Monthly Climate Bulletin

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Photo Credit: Molly Powers (SPC) Samoa Tide Gauge

SPREP
Secretariat of the Pacific Regional Environment Programme

Australian Government
Department of Foreign Affairs and Trade
Bureau of Meteorology

Australian Aid

Climate and Oceans Support Program in the Pacific

Pacific Community
Communauté du Pacifique

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Issued 11 January 2023

- La Niña continues in the tropical Pacific and models suggest a return to ENSO-neutral SSTs in January or February 2023.

- The Madden-Julian Oscillation (MJO) is expected to become weak before re-emerging in African longitudes later in January.

- The Intertropical Convergence Zone (ITCZ) was close to its average December position, while the South Pacific Convergence Zone (SPCZ) was displaced southwest over Vanuatu and Fiji.

- Sea surface temperatures (SSTs) in December 2022 displayed a La Niña pattern: a wedge of cool anomalies centred on the equator, with warm anomalies wrapping around them.

- The Coral bleaching status for 2 January 2023 shows 'Alert Level 2' extending southeast from the PNG Islands across the southwest Solomon Islands to western Vanuatu.

- For January-March 2023, the models unanimously agree on above normal rainfall for much of Palau, Guam, CNMI, FSM, northern and central 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 northern PNG and the PNG Islands, Nauru, central and eastern Kiribati, Tuvalu, Tokelau, Samoa, American Samoa, northern Cook Islands, northern French Polynesia, and Pitcairn Island.

- The ACCESS-S weekly tropical cyclone forecast model shows slightly increased risk between 18 and 24 January in the northwest Pacific, but somewhat reduced risk for the southwest Pacific over the fortnight to 24 January.

EL NIÑO–SOUTHERN OSCILLATION

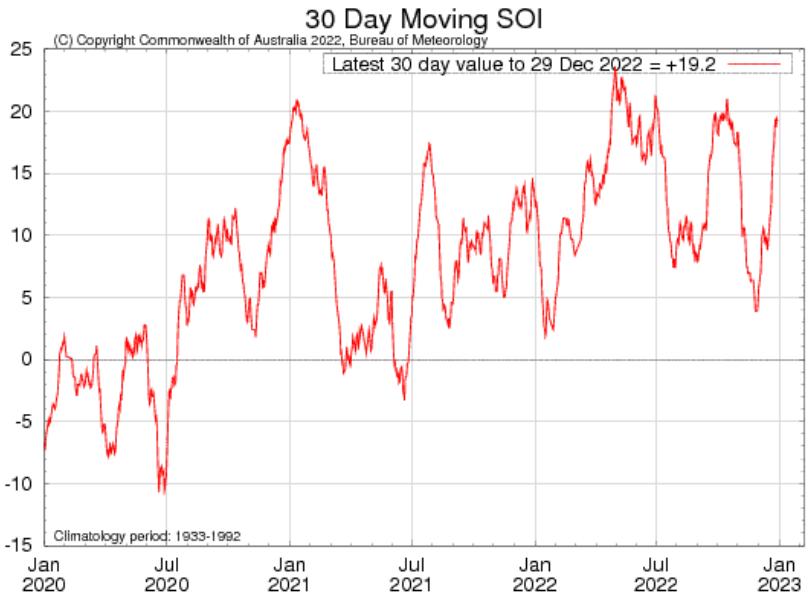
Indian Ocean Indian Ocean Dipole returns to neutral; La Niña anticipated to ease over summer

Click link to access Climate Driver Update issued on 04 January 2023

La Niña continues in the tropical Pacific but is slowly weakening. However, while the Pacific has warmed in recent weeks, atmospheric indicators are largely unchanged, remaining at La Niña levels.

Long-range forecasts suggest that the tropical Pacific Ocean will continue to warm towards ENSO-neutral levels over the coming weeks, with some change in atmospheric patterns towards neutral levels also possible. As long-range forecast accuracy is generally lower at this time of year, ENSO outlooks that extend through autumn should be viewed with caution.

The Southern Annular Mode (SAM) is strongly positive and is likely to be positive until at least mid-January. The 30-day Southern Oscillation Index (SOI) for the 30 days ending 2 January was +20 and have increased over the past fortnight. The 90-day SOI value was +14.



EL NIÑO–SOUTHERN OSCILLATION

Indian Ocean Indian Ocean Dipole returns to neutral; La Niña anticipated to ease over summer

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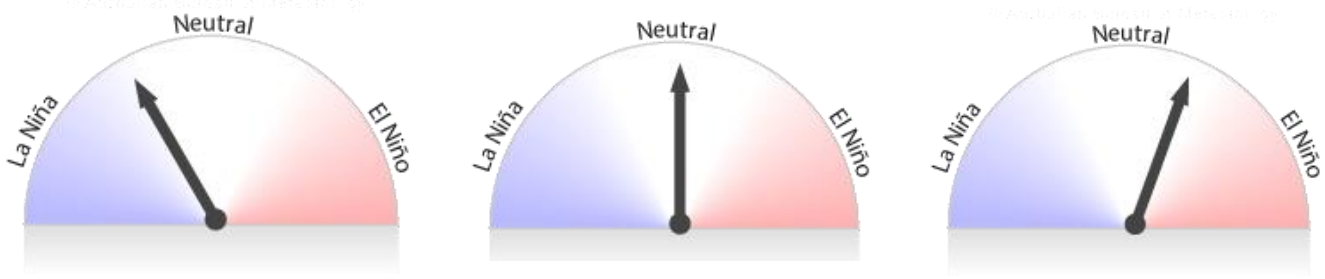
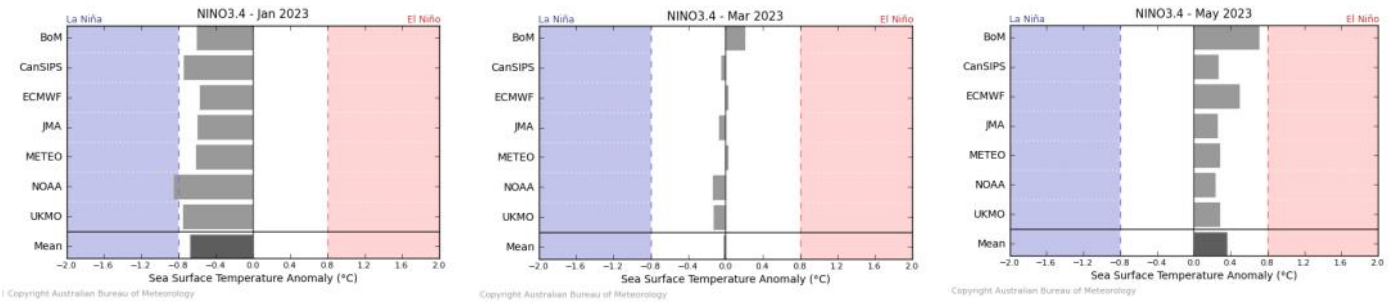
Bureau of Meteorology NINO3.4 ENSO Model Outlooks for January, March and May



Bureau of Meteorology NINO3.4 International Model Outlooks



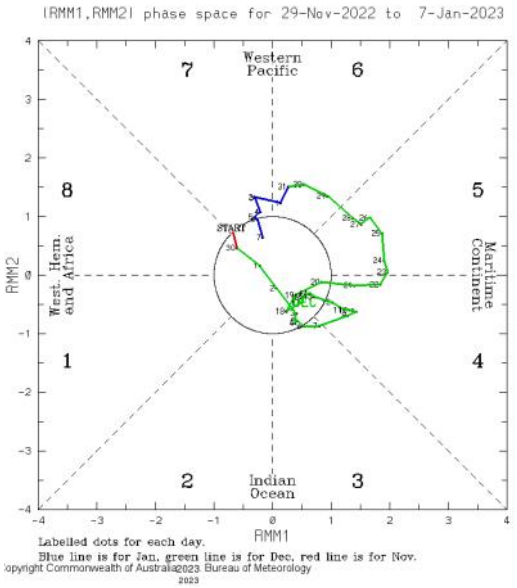
Bureau of Meteorology summary of international model outlooks for NINO3.4: http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean

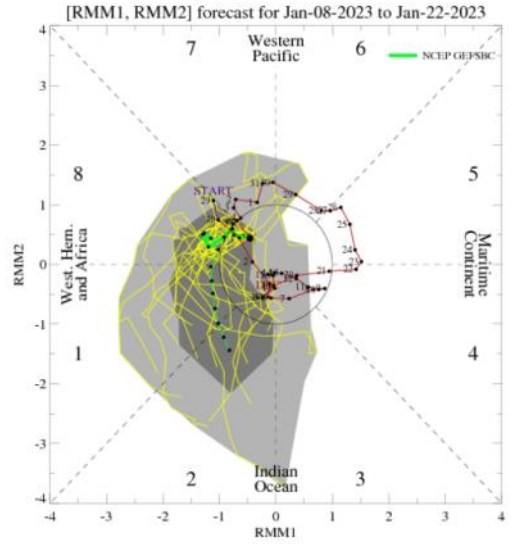
MADDEN–JULIAN OSCILLATION

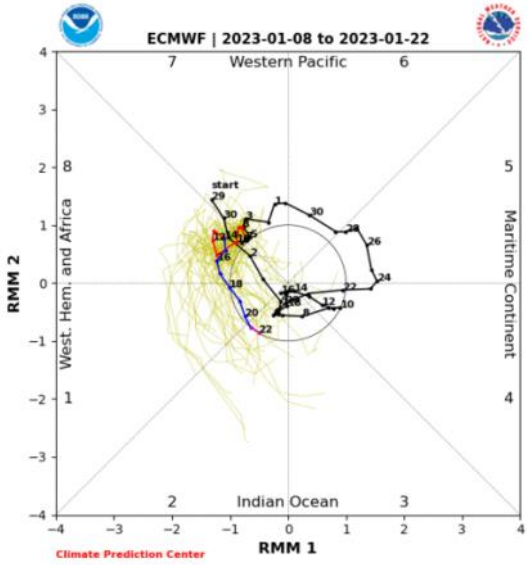
Click link to access *Tropical Climate Update* [Issued on Wednesday 4 January 2023]

