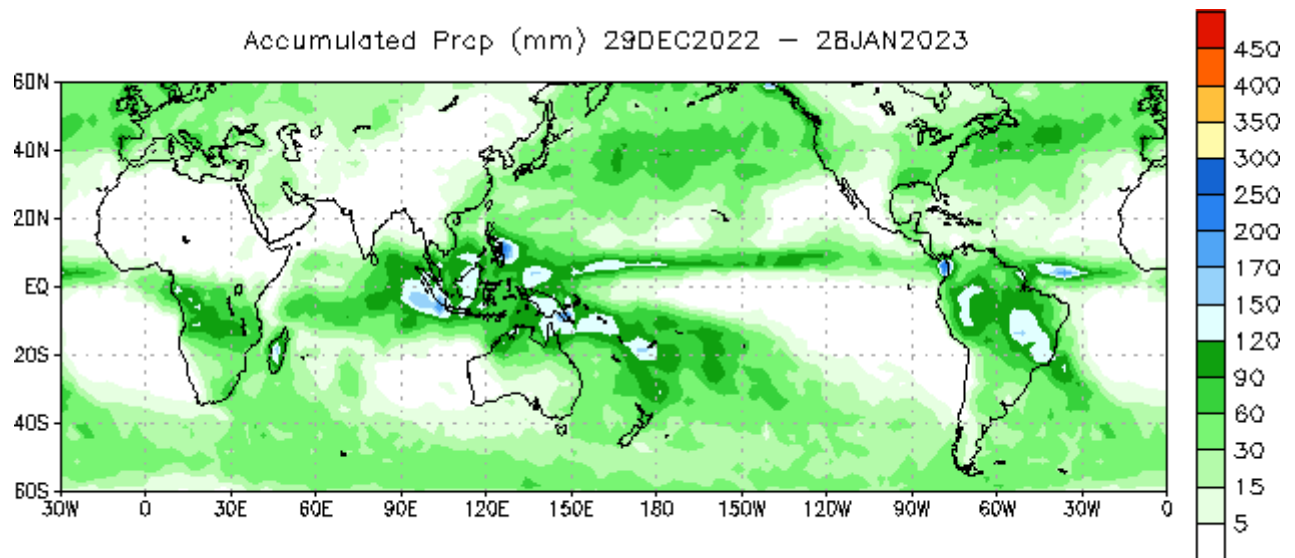


(C) Copyright Commonwealth of Australia 2023. Bureau of Meteorology

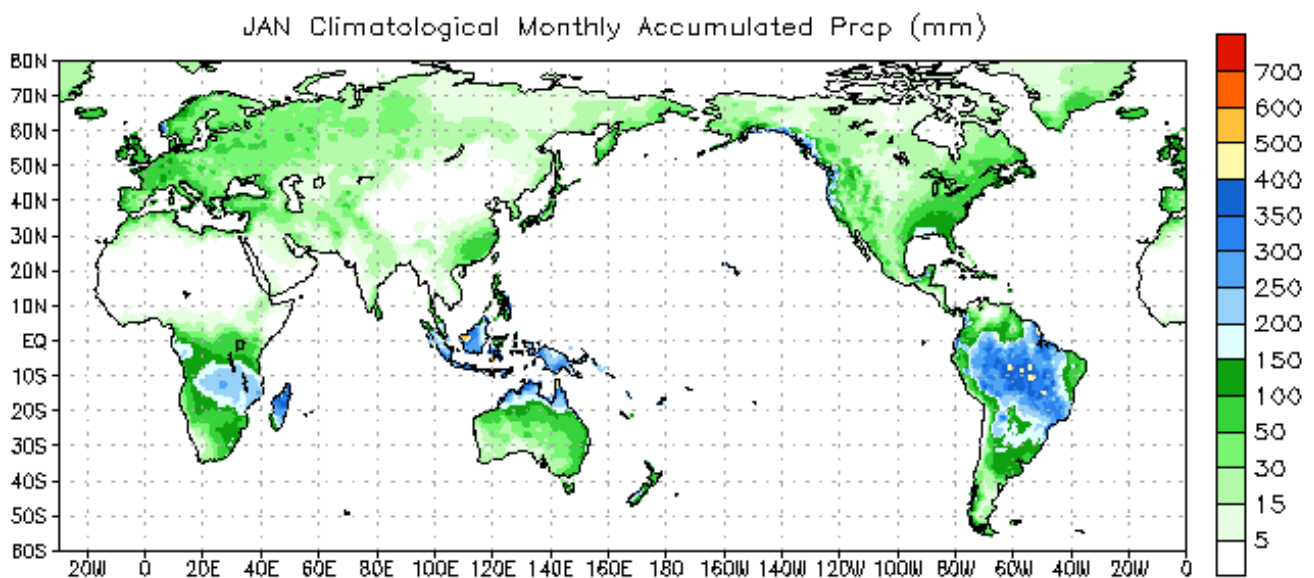


Data Source: NCEP CMAP Precipitation
Climatology (1991–2020)

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

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE

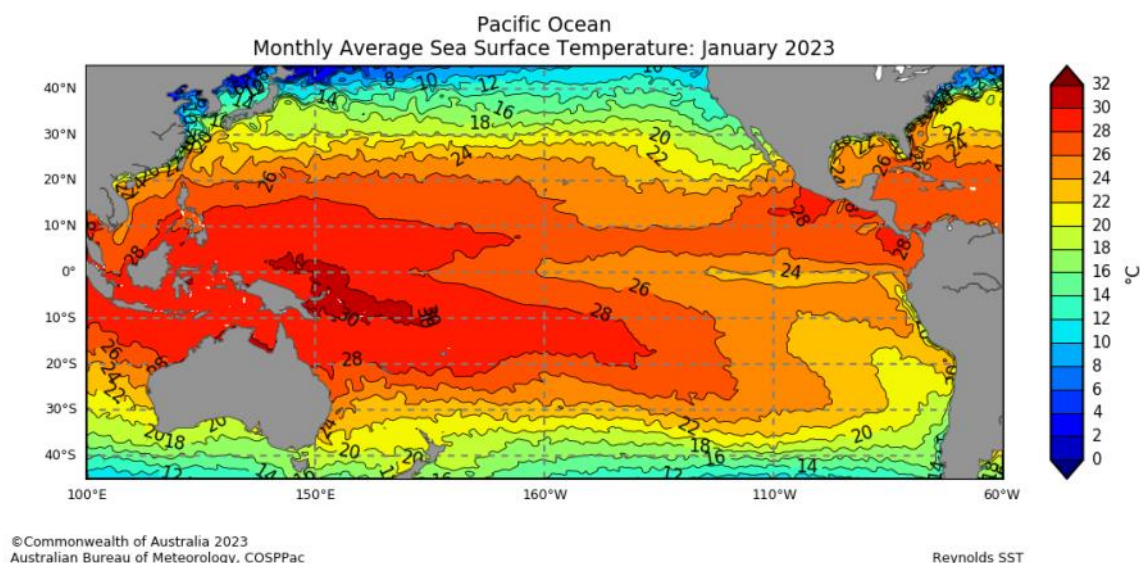


Click link to access [Pacific Community COSPPac Ocean Portal](#)

