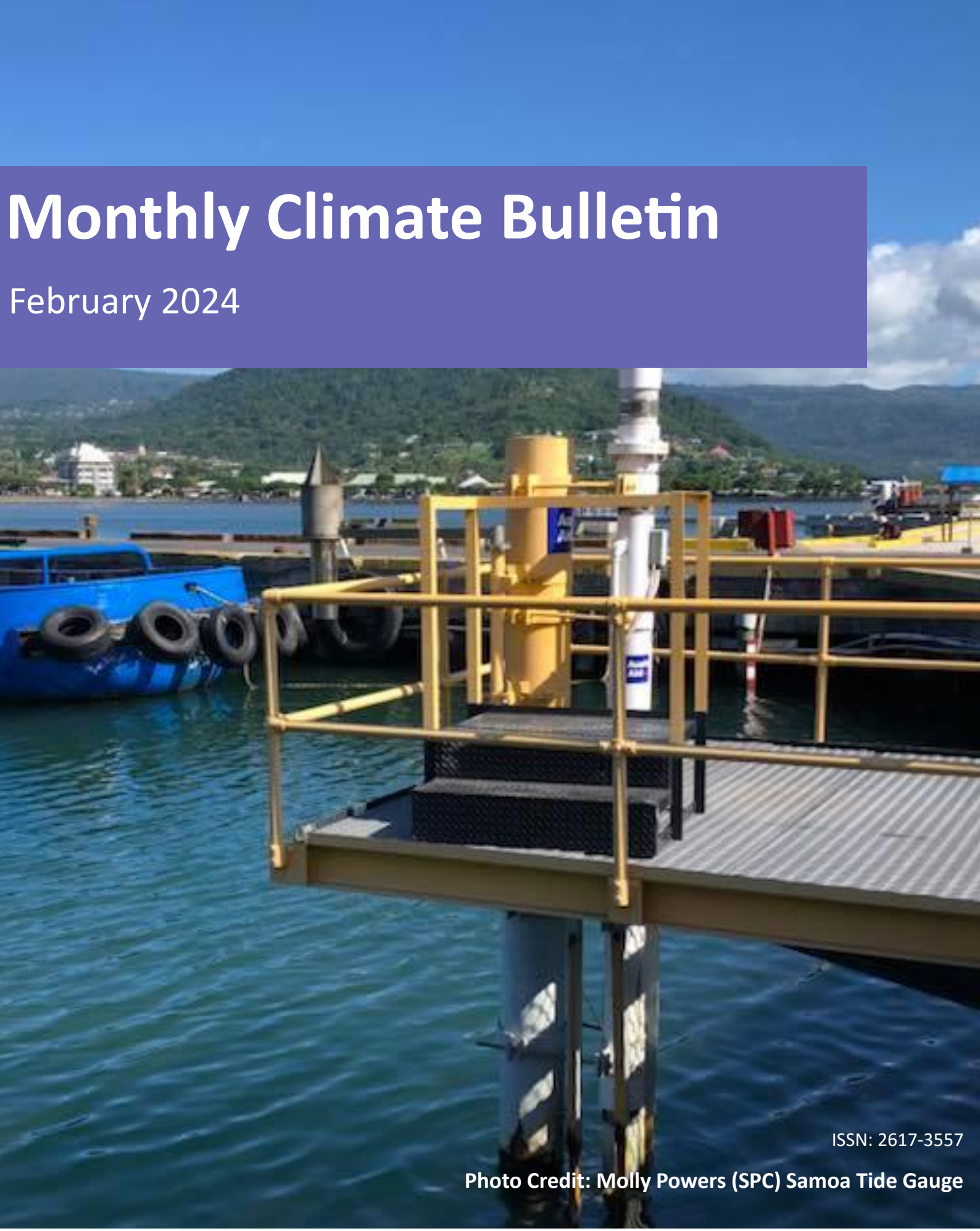
Monthly Climate Bulletin

February 2024



ISSN: 2617-3557

Photo Credit: Molly Powers (SPC) Samoa Tide Gauge

Sustainable, transformative, and resilient for a Blue Pacific SPREP PROE

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

CONTENTS

Issued 12 March 2024

- El Niño persists, but it is weakening. Climate models forecast sea surface temperatures in the central tropical Pacific to return to ENSO-neutral in June 2024.

- Currently in the Indian Ocean, a moderate to strong Madden Julian Oscillation (MJO) is forecast to move into the Maritime Continent in the coming days and progress eastwards over the coming fortnight into the Western Pacific.

- Both the ITCZ and SPCZ were active during February. The SPCZ was shifted northeast over PNG Islands, eastern Solomon Islands, Nauru, Fiji, Tuvalu, Wallis and Futuna, Samoa, Tonga, Niue, and central Cook Islands.

- Sea surface temperatures (SSTs) for February 2024 were warmer than average across the tropical Pacific Ocean.

- The Coral bleaching Outlook to 31 March shows 'Alert Level 2' over parts of southeastern Australia, southern PNG, southern Solomon Islands, northern New Caledonia, northern Vanuatu, northern Fiji, eastern Tuvalu, Kiribati (southern Phoenix Islands), Tokelau, Wallis and Futuna, Samoa, American Samoa, and northwestern Cook Islands.

- For March to May 2024, the models agree on below normal rainfall being likely or very likely for Palau, Guam, CNMI, northern FSM, northern RMI, New Caledonia, Vanuatu, northern and eastern Fiji, central Tonga, southern Cook Islands, plus northeast and parts of southern French Polynesia. In addition, there's model agreement on above normal rainfall being likely or very likely in near-equatorial regions from the PNG eastward across the northern Solomon Islands, Nauru, Kiribati (mainly Phoenix and northern Line Is.), Tuvalu, Tokelau, northern American Samoa, and the northern Cook Islands.

- The ACCESS-S weekly tropical cyclone outlook shows reduced risk in the southwest Pacific for the fortnight from 16 to 22 March. The risk is reduced in the northwest Pacific for the same period.

EL NIÑO–SOUTHERN OSCILLATION

Neutral El Niño Southern Oscillation (ENSO) during Autumn

Click link to access Climate Driver Update issued on 5 March 2024

El Niño persists, although a steady weakening trend is evident in its oceanic indicators. Climate models indicate sea surface temperatures in the central tropical Pacific are expected to continue declining and are forecast to return to ENSO-neutral in the southern hemisphere autumn 2024. Atmospheric indicators are mixed but are consistent with a steadily weakening El Niño. Cloudiness near the equatorial Date Line has decreased over the last fortnight, returning to the climatological average. The 30-day Southern Oscillation Index (SOI) is currently less than -7.0, characteristic of an El Niño state, but indicative of ENSO-neutral over the 60- and 90-day periods. Temporary fluctuations of ENSO atmospheric indicators are common during summer and are not an indication of El Niño strength.