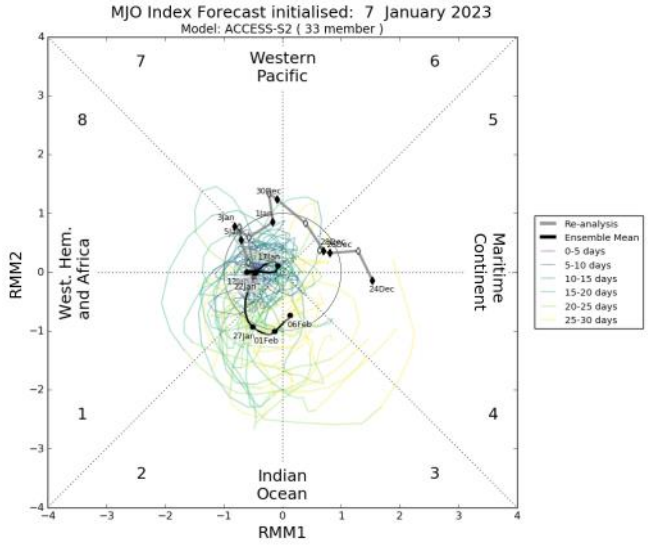
A weak to moderate pulse of the Madden-Julian Oscillation (MJO) propagated over the Maritime Continent in December, reaching the western Pacific at the end of the month. It has shown signs of weakening in recent days.

ACCESS forecasts the MJO to become weak or indiscernible in the coming week, before re-emerging in African longitudes later in the month and into early February. The NOAA forecast is similar, but it only forecasts two weeks ahead.
This is an abbreviated version of the Tropical Climate Update. Click on the *Weekly Tropical Update* for more information .







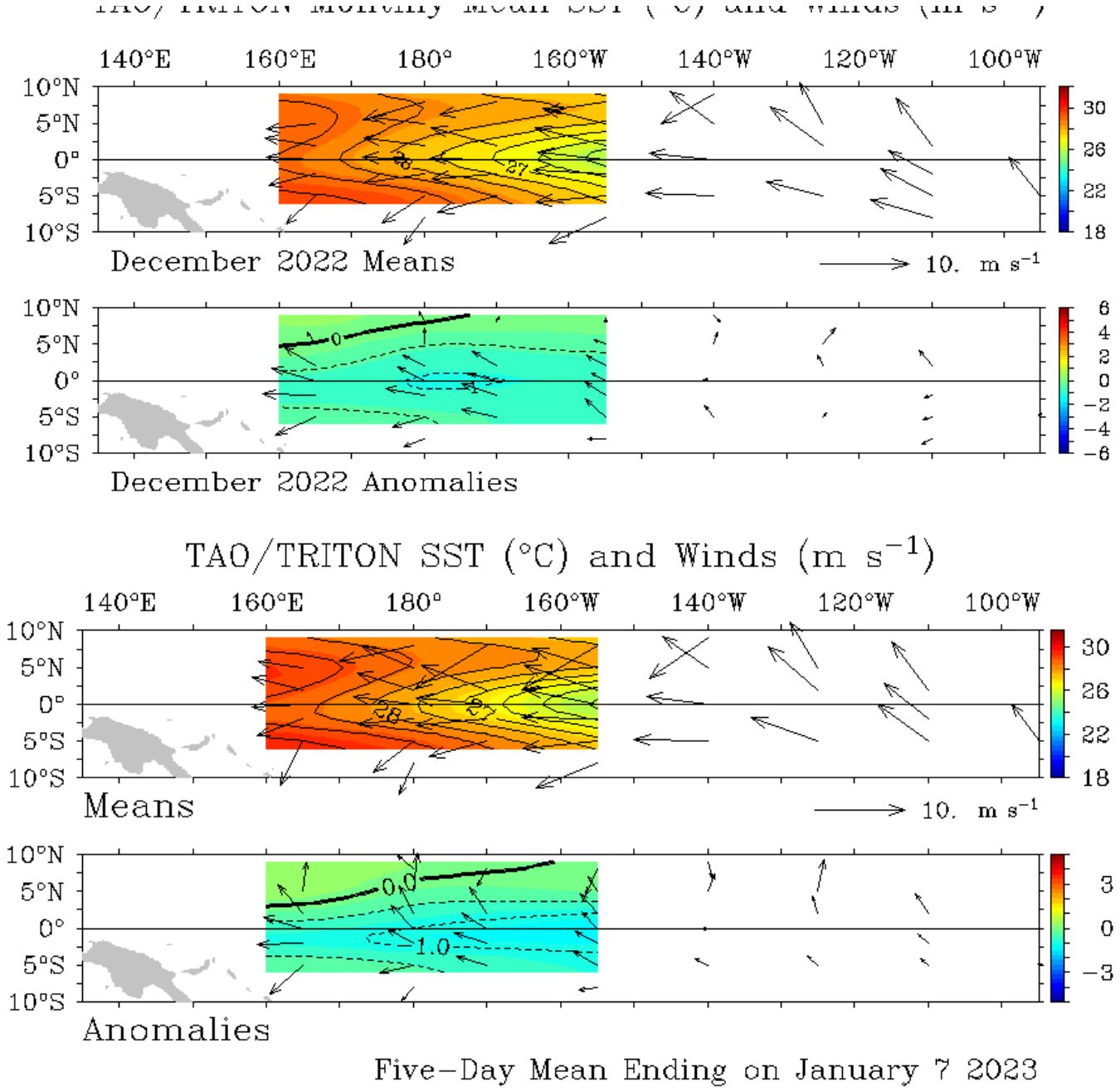


WIND

Click link to access Wind plots link

For the five days ending 4 January 2023, the trade winds were stronger than normal across the near-equatorial Pacific, particularly in western and central longitudes. Similarly, they were stronger than normal in the western and central equatorial Pacific in December, 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.