Sea surface temperatures (SST) in January 2023 were cooler than average across much of the tropical Pacific Ocean, extending from around 160°E in a broadening wedge to the South American coastline. Peak negative anomalies of -1.0°C to -1.5°C were observed in a few small patches of Kiribati. A boomerang-shape of warm anomalies surrounded the cool anomalies in both hemispheres. Peak positive anomalies upmost +2.0°C in a region extending from eastern Fiji to southern Tonga. Cool anomalies in the eastern Pacific were a little weaker than those in December. The overall pattern was typical of a weakening La Niña.

Record-high January SSTs occurred in FSM, Marshall islands, southern Vanuatu, eastern New Caledonia, eastern Fiji and Tonga. The record-high SSTs were surrounded by large areas with SSTs in decile 10 (very much above average) and above average (8-9). In contrast, SSTs below average (2-3) and very much below average (decile 1) for January were observed in Nauru, Kiribati, Tokelau, and the far northern and southern Cook Islands.

Mean Sea Surface Temperature

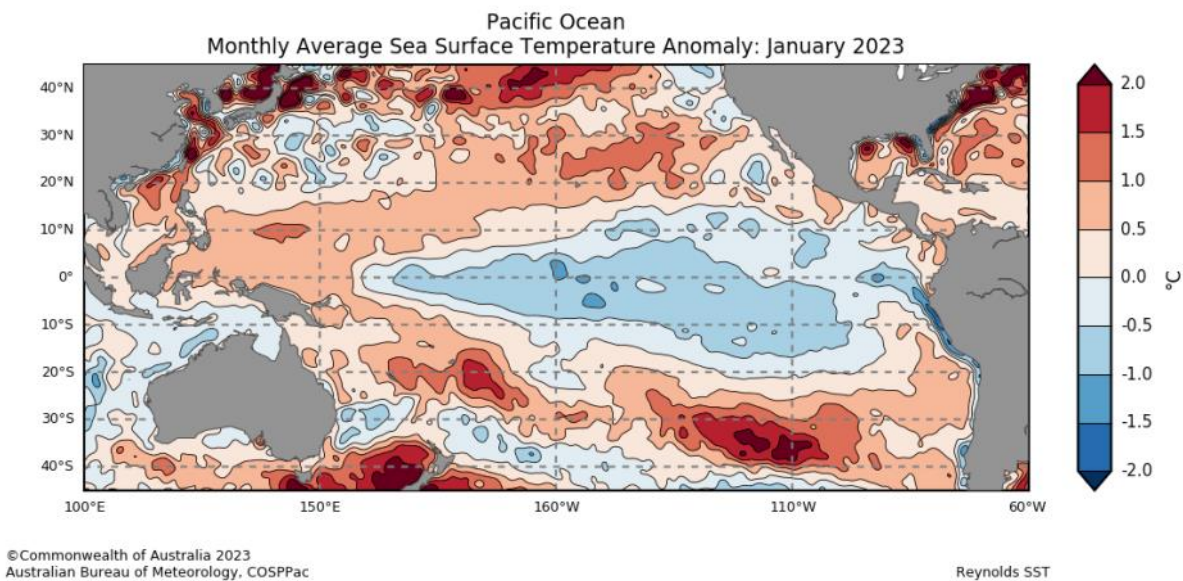


OCEAN CONDITIONS

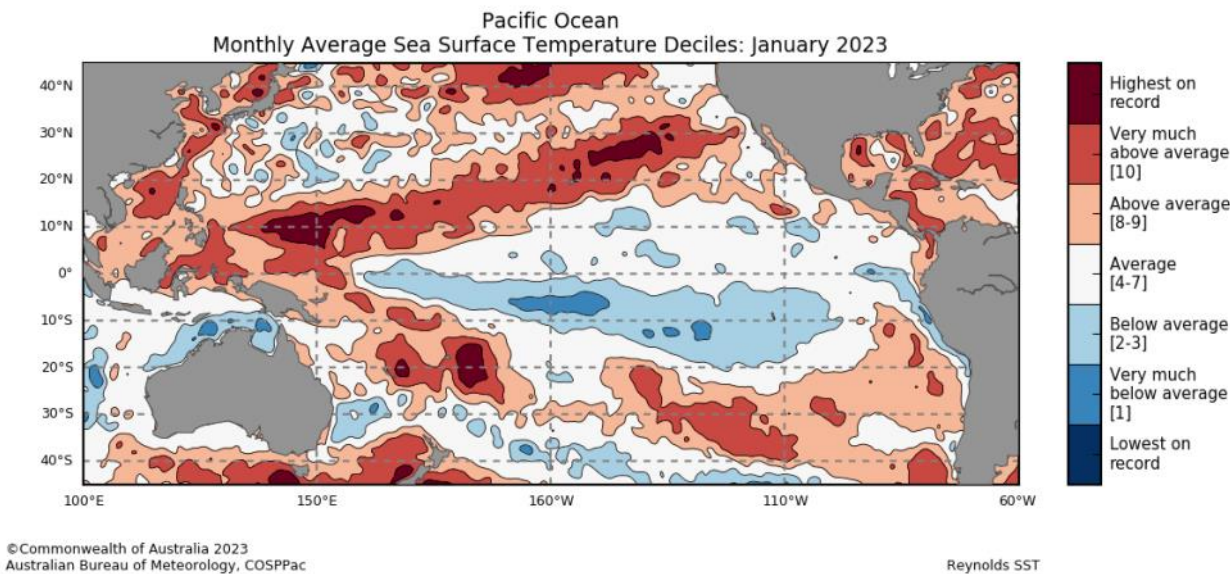
Click link to access [→SEA SURFACE TEMPERATURE](#)



Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles



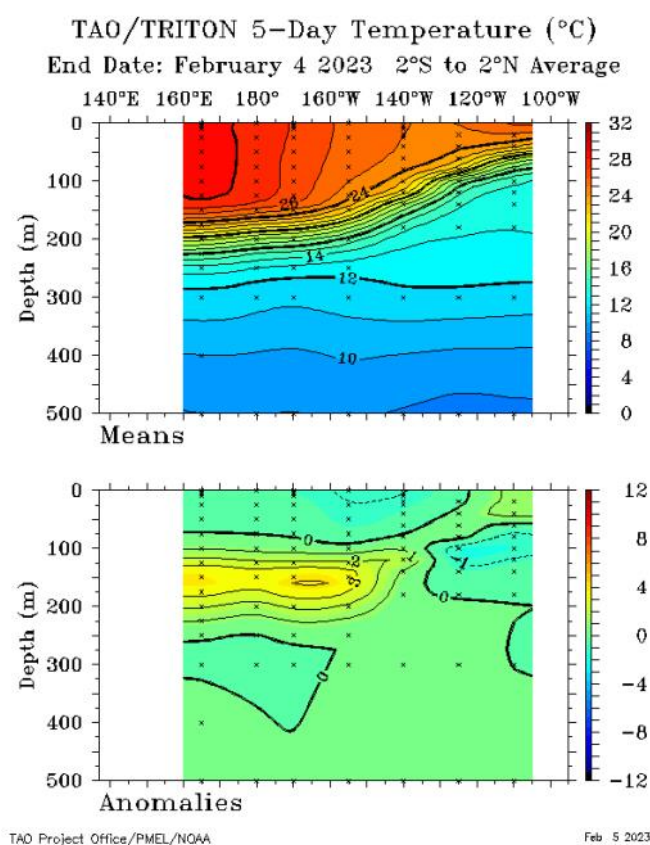
OCEAN CONDITIONS

SUB SURFACE

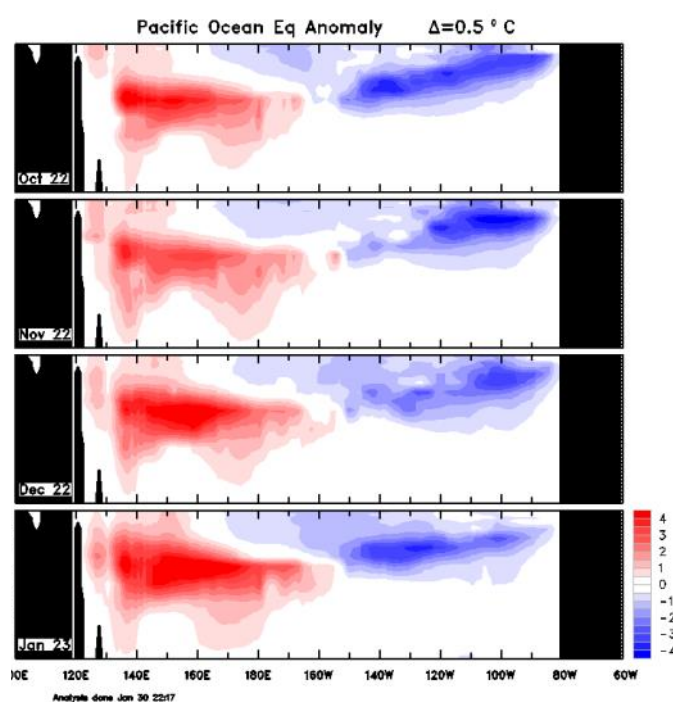


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 26 January 2023) shows cool anomalies in the eastern half of the equatorial Pacific, from the surface to around 150 m depth. Anomalies reached more than 2 °C cooler than average across much of the region east of 115°W to around 100 m depth. Warm anomalies are in place between around 50 and 250 m depth in the western to central equatorial Pacific (west of 160°W). Anomalies reached more than 3 °C warmer than average across much of this region. Compared to previous months, warm anomalies have increased in strength during January and have expanded towards the central equatorial Pacific, while cool anomalies have decreased in strength.

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

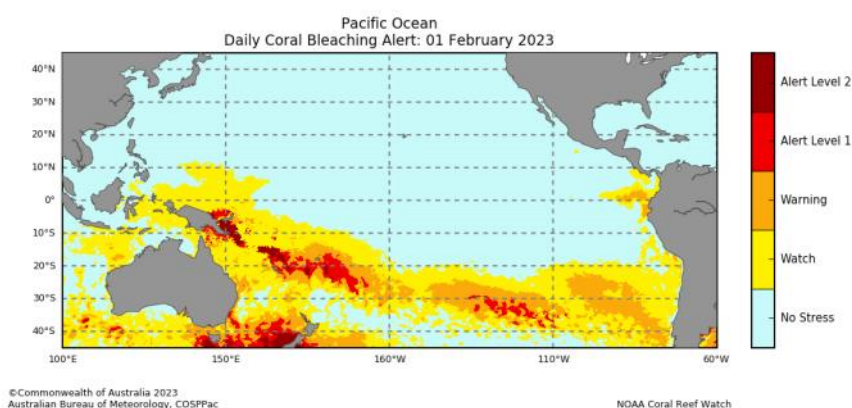
CORAL BLEACHING



The daily Coral Bleaching Alert status for 1 February 2023 shows 'Alert Level 2' extending southeastward from southeast PNG, western Vanuatu, and southern Fiji. 'Alert Level 1' were observed around PNG mainland, eastern New Caledonia, Vanuatu, southern Fiji and southern Tonga. Patches of 'Warning' are shown in New Caledonia and southeastward to southern French Polynesia. The four-week Coral Bleaching outlook to 26 February shows a broad area of Warning to 'Alert Level 2' ratings coinciding with the peak positive SST anomalies extending southeast from PNG across the Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga, Samoa.