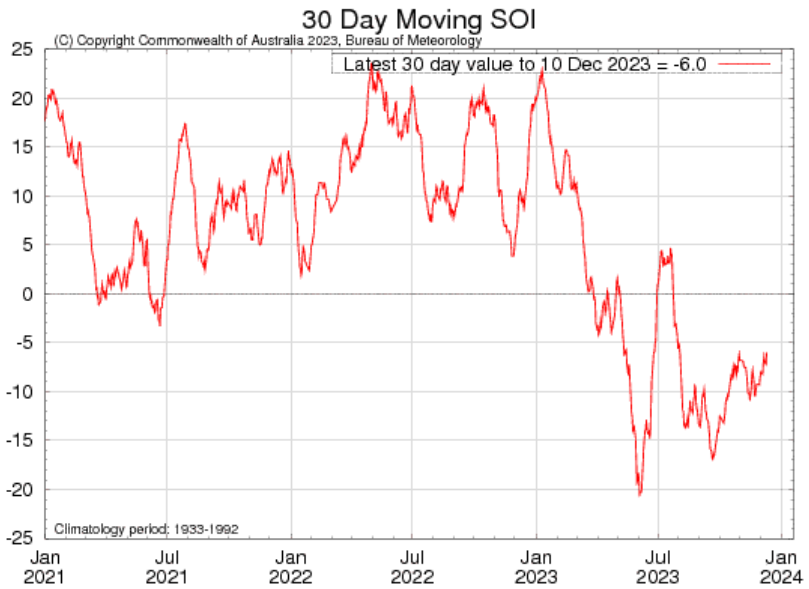
International climate models suggest the central tropical Pacific Ocean will continue to cool in the coming months, with four out of seven climate models indicating the central Pacific is likely to return to neutral El Niño-Southern Oscillation (ENSO) levels by the end of April (i.e., neither El Niño nor La Niña), and all models indicating neutral in May. ENSO predictions made in autumn tend to have lower accuracy than predictions made at other times of the year. This means that current forecasts of the ENSO state beyond May should be used with caution.

The positive Indian Ocean Dipole (IOD) is neutral. IOD events are typically unable to form between December and April. This is because the monsoon trough shifts south over the tropical Indian Ocean changing wind patterns and preventing the IOD pattern from forming.

The Southern Annular Mode (SAM) is currently neutral, as of 3 March. Forecasts indicate SAM will remain neutral over the coming fortnight.

The annual global mean temperature for the 12 months from February 2023 to January 2024 was the highest on record, with Copernicus reporting that it was 1.52 °C above the 1850-1900 pre-industrial average. However, this does not mean that the 1.5 °C target referred to in the Paris Agreement has been exceeded, as the magnitude of global warming is assessed using multi-year averages, and this is only one 12-month period.

The 30-, 60- and 90-day SOI values for the period ending 3 March 2024 were -11, -4 and -4, respectively. Compared to last fortnight, the 30-day SOI has become more positive while the 60-day and 90-day values have remained similar. The 30-day SOI can have increased variability in the southern hemisphere summer due to local weather systems over northern Australia or Tahiti.

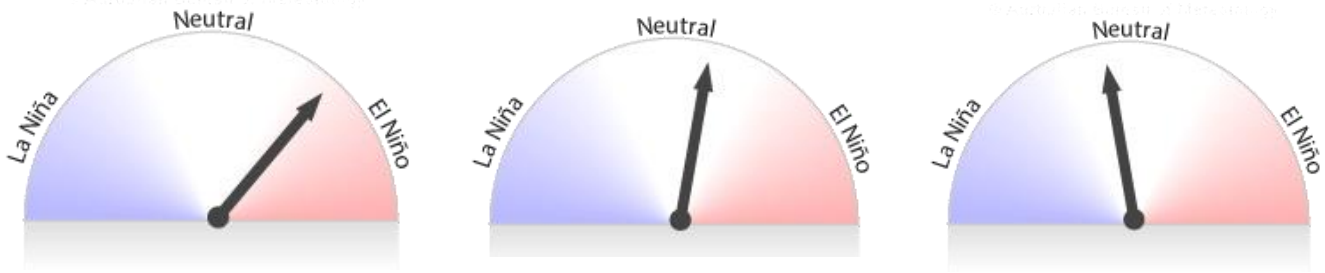


EL NIÑO–SOUTHERN OSCILLATION

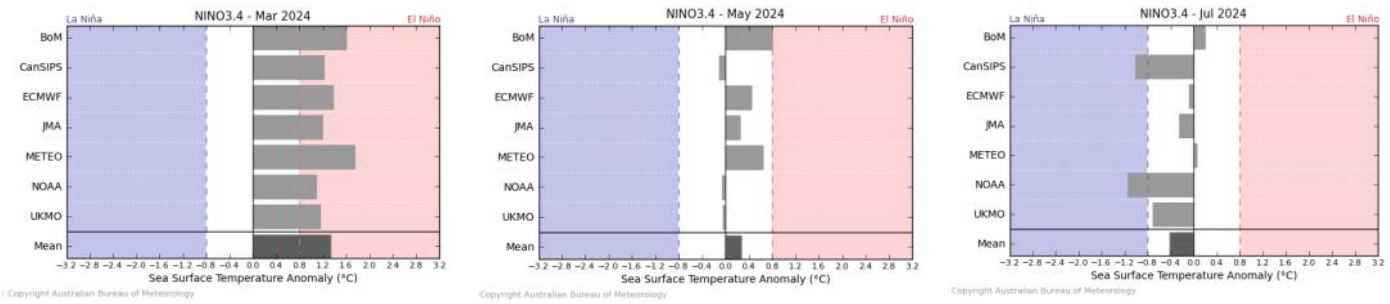
Neutral El Niño Southern Oscillation (ENSO) during Autumn

Click link to access Climate Driver Update issued on 5 March 2024

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



Bureau of Meteorology NINO3.4 International Model Outlooks



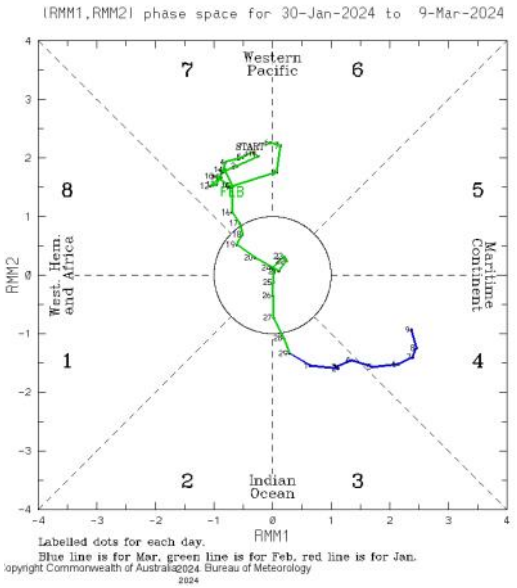
Bureau of Meteorology summary of international model outlooks for NINO3.4: http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean

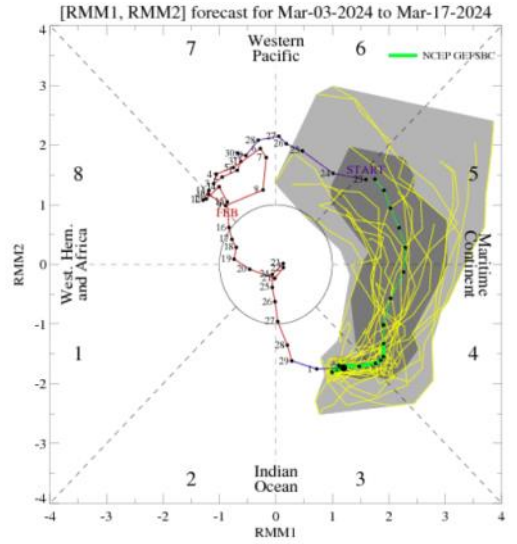
MADDEN–JULIAN OSCILLATION

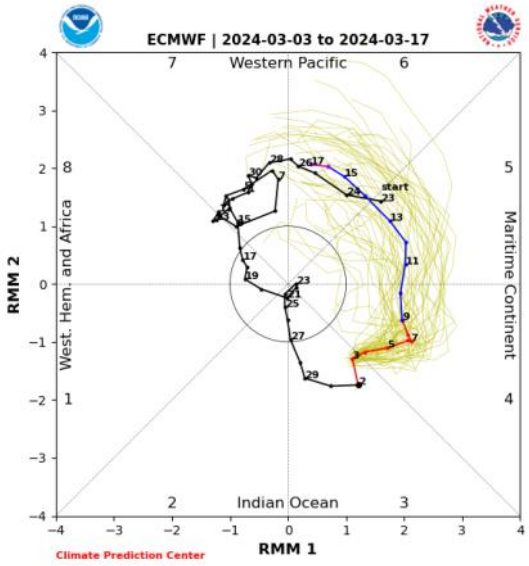
Click link to access *Tropical Climate Update* [Issued on Tuesday 5 March 2024]

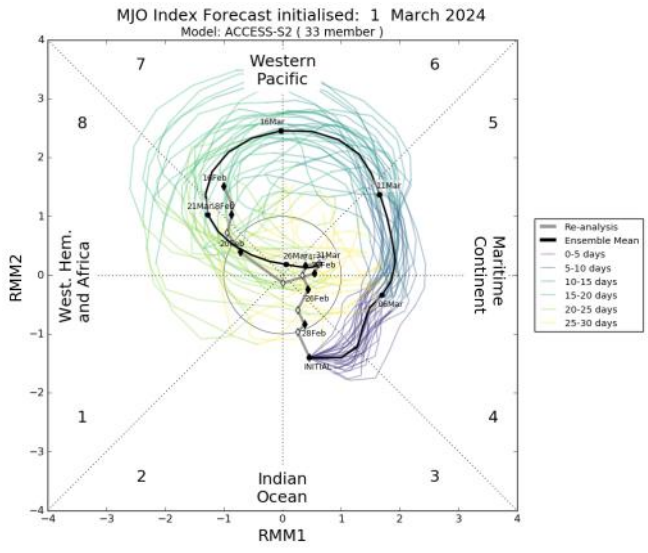
The Madden Julian Oscillation (MJO) was active over the Western Pacific during the first two weeks of February. A moderate to strong MJO is currently in the eastern Indian Ocean. Most climate models indicate that the moderate to strong MJO pulse will move into the Maritime Continent in the coming days and progress eastwards over the coming fortnight into the Western Pacific.