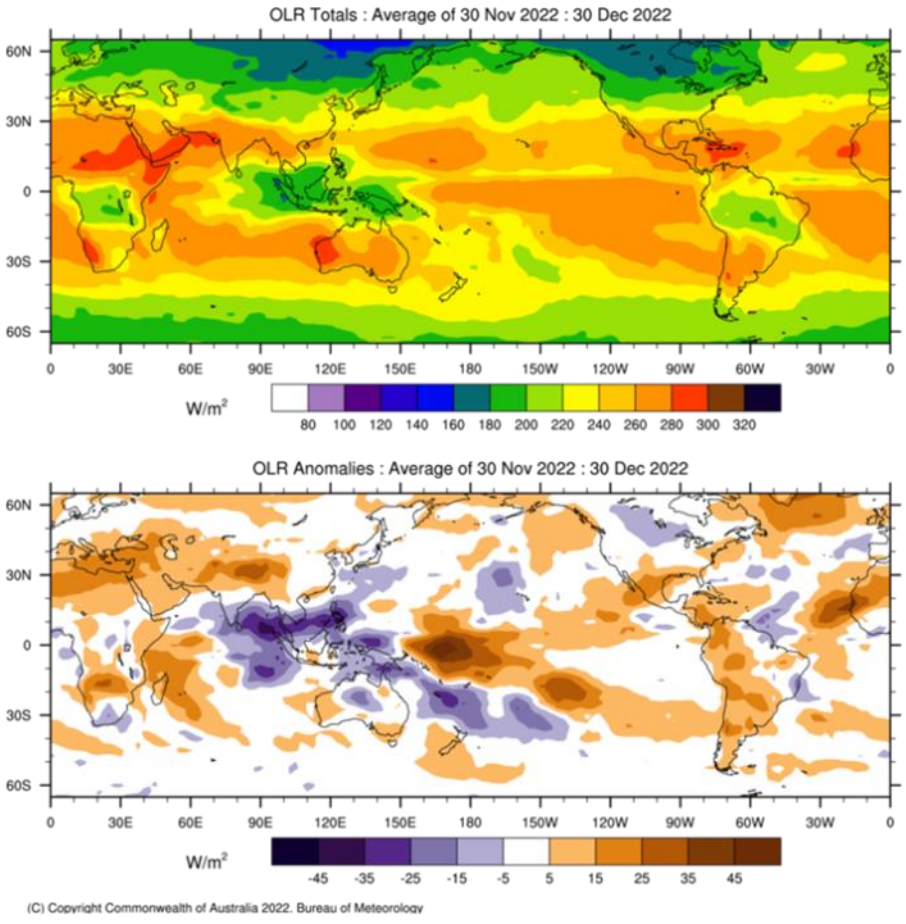
CLOUD AND RAINFALL

Click link to access OLR

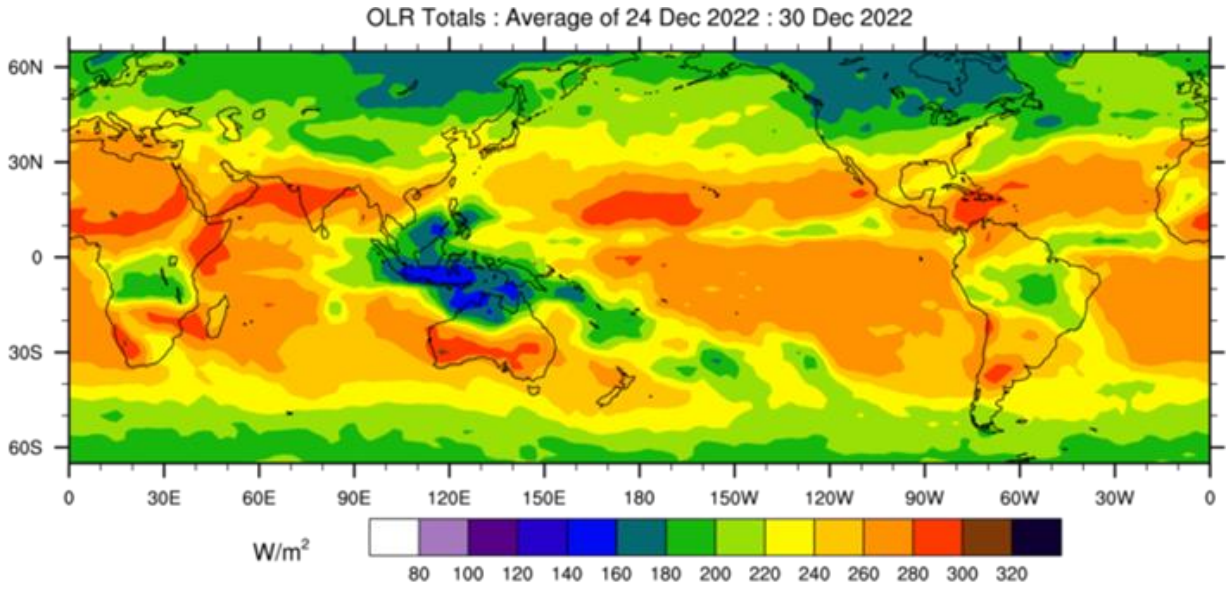
The main feature of the December 30-day OLR total and anomaly maps was the dipole pattern across the Indo-Pacific indicating a mature La Niña. The centre of low OLR (increased convection) was situated to the north and west of Indonesia, while a secondary centre was located over PNG. A spur to the southeast 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 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 December showed an active Australian monsoon as part of a broad region of increased cloudiness extending northwards across the Maritime Continent to the South China Sea, and an active SPCZ which was displaced to the southwest..

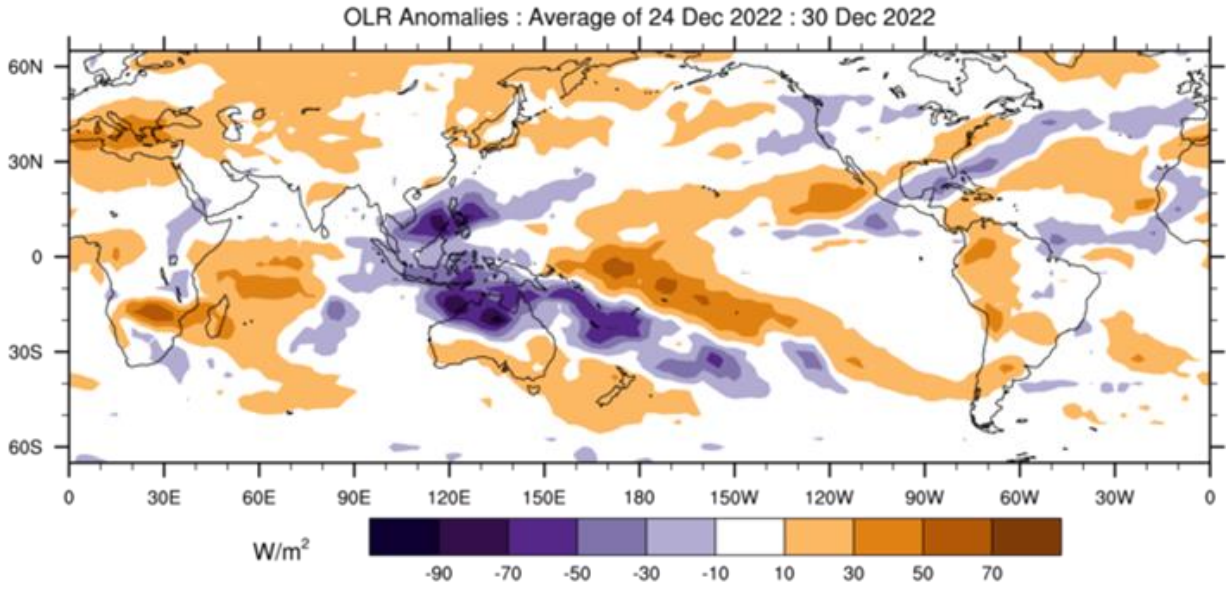
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2. In the bottom panel, negative values (blue shading)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