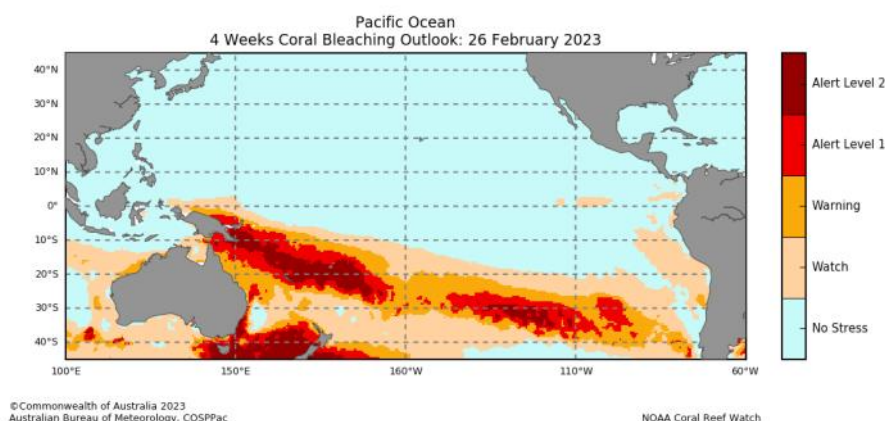
Daily Coral Bleaching Alert

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



4 Weeks Coral Bleaching Outlook

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



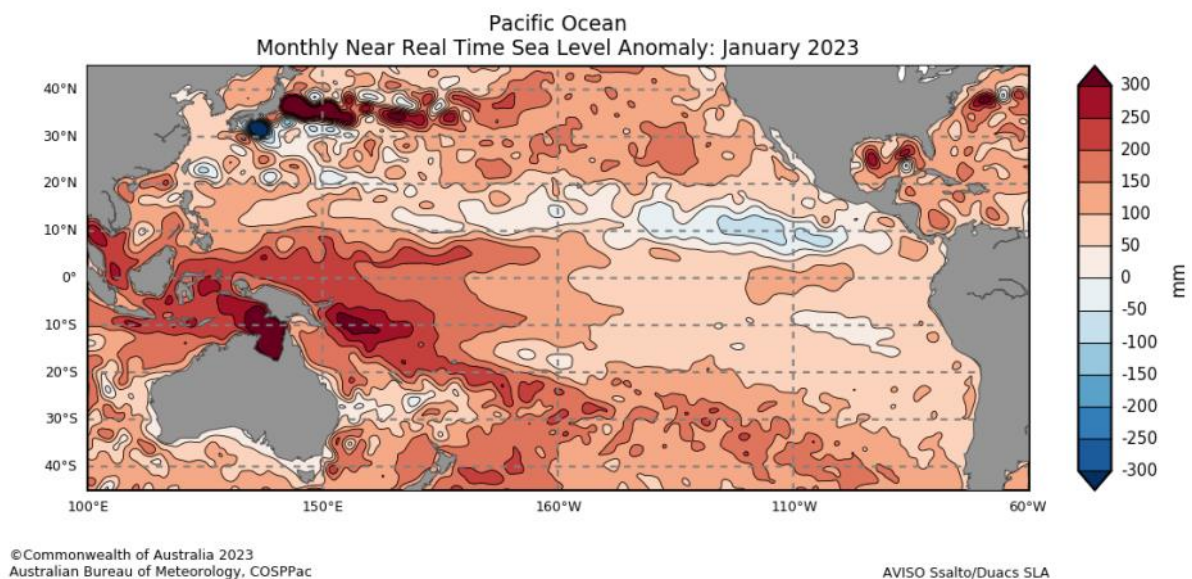
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Apart from northern RMI and the central Cook Islands where sea level was close to normal, January sea level was above normal over COSPPac countries. Anomalies above +300 mm were observed in eastern PNG and western Solomon Islands. Anomalies of +200 mm were observed in PNG, Solomon Islands, Vanuatu, northern New Caledonia, and in patches of Fiji, Tonga and Niue. Sea level was generally 100 mm to 250 mm above average elsewhere.