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







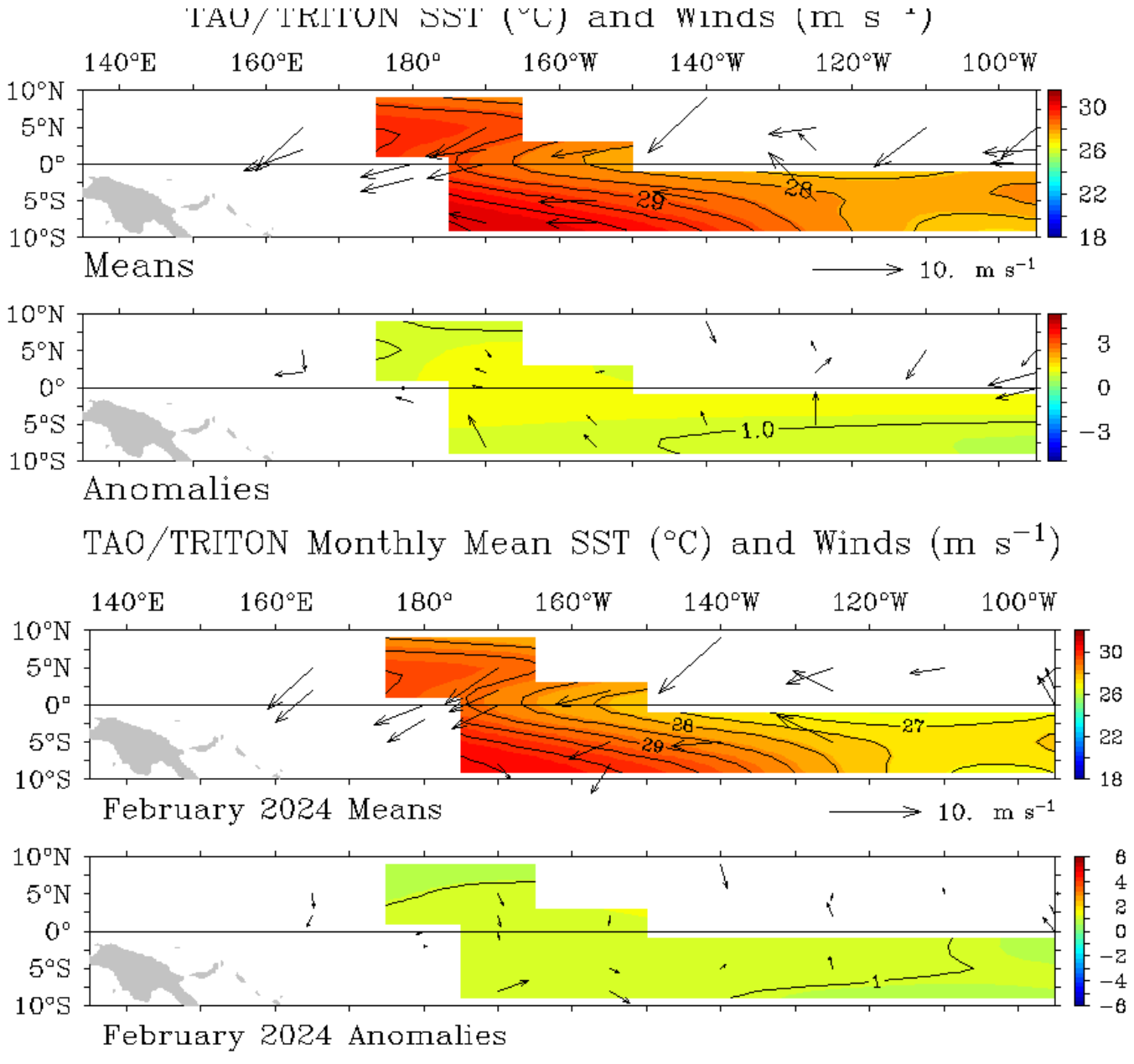


WIND

Click link to access Wind plots link

During February, the trade winds were generally close to normal over the equatorial Pacific, although they were somewhat weaker than normal near and just east of the Date Line in the southern hemisphere. For the five days ending 2 March 2024, the trade winds were close to or somewhat stronger than normal over the equatorial Pacific.