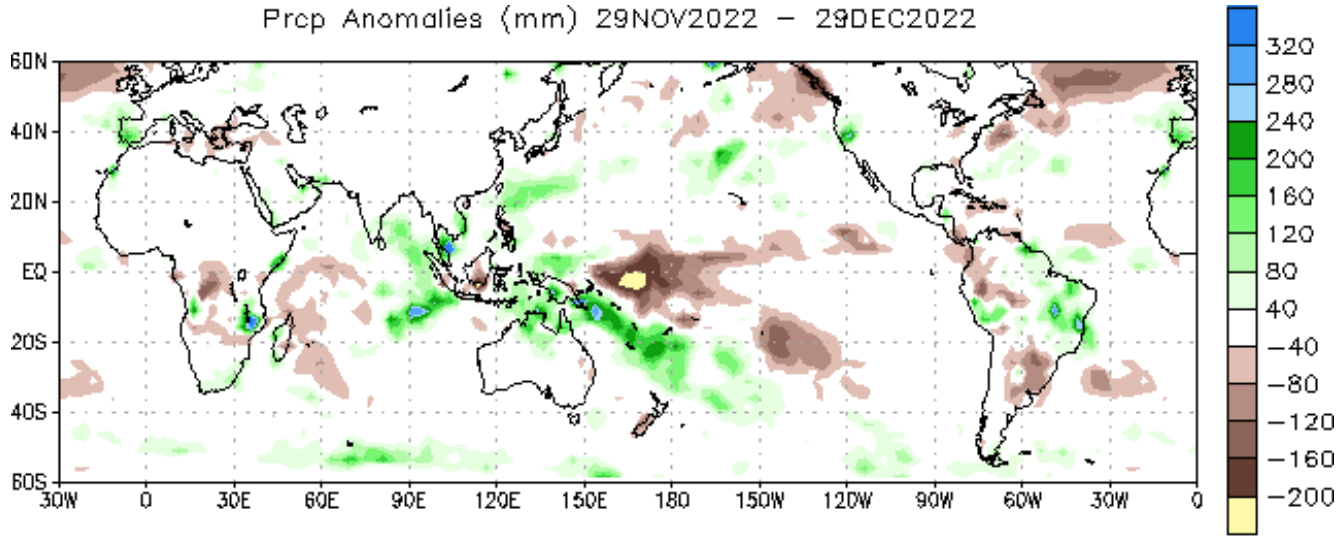
OLR Total and Anomalies, 30 Day OLR



OLR Total and Anomalies, 7 Day OLR

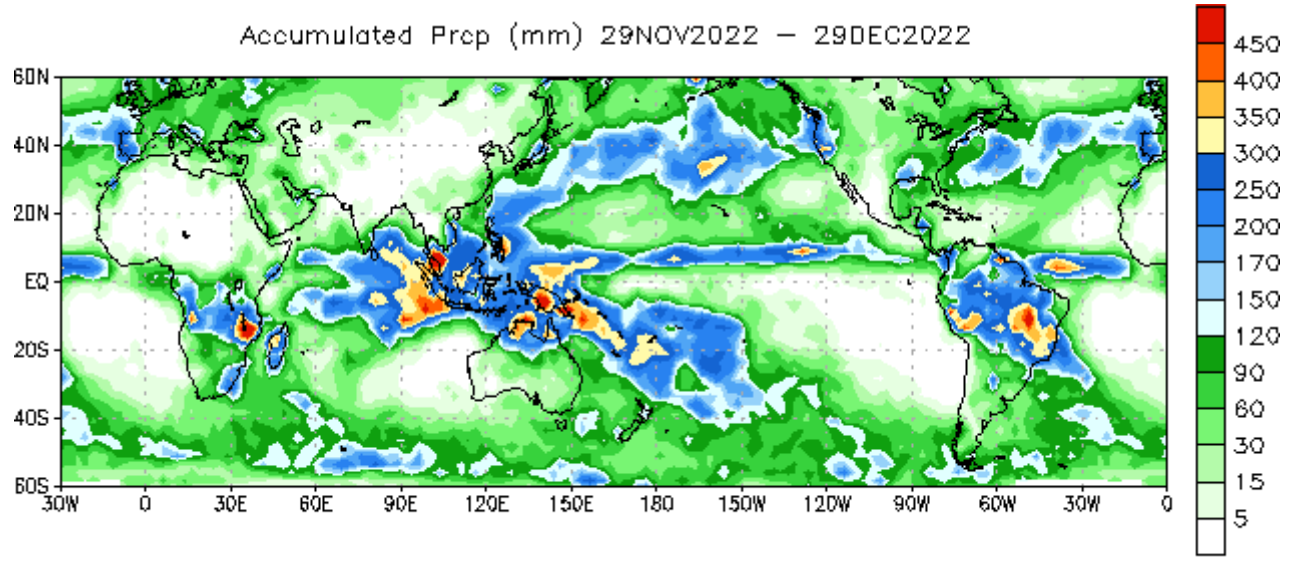




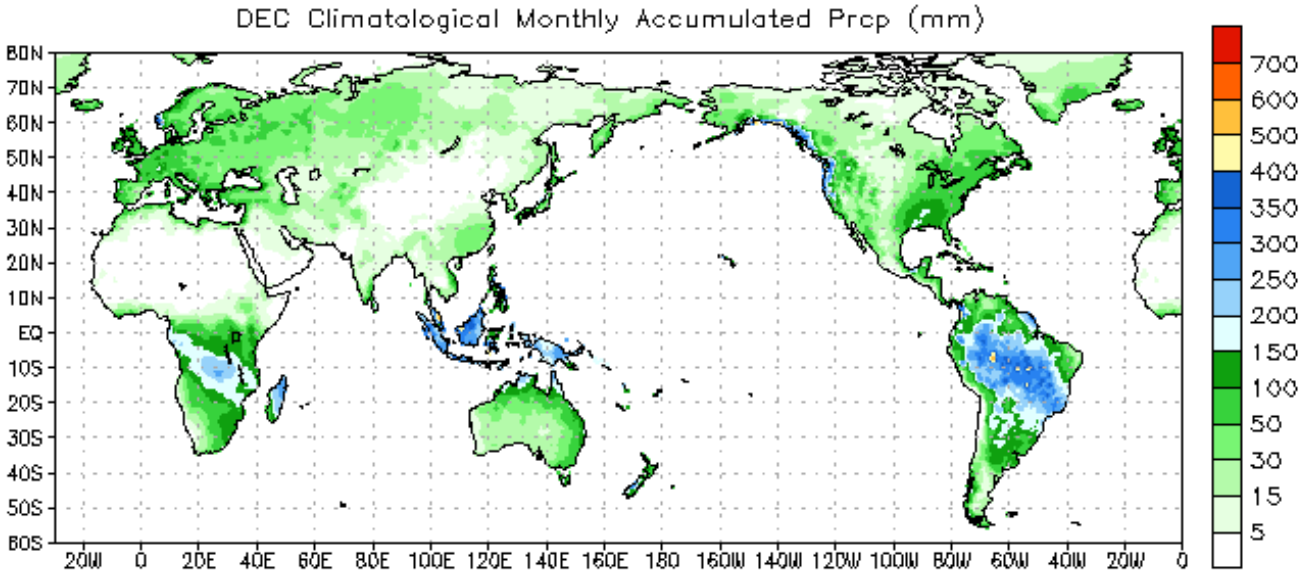


Data Source: NCEP CMAP Precipitation Climatology (1991–2020)

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

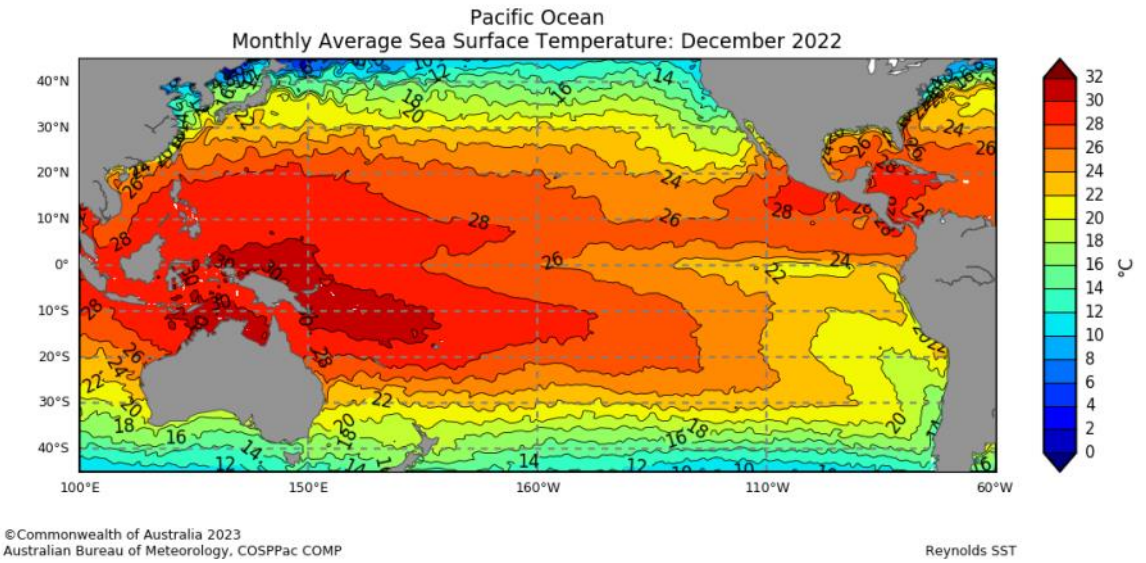
SEA SURFACE TEMPERATURE

Click link to access Pacific Community COSPPac Ocean Portal

Sea surface temperatures (SST) in December 2022 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 exceeded +2.0°C in a region extending from the southern Solomon Islands to southern Tonga. Cool anomalies in the eastern Pacific were a little weaker than those in November. The overall pattern was typical of a La Niña.

Record-high December SSTs occurred in a zone from the southeast of PNG across the southern Solomon Islands, northern New Caledonia, Vanuatu, Fiji, and western Tonga. In addition, record-high December SSTs were also observed in central to northern FSM, and in small patches of Palau and RMI. The record-high SSTs were surrounded by large areas with SSTs in decile 10 (very much above average). In contrast, SSTs in decile 1 for December were observed in a narrow strip from northern Tuvalu across central Kiribati, the far northern Cook Is., the southern half of eastern Kiribati, and northern French Polynesia.