Monthly Sea Level Anomalies

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

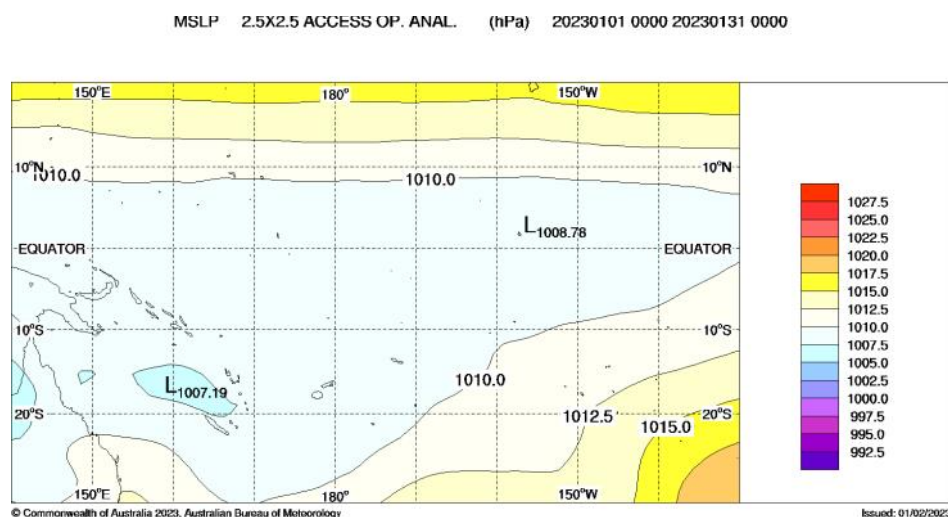


MEAN SEA LEVEL PRESSURE

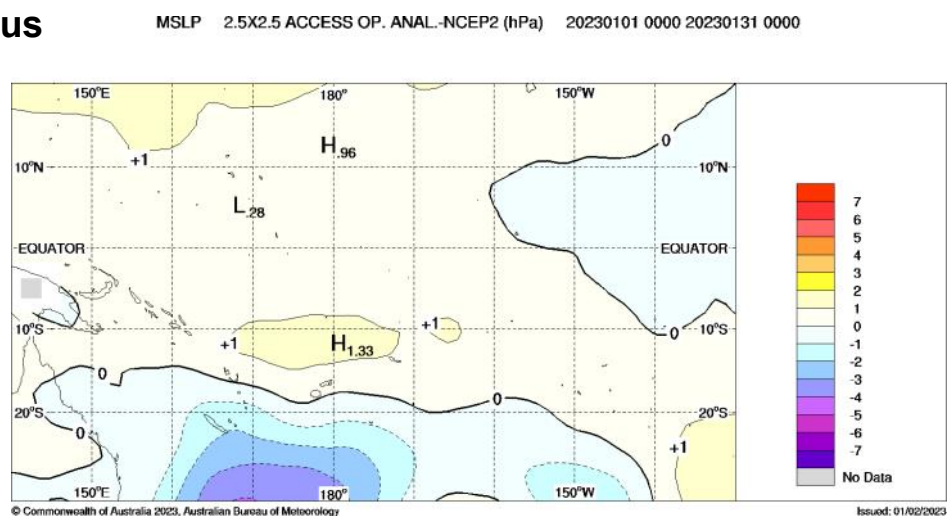
The January mean sea level pressure (MSLP) anomaly map shows mostly negative anomalies of 1hPa or greater over southern Vanuatu, New Caledonia and towards New Zealand, as well as east of the Date Line. Positive anomalies of 1hPa or greater were analysed over the northern Vanuatu to Tokelau and regions further north of FSM.

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

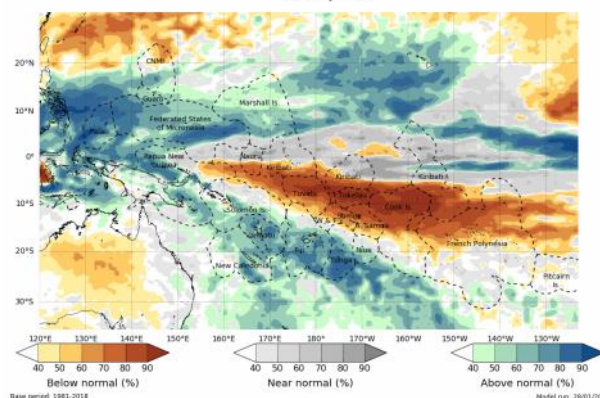
February—April 2023



The ACCESS-S model forecast for February 2023, favours below normal rainfall for the far northeast of PNG's EEZ, southern Nauru, the southern halves of central and eastern Kiribati plus the far south of western Kiribati, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern and central Cook Islands, and northern and central French Polynesia. Above normal rainfall is likely or very likely for Palau, Guam, southern CNMI, most of FSM, most of RMI, the southeast and north of PNG's EEZ, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue.

The three-month rainfall outlook (February-April 2023) is very similar to the February outlook as it favours below normal rainfall for northeast PNG EEZ, northern Solomon Islands EEZ plus parts of the main western and central islands, Nauru, southern part of western, central Kiribati eastern Kiribati, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern and central Cook Islands, central and northern French Polynesia, and Pitcairn Island. Above normal rainfall is likely or very likely for Palau, Guam, central and southern CNMI, most of FSM, much of RMI, the southeast and northwest of PNG's EEZ, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, the far southern Cook Islands, and patches of southern French Polynesia.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for February-April 2023 differs from the ACCESS-S model in only some minor details, the main ones being with the dry signal extending a little further west to the PNG mainland, as well as a little further north over western Kiribati. In addition, the southern hemisphere wet signal is a little further south in comparison, especially around Fiji, Tonga and Niue.

The APEC Climate Centre multi-model for February-April 2023 is also very similar to the ACCESS-S model. The main differences are an increased wet signal for CNMI and drier signal for western and central Kiribati.