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



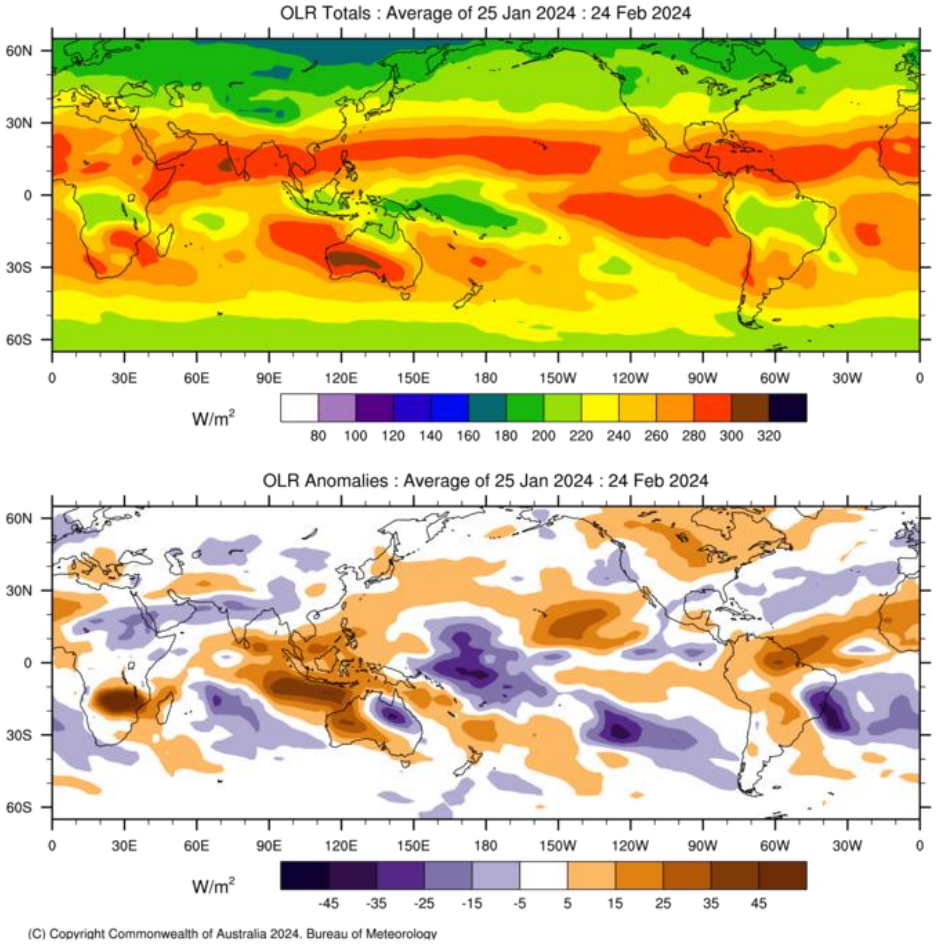
CLOUD AND RAINFALL

Click link to access OLR

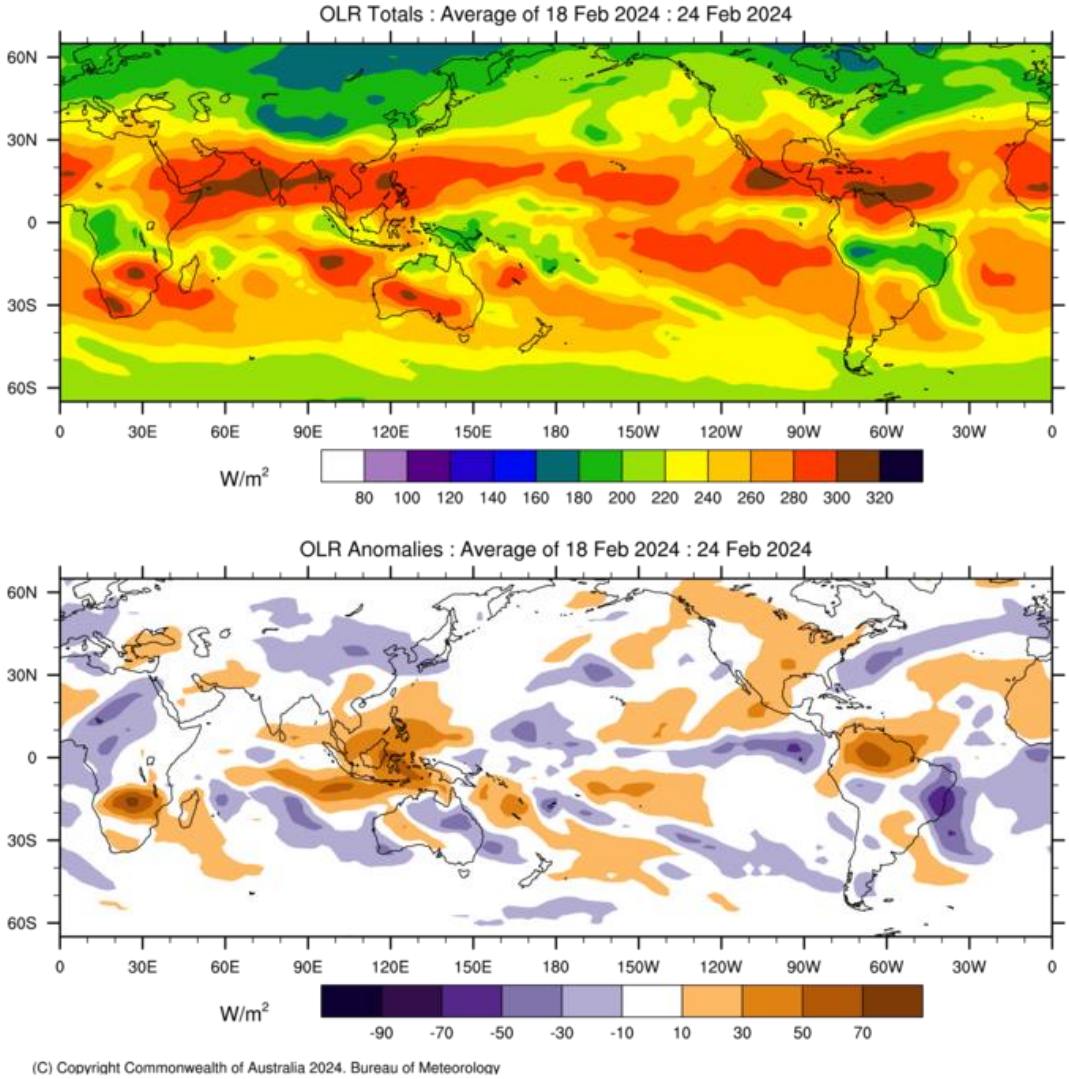
The February 30-day OLR anomaly map shows a large region of low OLR (increased convection) straddling the equator centred near the Date Line. The South Pacific Convergence Zone (SPCZ) was evident and shifted northeast over PNG Islands, eastern Solomon Islands, Nauru, Fiji, Tuvalu, Wallis and Futuna, Samoa, Tonga, Niue, and central Cook Islands. Areas of high OLR (decreased convection) were evident over Palau, and western FSM in the northern hemisphere. In the southern hemisphere, anomalously high OLR stretched south-eastwards from southern PNG, and southern Solomon Islands to New Caledonia and Vanuatu.

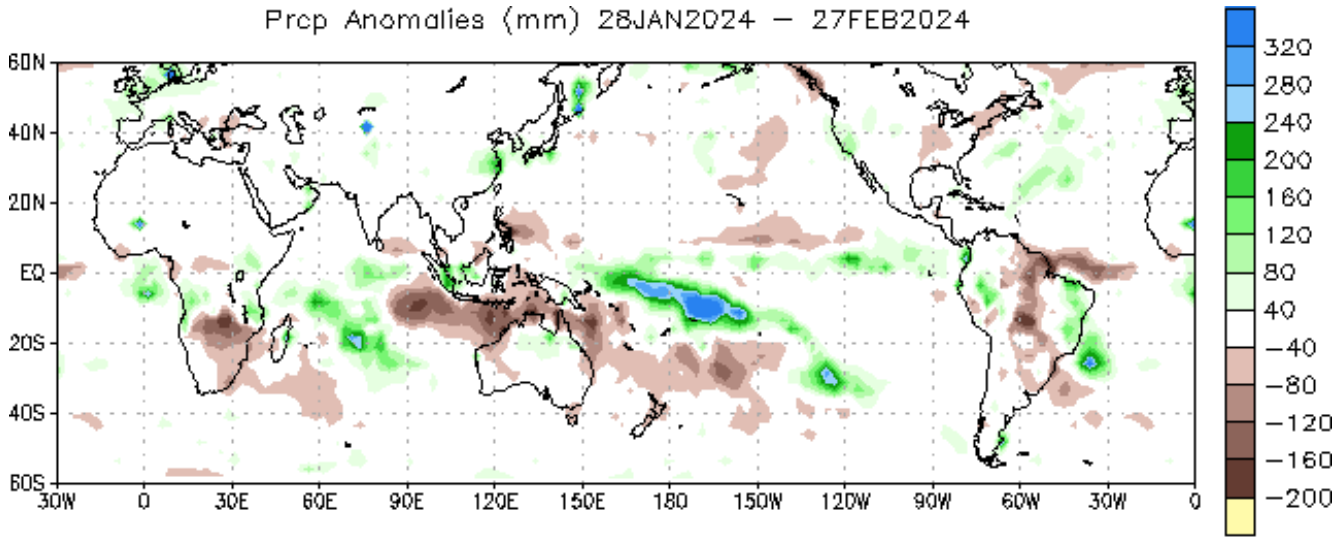
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2. In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR