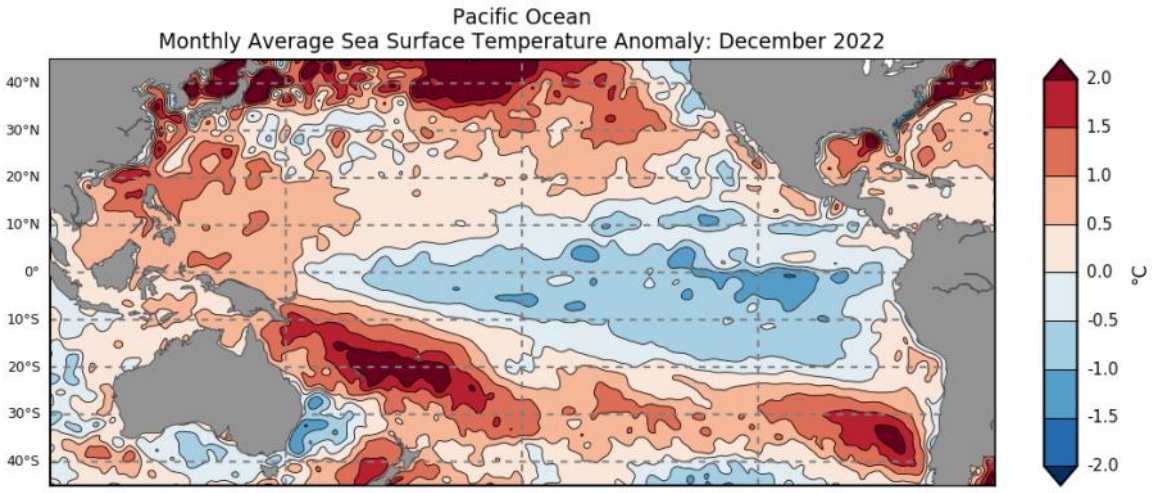
Mean Sea Surface Temperature



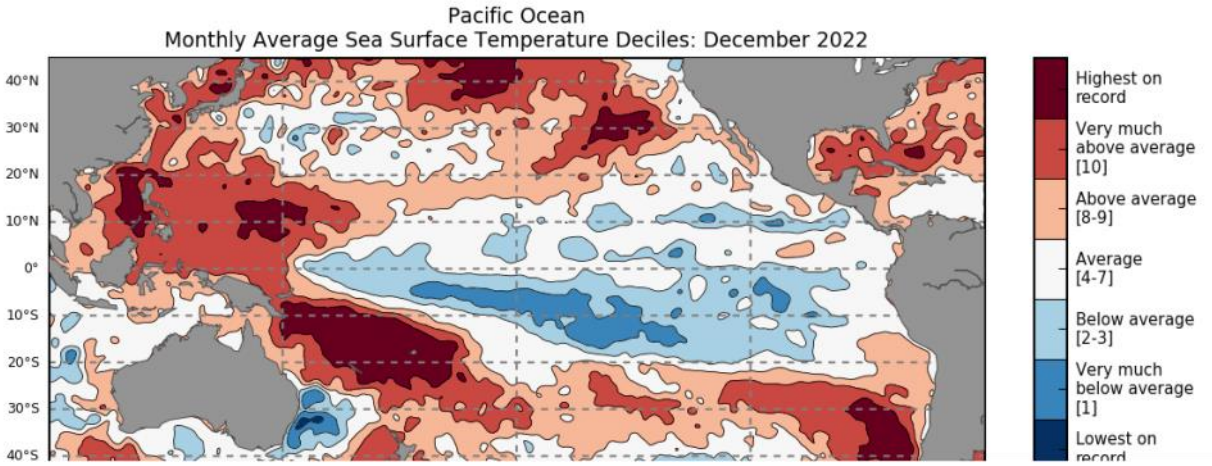
OCEAN CONDITIONS

Click link to access SEA SURFACE TEMPERATURE

Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles

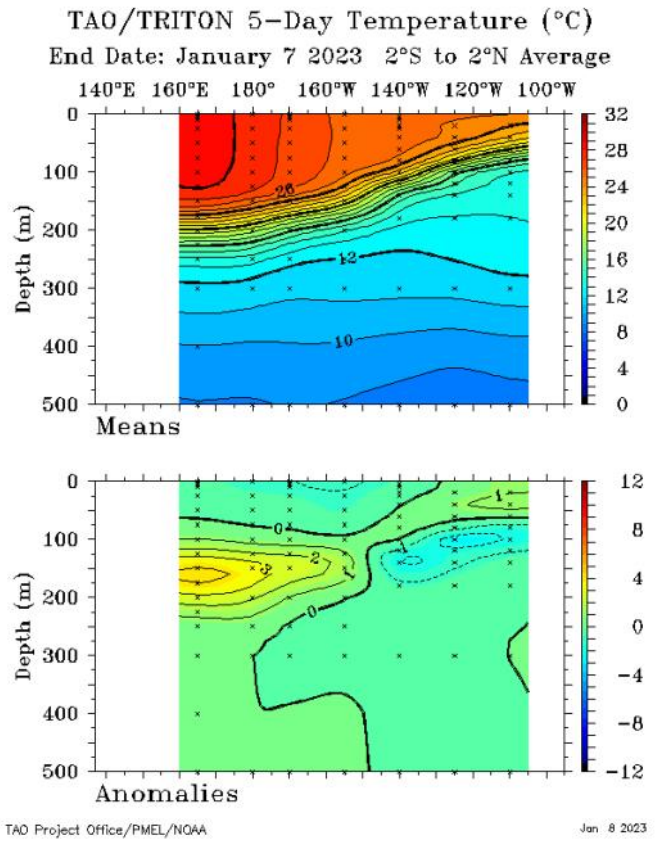


OCEAN CONDITIONS

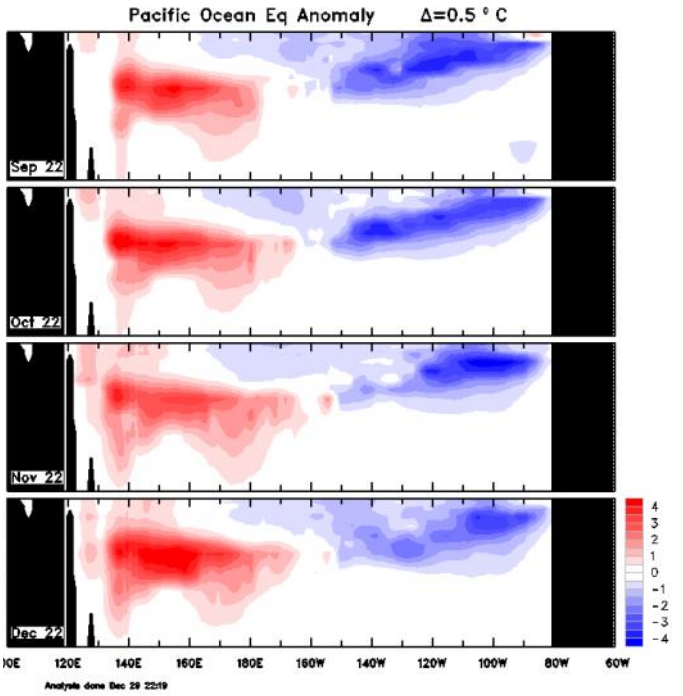
SUB SURFACE

The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 2 January 2023) shows a classic La Niña dipole pattern of cool anomalies in the east and warm anomalies in the west. The cool anomalies reduced in strength from November to December, while the warm anomalies intensified.

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/

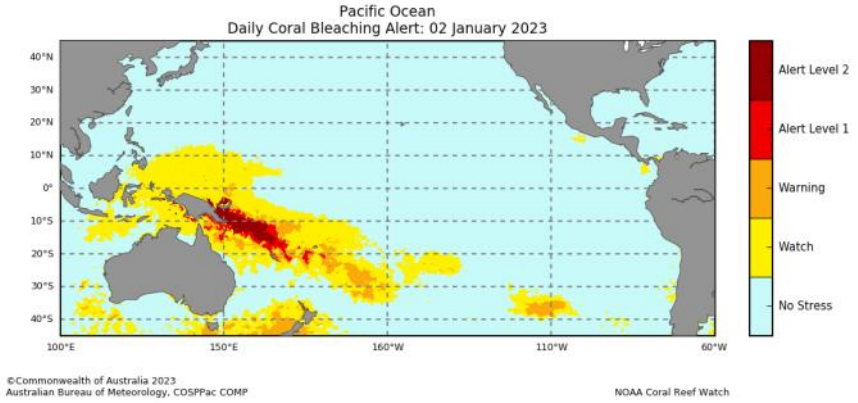
OCEAN CONDITIONS

CORAL BLEACHING

The daily Coral Bleaching Alert status for 2 January 2023 shows 'Alert Level 2' extending southeast from the PNG Islands across the southwest Solomon Islands to western Vanuatu. This was surrounded by a slightly larger region of 'Alert Level 1' extending into southern Vanuatu, with another two small patches in Fiji's EEZ. Patches of 'Warning' are shown in eastern Solomon Islands, southern Fiji, and southwest Tonga. The four-week Coral Bleaching outlook to 29 January 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.

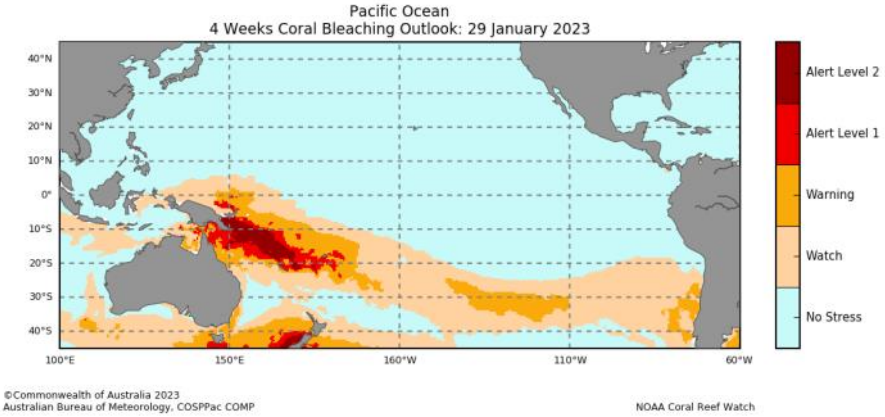
Daily Coral Bleaching Alert

(Source: Pacific Community COSPPac Ocean Porta Coral Bleaching)



4 Weeks Coral Bleaching Outlook

(Source: Pacific Community COSPPac Ocean Portal)



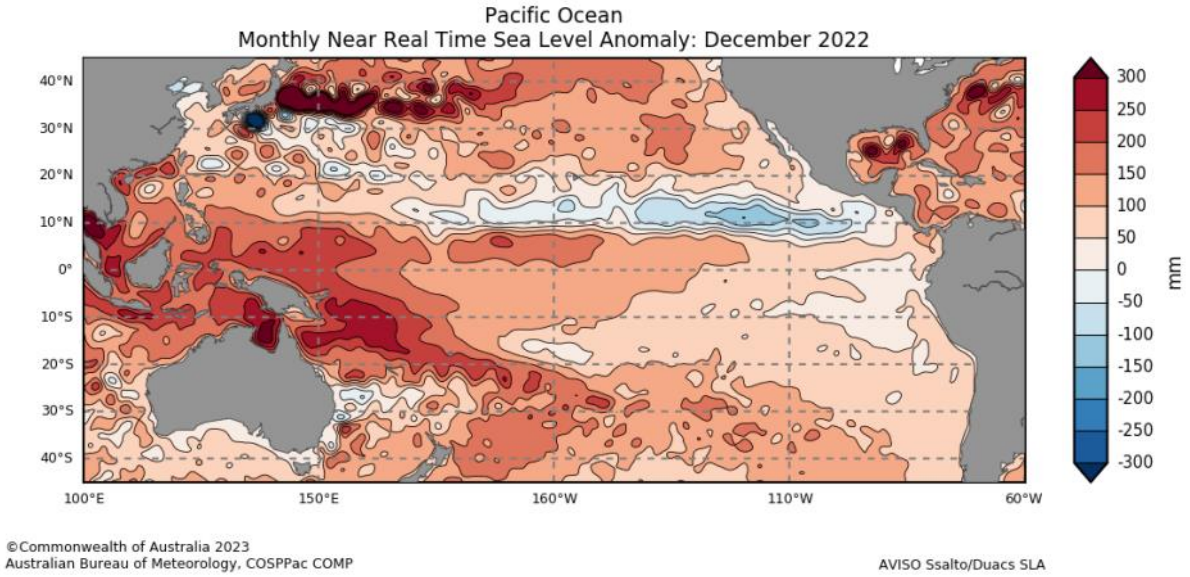
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Apart from northern RMI and the central Cook Islands where sea level was close to normal, December sea level was above normal over COSPPac countries. Anomalies above +250 mm were observed in southeastern PNG, the Solomon Islands, Vanuatu, northern New Caledonia, and in patches of Fiji, Tonga and Niue. In addition, a few small parts of FSM also had anomalies over +250 mm. Sea level was generally 100 mm to 250 mm above average elsewhere.