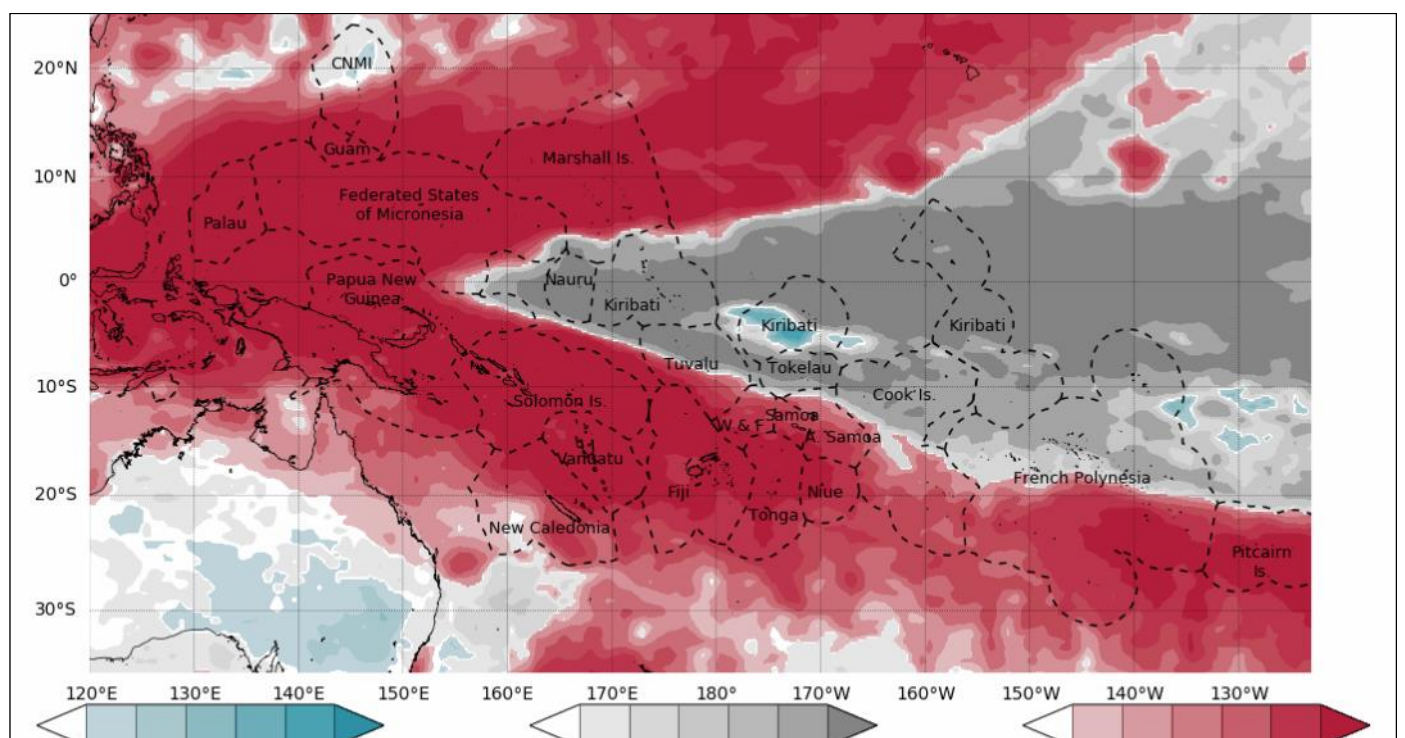
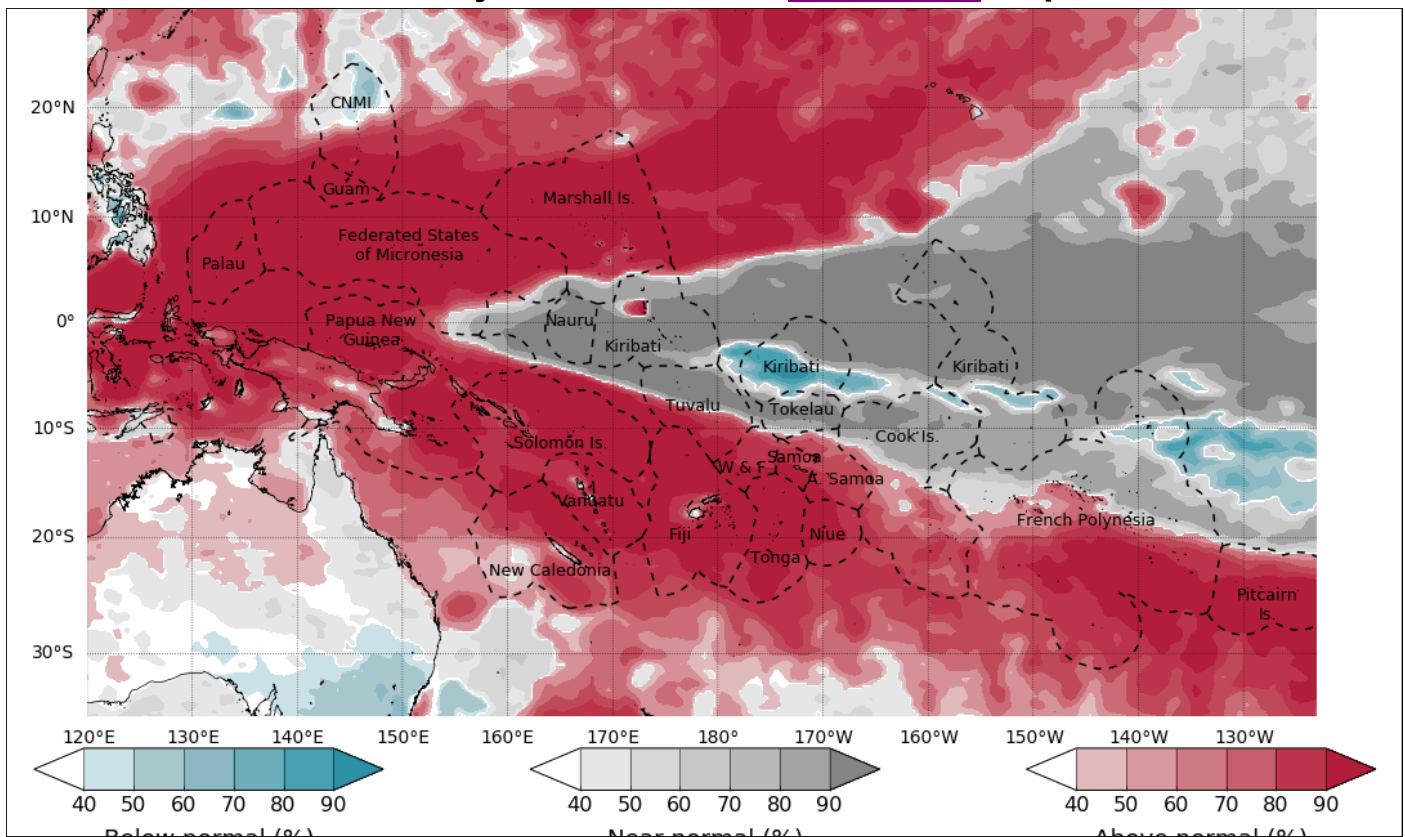
For February-April 2023, the models unanimously agree on above normal rainfall for much of Palau, Guam, CNMI, most of FSM, most of RMI, eastern Solomon Islands, New Caledonia, Vanuatu, Fiji (except Rotuma), central and southern Tonga, and Niue. The models are also unanimous in showing that below normal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