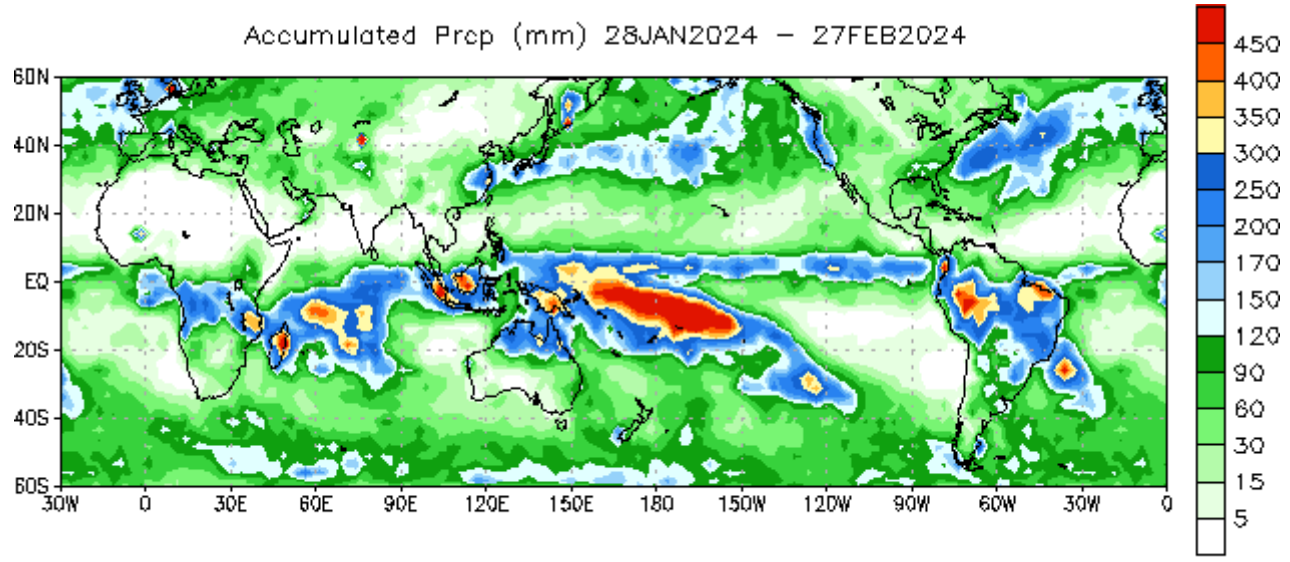
OLR Total and Anomalies, 7 Day OLR



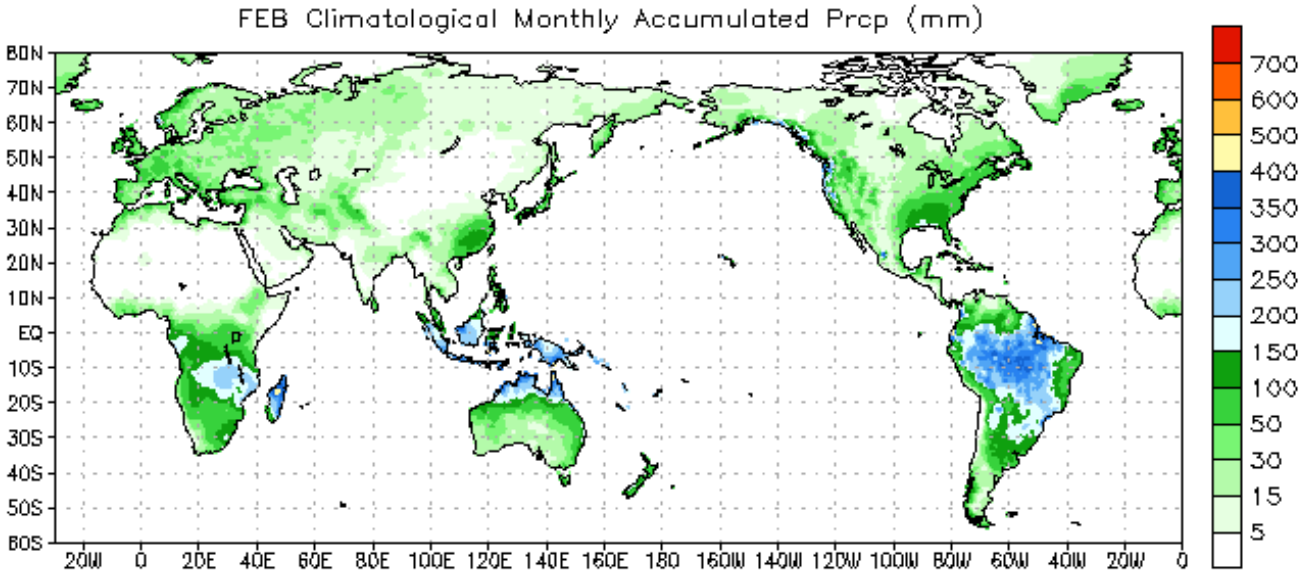


Data Source: NCEP CMAP Precipitation Climatology (1991–2020)

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

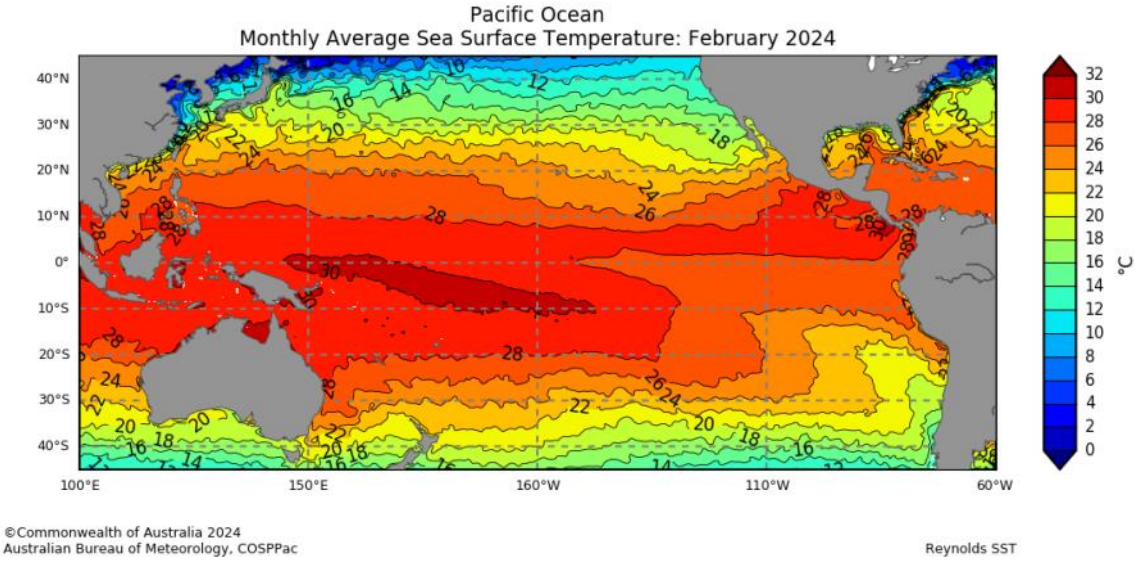
Click link to access Pacific Community COSPPac Ocean Portal

Sea surface temperatures (SSTs) for February 2024 were warmer than average across the tropical Pacific Ocean. Between 10 °S and 10 °N. SSTs were more than 1.2 °C warmer than the long-term (1961-1990) average in the central and eastern Pacific Ocean. The extent and magnitude of warm anomalies across the equatorial Pacific decreased compared with January 2024.

Warm SST anomalies up to 2 °C above average also continued off most of the eastern Australian coast from central Queensland southwards, south of Australia, and in the Tasman Sea, increasing to up to 3 °C above average east of Tasmania. When compared with January 2024, SST anomalies have generally decreased, especially in the eastern Tasman Sea and the northern Coral Sea. Small regions of cool anomalies, up to 1.2 °C below the 1961-1990 average, were present in the Great Australian Bight.