Monthly Sea Level Anomalies

Source: Pacific Community COSPPac Ocean Portal

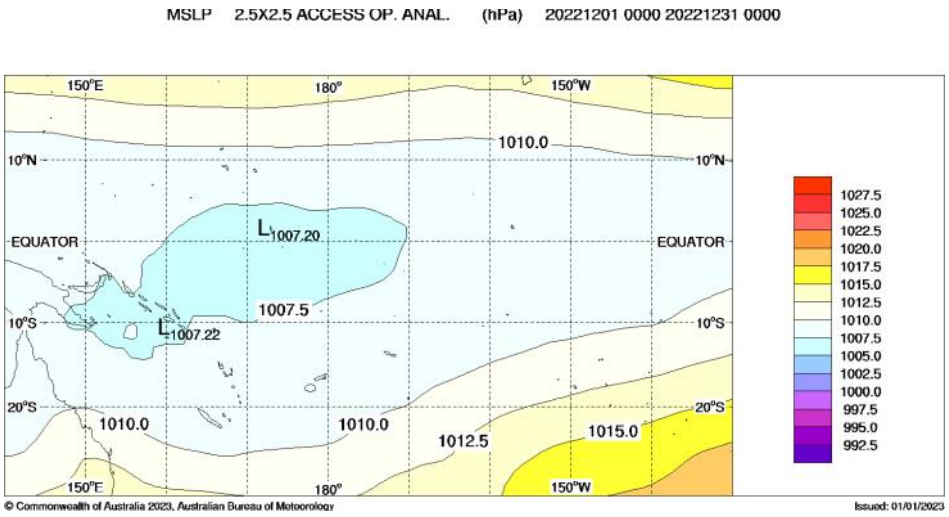


MEAN SEA LEVEL PRESSURE

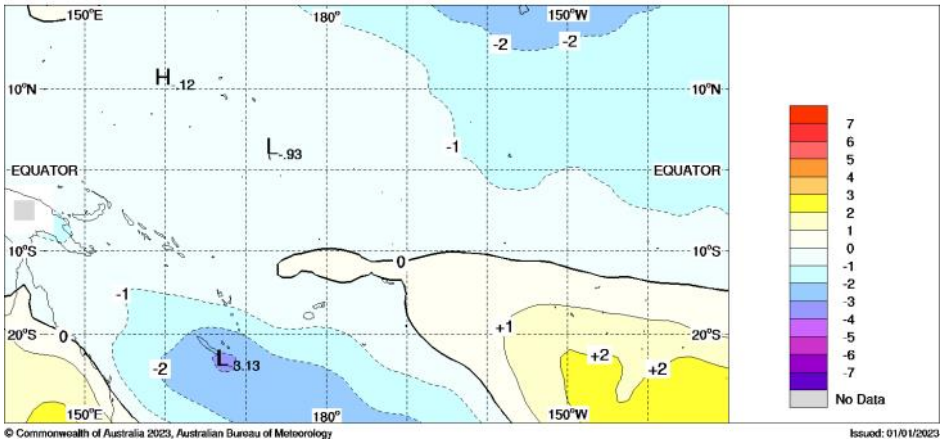
The December mean sea level pressure (MSLP) anomaly map shows mostly negative anomalies of 1hPa or greater over Vanuatu, New Caledonia and towards New Zealand, as well as north of the equator and east of the Date Line. Positive anomalies of 1hPa or greater were analysed over the southern Cook Islands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

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

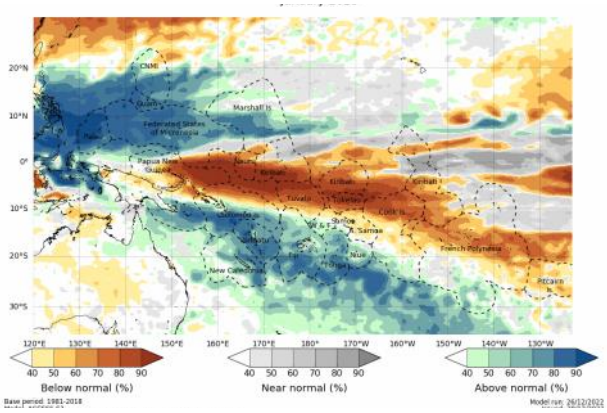
SEASONAL RAINFALL OUTLOOK

January—March 2023

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

The three-month rainfall outlook (January-March 2023) is very similar to the January outlook as it favours below normal rainfall for southeastern FSM, PNG Islands and much of the PNG mainland, northern Solomon Islands EEZ plus parts of the main western and central islands, Nauru, central Kiribati plus the southern halves of western and eastern Kiribati, Tuvalu, Tokelau, 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, CNMI, most of FSM, much of RMI, the southeast 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 January-March 2023 differs from the ACCESS-S model in only some minor details, the main ones being an ambiguous signal over the southern Cook Islands, central and eastern Kiribati, and northern Tonga, a wetter signal over the southern PNG mainland and central Solomon Islands, and a drier signal for western Kiribati.

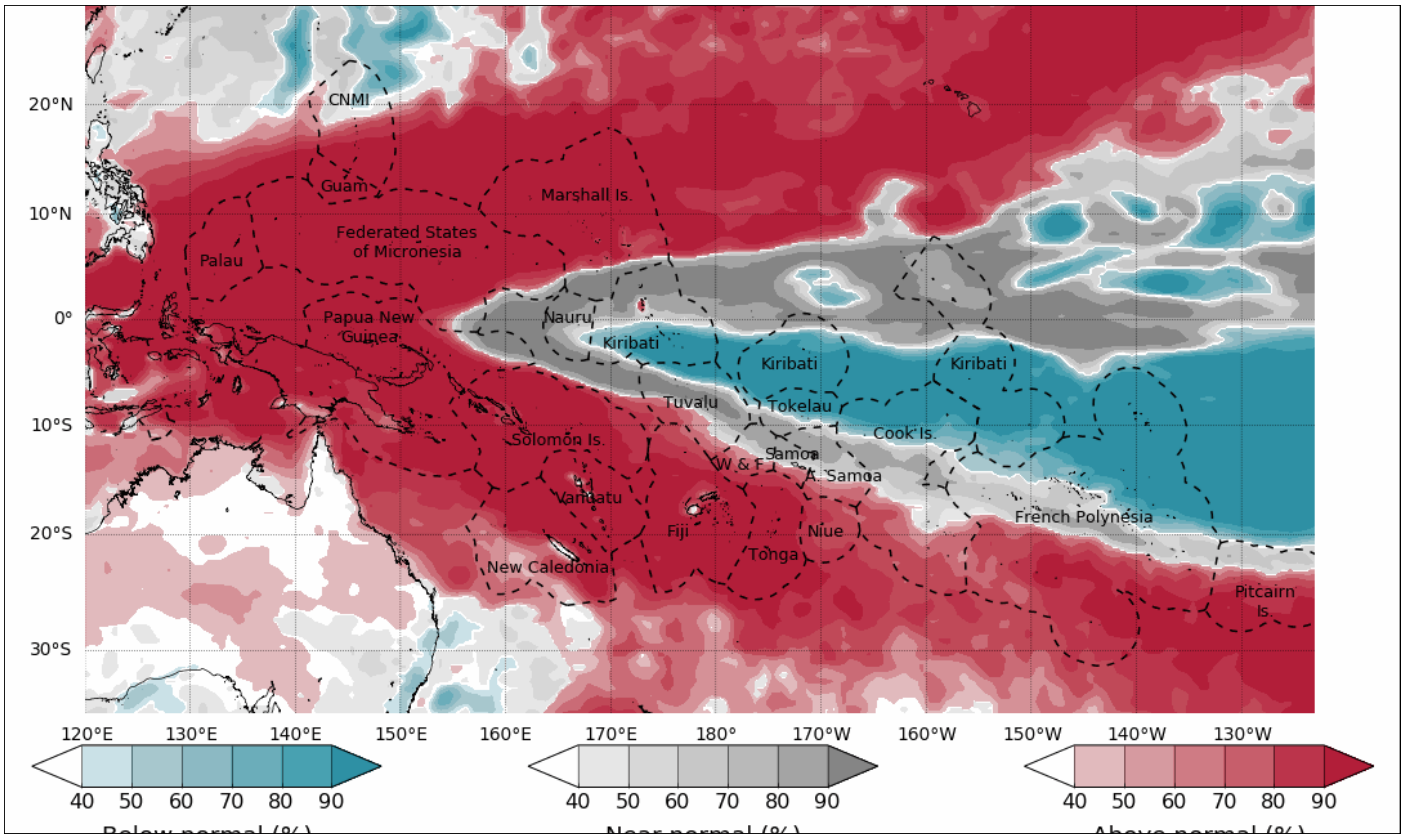
The APEC Climate Centre multi-model for January-March 2023 is also very similar to the ACCESS-S model. The main differences are an increased wet signal for Rotuma, the PNG Highlands, and the central Solomon Islands.