SEASONAL TEMPERATURE OUTLOOK

February—April 2023



Monthly Tmax and Tmin ACCESS-S Maps



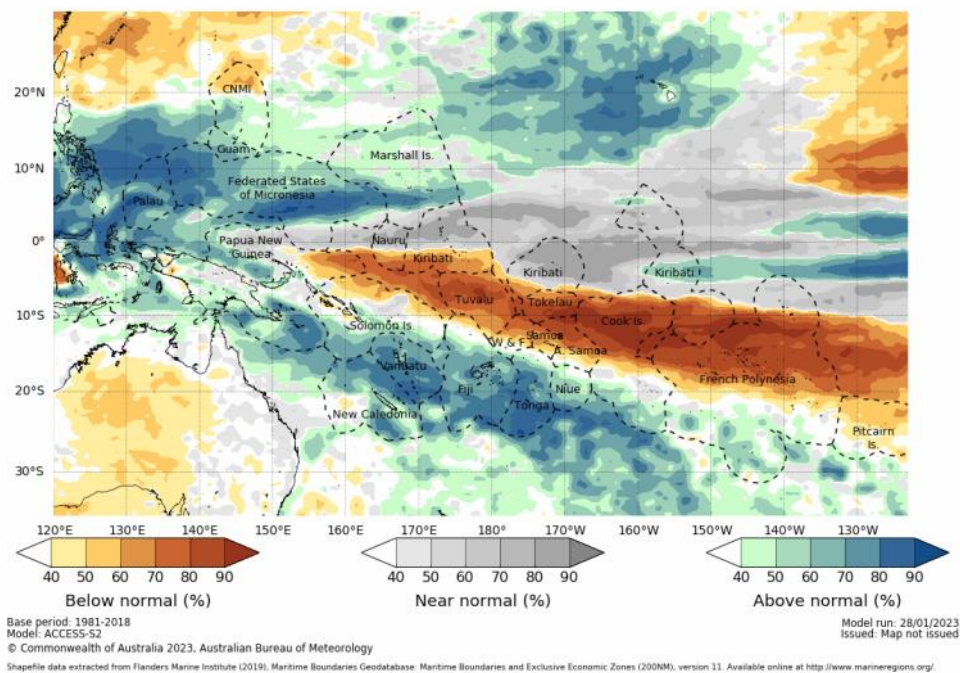
SEASONAL RAINFALL OUTLOOK

February—April 2023

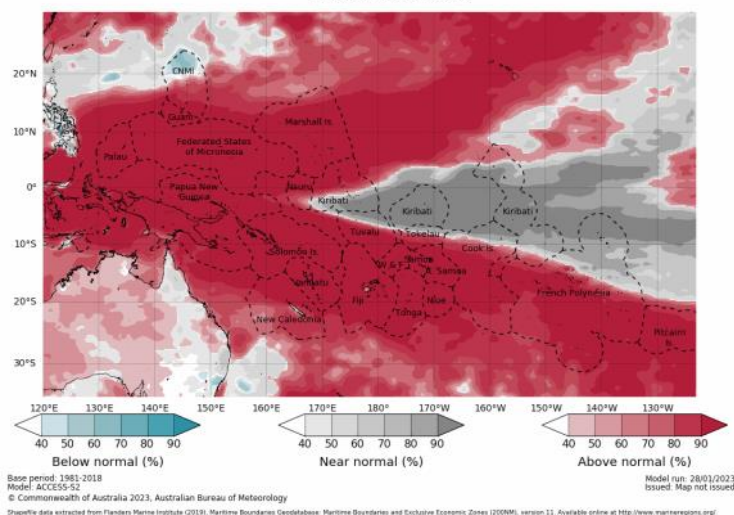


Seasonal ACCESS-S maps

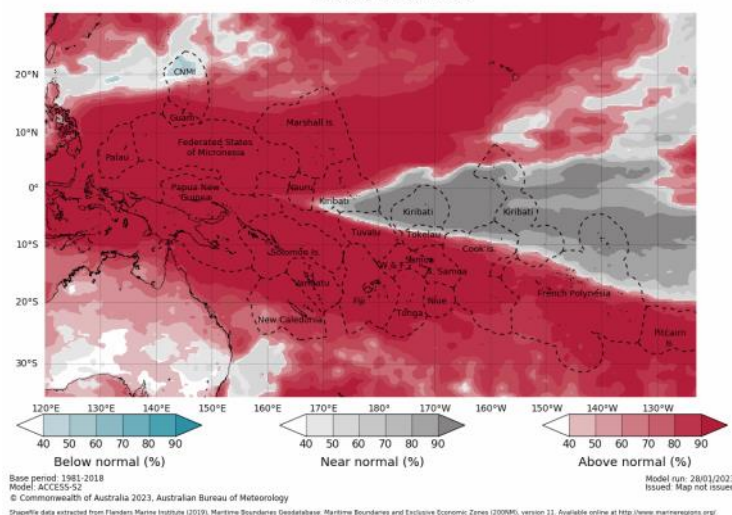
Tercile rainfall probabilities for
February to April 2023



Tercile maximum temperature probabilities for
February to April 2023



Tercile minimum temperature probabilities for
February to April 2023



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

SEASONAL RAINFALL OUTLOOK

February—April 2023



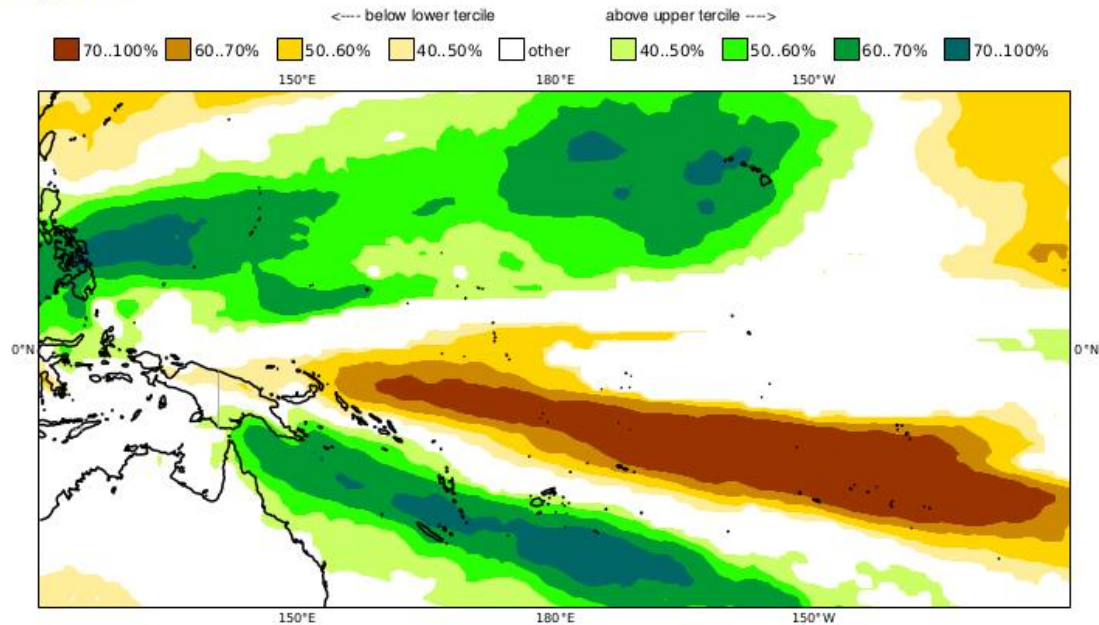
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