Highest-on-record February SSTs occurred in parts of Kiribati (southern Gilbert, central Phoenix, and northern and southern Line Islands), and also in patches of northern PNG, Vanuatu, Nauru, Tuvalu, Tokelau, northern Cook Islands and central French Polynesia. The SST in decile 10 (very much above average) stretched from northern PNG and southern FSM in the west and expanded eastwards towards the south American coast affecting Nauru, southern RMI, Kiribati (most of Gilbert, Phoenix and Line Islands), western New Caledonia, northern Vanuatu, parts of Fiji, parts of Tonga, Tuvalu, Tokelau, parts of American Samoa, northern Cook Islands, and northern French Polynesia. Above average (8-9) decile are observed for majority of the Pacific Island Countries, spanning south-eastward from FSM, northern RMI, parts of PNG, northern New Caledonia to eastern French Polynesia. Average SSTs (4-7) for February were observed in parts of Palau, parts of PNG, western and central Solomon Islands, southern Vanuatu, southern Fiji, spanning eastwards to Cook Islands. Patches of decile 2-3 (below average) were observed in parts of southern Cook Islands and southern French Polynesia.

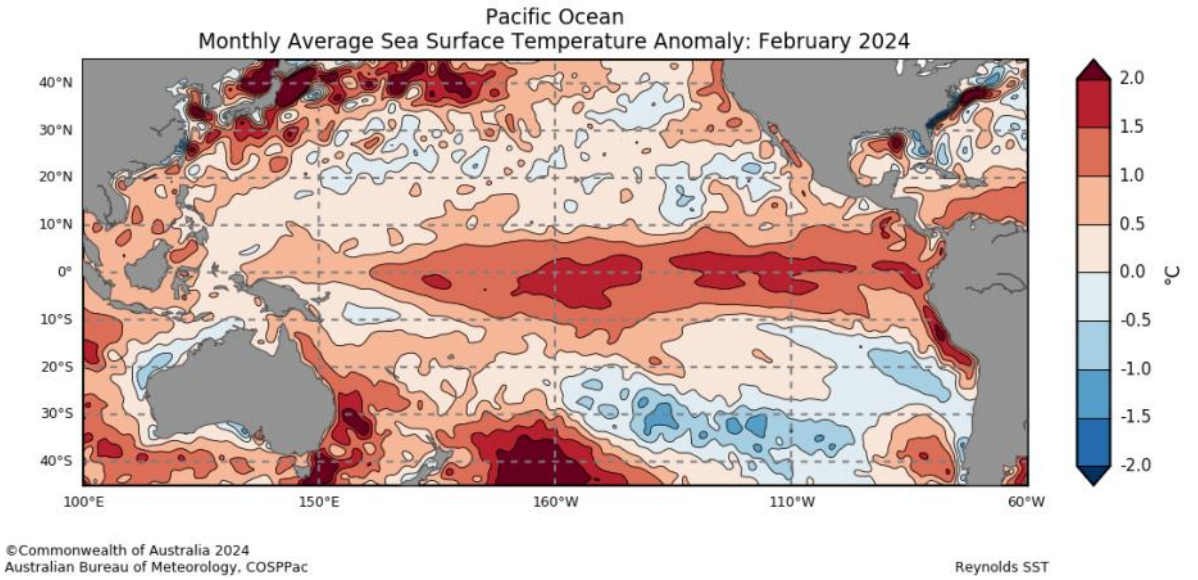
Mean Sea Surface Temperature



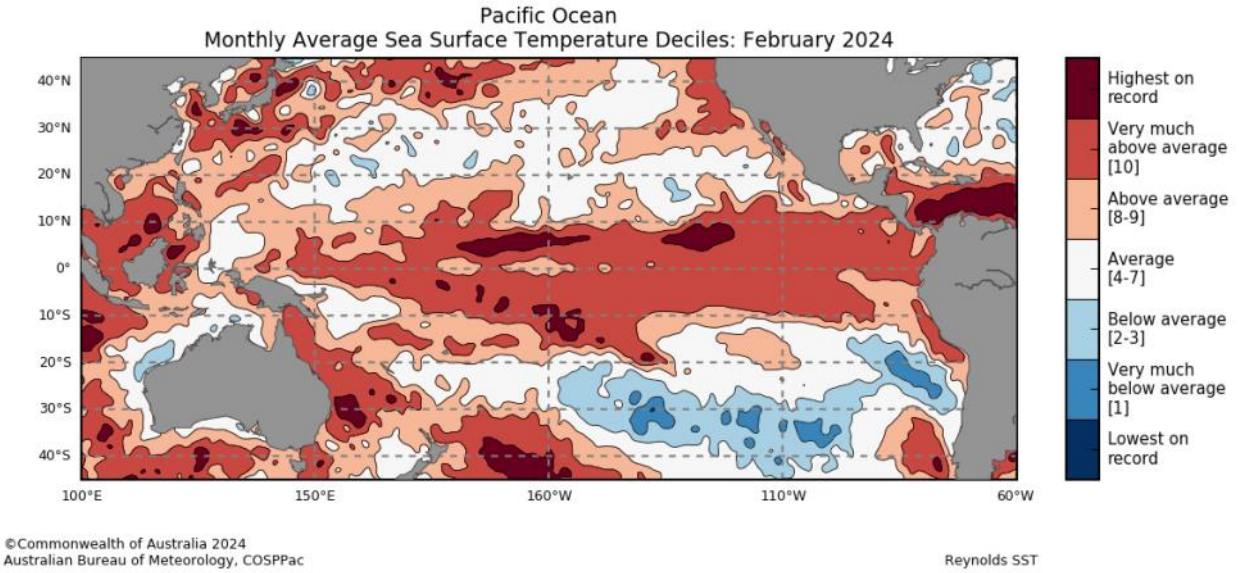
OCEAN CONDITIONS

Click link to access SEA SURFACE TEMPERATURE

Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles



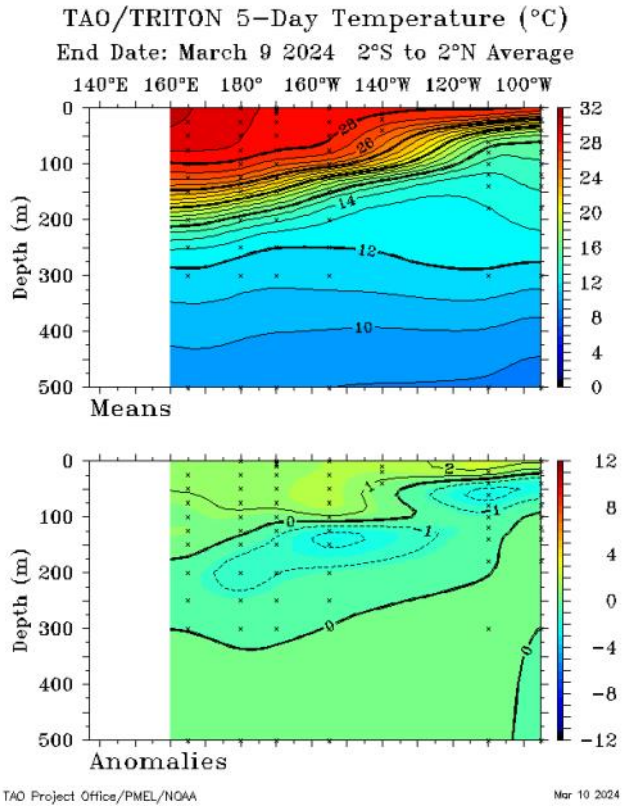
OCEAN CONDITIONS

SUB SURFACE

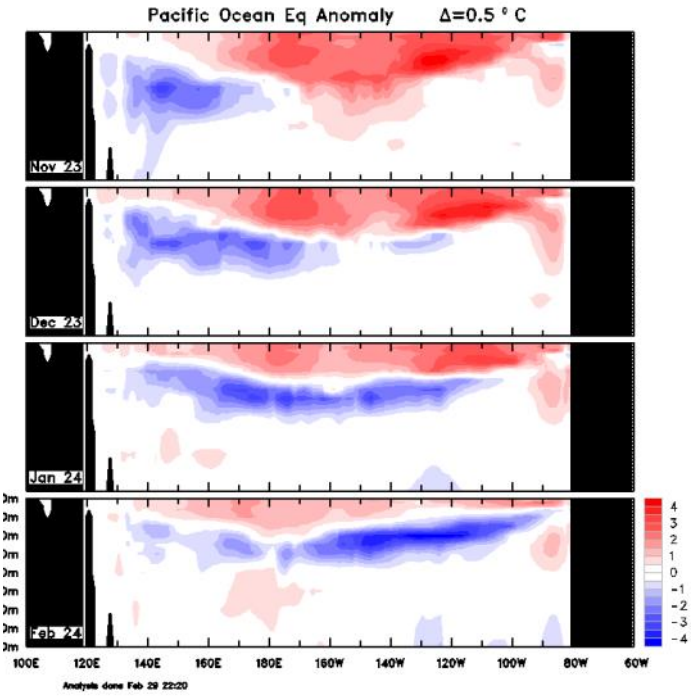
The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 29 February 2024) shows weak warm anomalies across the top 25 to 100m of the equatorial Pacific during February. Cool anomalies, more than 3 °C in magnitude east of 170 °W, were present below this shallow layer of warm anomalies.

The depth and magnitude of warm anomalies has significantly decreased over the November to February period, with weak warm anomalies less than +2 °C , persisting only close to the surface in February. The magnitude and extent of cool anomalies has increased across the past few months and has spread eastwards. This sub-surface pattern, where warm water in the top layer of the ocean is undercut by cool anomalies propagating eastwards, typical of the declining phase of El Niño.