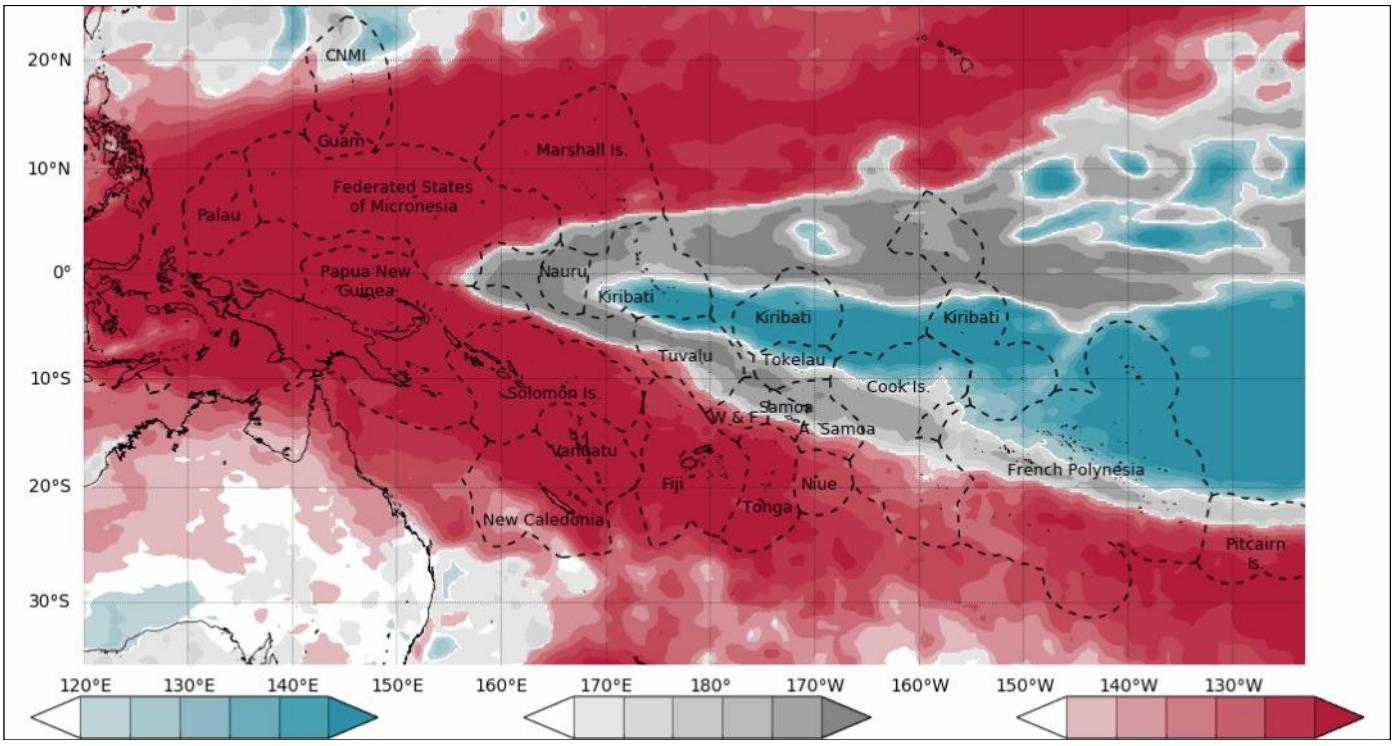
For January-March 2023, the models unanimously agree on above normal rainfall for much of Palau, Guam, CNMI, FSM, northern and central RMI, eastern Solomon Islands, New Caledonia, Vanuatu, Fiji (except Rotuma), central and southern Tonga, and Niue. The models are also unanimous in showing that below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