FMA 2023

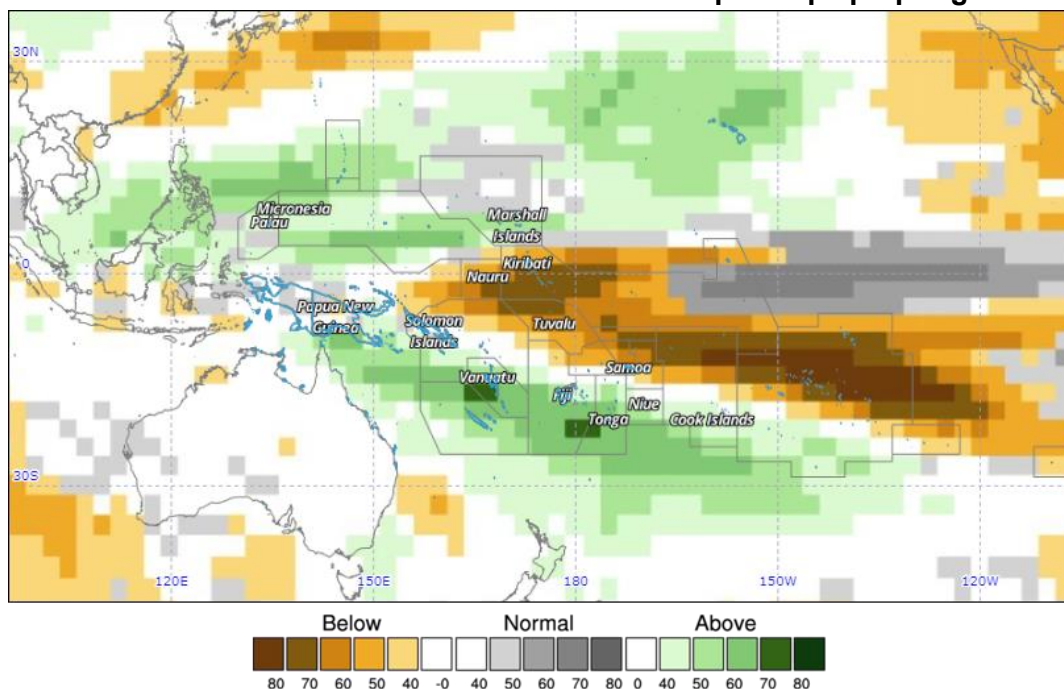
Nominal forecast start: 01/01/23

Unweighted mean



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

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



Year: 2023, Season: FMA, Lead Month: 3, Method: GAUS

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

Generated using CLIK® (2023-2-8)

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TROPICAL CYCLONE

2022/2023 Season



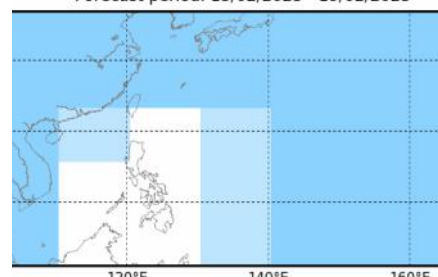
The northwest Pacific, 2021-22 tropical cyclone season is year around, with most cyclones occurring between May and October. Twenty-four named TCs have occurred as of 31 October with four reaching super typhoon intensity. Most TCs in the southwest Pacific occur between November to April. Associated with 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 slight to moderately increased risk between 11 and 24 February around the eastern Australia and Coral Sea Region. The cyclone risk for the northwest Pacific for the same period is slightly below normal.

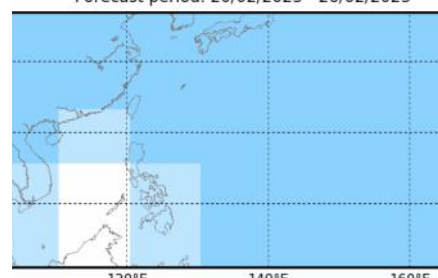
ACCESS-S Weekly Forecasts –Northwest Pacific

Difference from normal chance of Tropical Cyclone's in the Northwest Pacific
Forecast period: 13/02/2023 - 19/02/2023



Model: ACCESS_S2 Model Run: 05/02/2023
Probability in overlapping 15 x 20 degree boxes
123. Australian Bureau of Meteorology

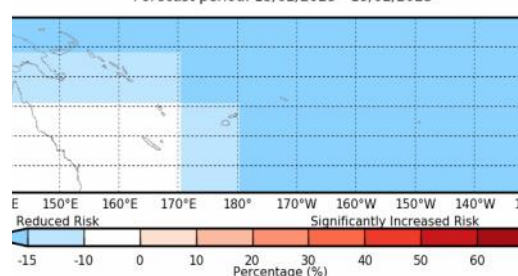
Difference from normal chance of Tropical Cyclone's in the Northwest Pacific
Forecast period: 20/02/2023 - 26/02/2023



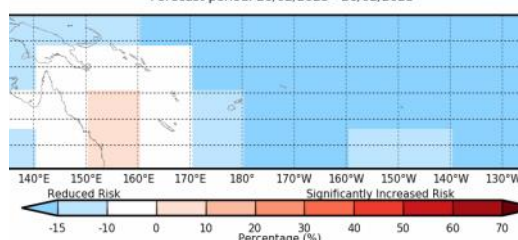
Model: ACCESS_S2 Model Run: 05/02/2023
Probability in overlapping 15 x 20 degree boxes
123. Australian Bureau of Meteorology

ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the Southwest Pacific
Forecast period: 13/02/2023 - 19/02/2023



Model: ACCESS_S2 Model Run: 05/02/2023
Probability in overlapping 15 x 20 degree boxes
123. Australian Bureau of Meteorology



Model: ACCESS_S2 Model Run: 05/02/2023
Probability in overlapping 15 x 20 degree boxes
123. Australian Bureau of Meteorology

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.

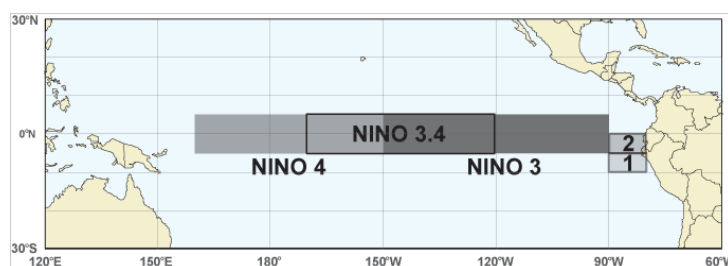
20 degrees Celsius Isotherm Depth

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