SEASONAL TEMPERATURE OUTLOOK

January—March 2023

Monthly Tmax and Tmin ACCESS-S Maps

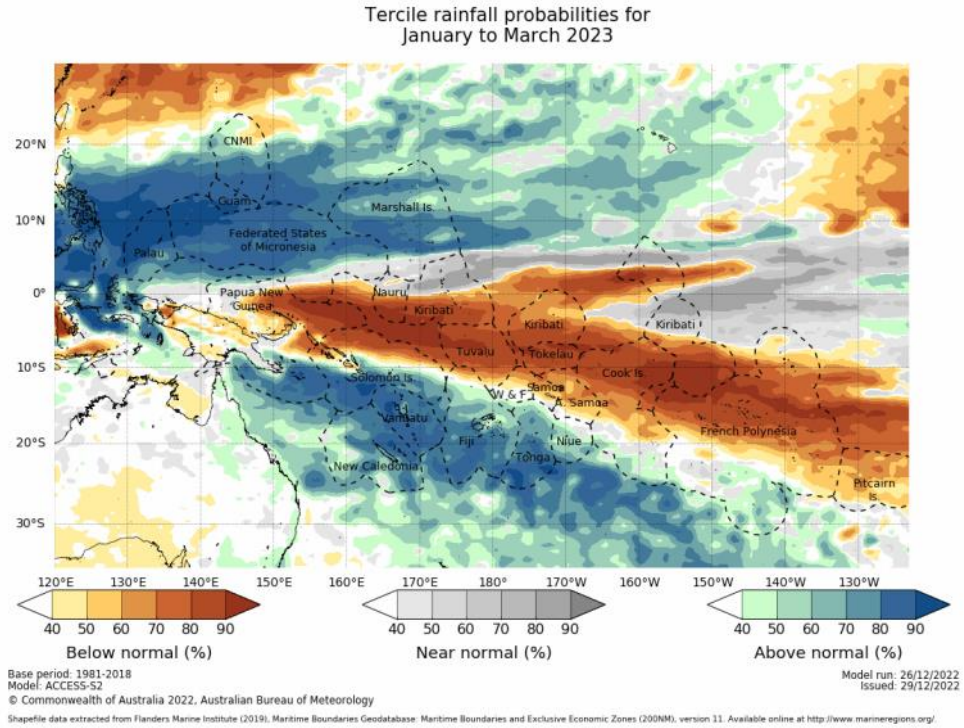


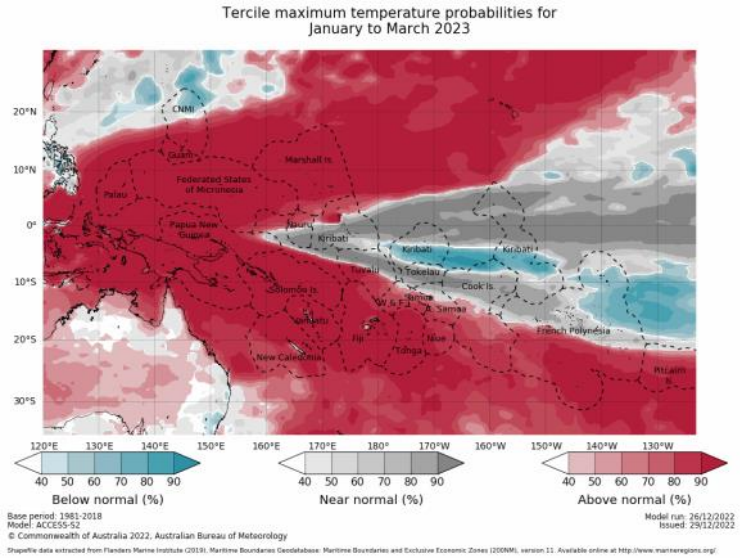


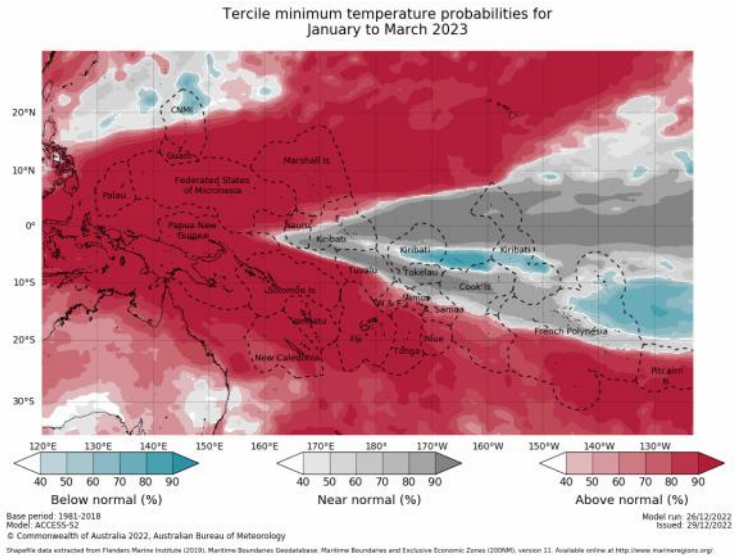
SEASONAL RAINFALL OUTLOOK

January—March 2023

Seasonal ACCESS-S maps





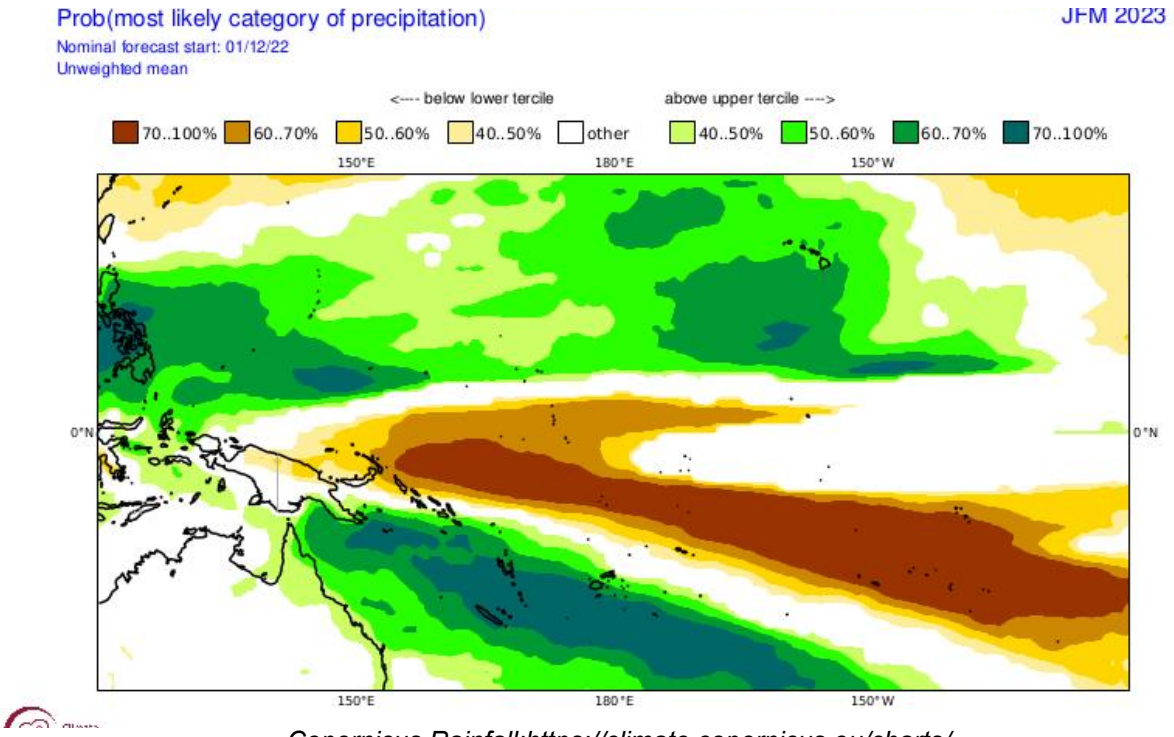


'About ACCESS-S http://access-s.clide.cloud/

SEASONAL RAINFALL OUTLOOK

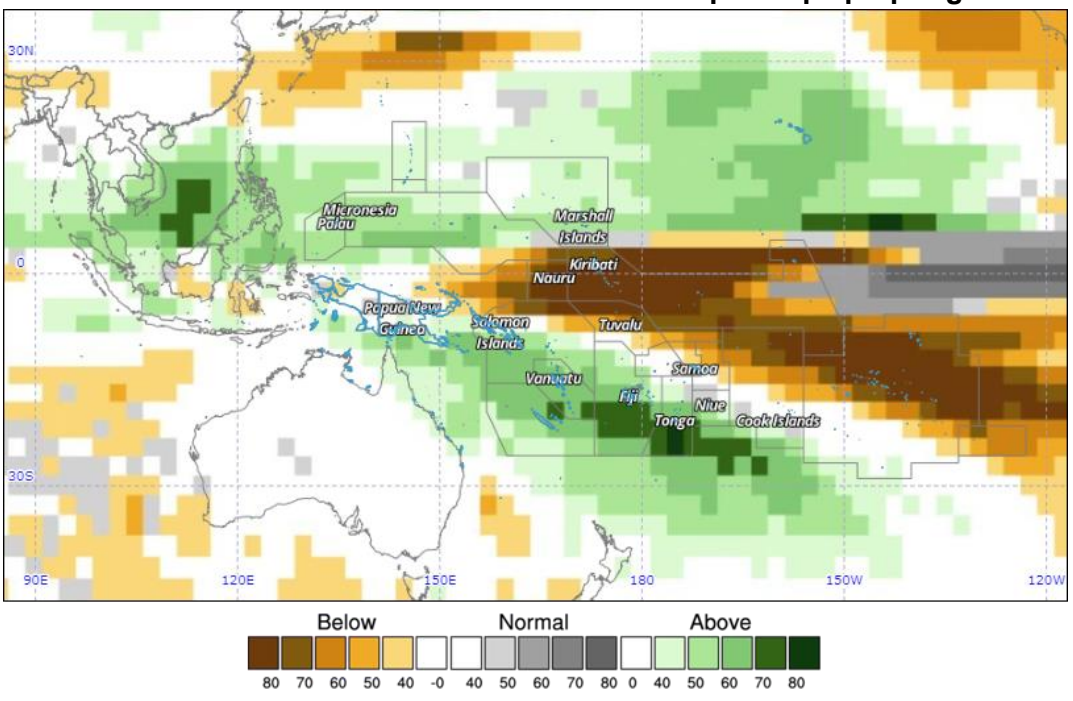
January—March 2023

Copernicus (C3S multi-system)-Rainfall



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

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



Year: 2023, Season: JFM, Lead Month: 3, Method: GAUS
Model: APCC, BOM, CMCC, CWB, MSC, NASA, NCEP
Generated using CLIKP (2023-1-9)

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TROPICAL CYCLONE

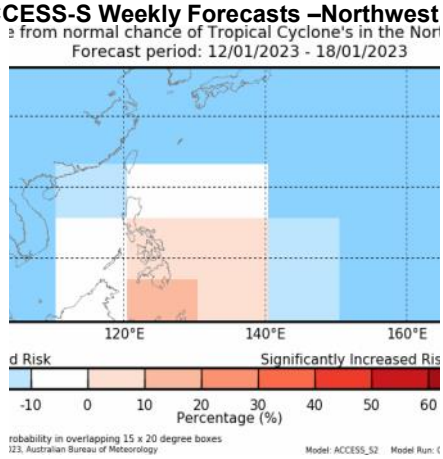
2022/2023 Season

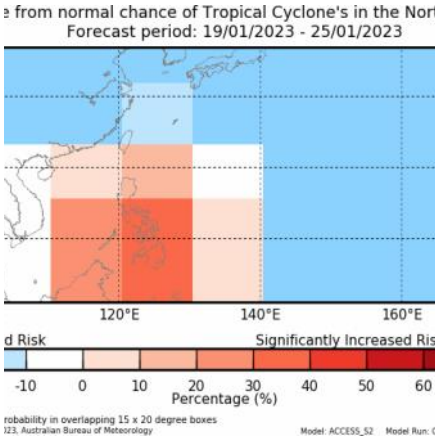
The northwest Pacific, 2021-22 tropical cyclone season is year around, with most cyclones occurring between May and October. Twenty-four named TCs have occurred as of 31 October with four reaching super typhoon intensity. Most TCs in the southwest Pacific occur between November to April. Associated with 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 PICOF-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).

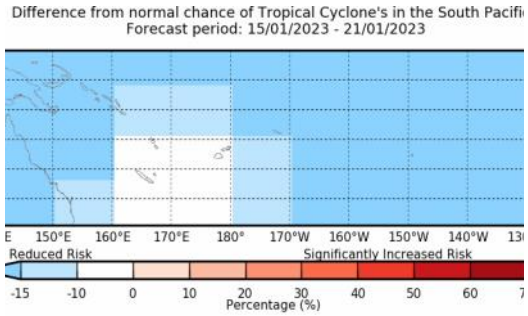
The weekly tropical cyclone forecast from the ACCESS-S model shows a slight to moderately increased risk between 12 and 18 January, and a significantly increased risk between 19 and 25 January for the northwest Pacific around the Philippines, and to a lesser extent around Palau and western FSM. The cyclone risk for the southwest Pacific for the period 12 to 25 January is slightly below normal.

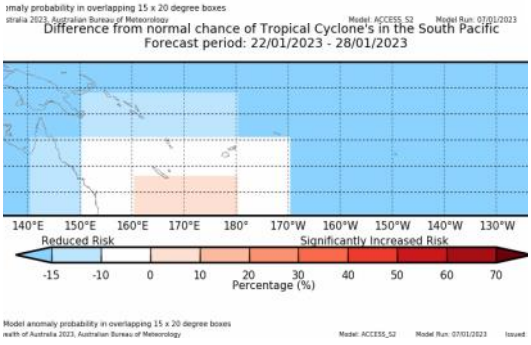
ACCESS-S Weekly Forecasts –Northwest Pacific





ACCESS-S Weekly Forecasts –Southwest Pacific





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.

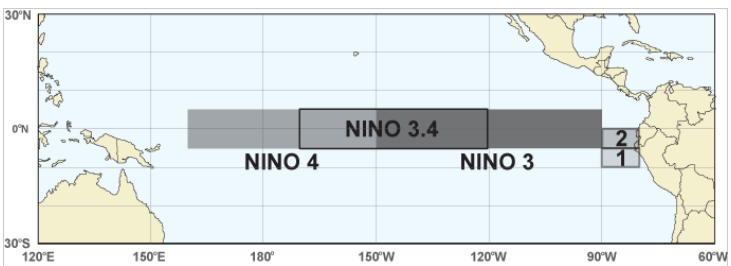
20 degrees Celsius Isotherm Depth

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