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/

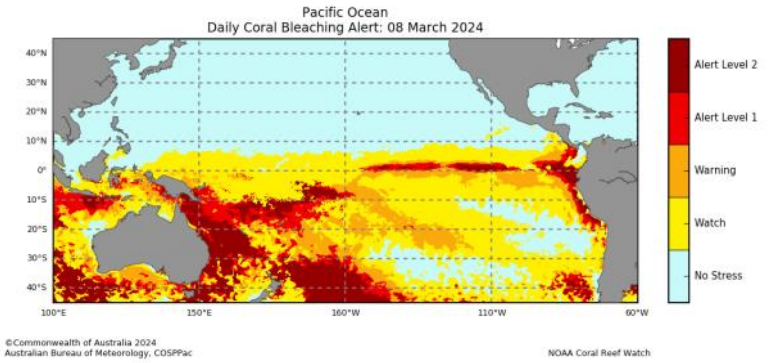
OCEAN CONDITIONS

CORAL BLEACHING

The daily Coral Bleaching Alert status for 8 March 2024 shows an area of 'Alert Level 2' over the majority of eastern Australia, southern PNG, eastern Solomon Islands, western New Caledonia, northern Vanuatu, northern Fiji, southern Tuvalu, Tokelau, Kiribati (southern Phoenix Islands) and northern Cook Islands. 'Alert Level 1' over parts of eastern PNG mainland, southern Solomon Islands, northern New Caledonia, most parts of Vanuatu and Fiji, northern Tonga, Wallis and Futuna, Samoa, most of American Samoa and northern Cook Islands. 'Warning' status stretches south-eastwards from Kiribati (southern Line Islands) to French Polynesia and Pitcairn Islands. There is also an area of 'Warning' status that stretches from northern PNG, southern Vanuatu, southern Fiji, southern Tonga to Niue and central Cook Islands. 'Watch' or 'No stress' for the rest of the countries. The four-week Coral Bleaching Outlook to 31 March shows 'Alert Level 2' over parts of southeastern Australia, southern PNG, southern Solomon Islands, northern New Caledonia, northern Vanuatu, northern Fiji, eastern Tuvalu, Kiribati (southern Phoenix Islands), Tokelau, Wallis and Futuna, Samoa, American Samoa, and northwestern Cook Islands. 'Alert Level 1' rating over similar areas to Alert Level 2 but extend to southern Nauru, eastern Solomon Islands, Kiribati (southern Gilbert) to western French Polynesia. 'Warning' similar to 'Alert Level 1' but extend further east to Kiribati (central Line Islands) and northern French Polynesia. 'Watch' or ' No Stress' over the rest of the countries.

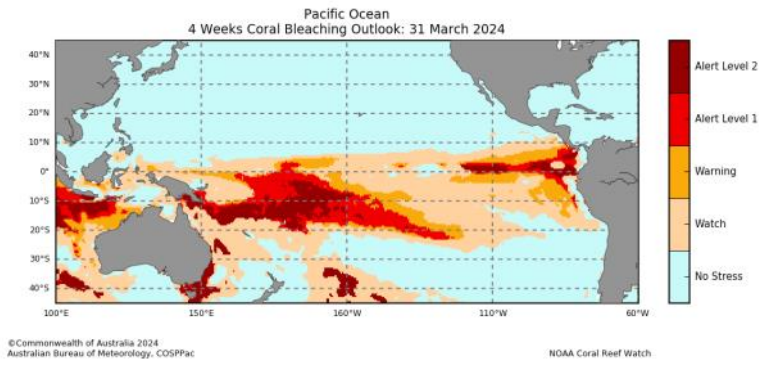
Daily Coral Bleaching Alert

(Source: Pacific Community COSPPac Ocean Porta Coral Bleaching)



4 Weeks Coral Bleaching Outlook

(Source: Pacific Community COSPPac Ocean Portal)



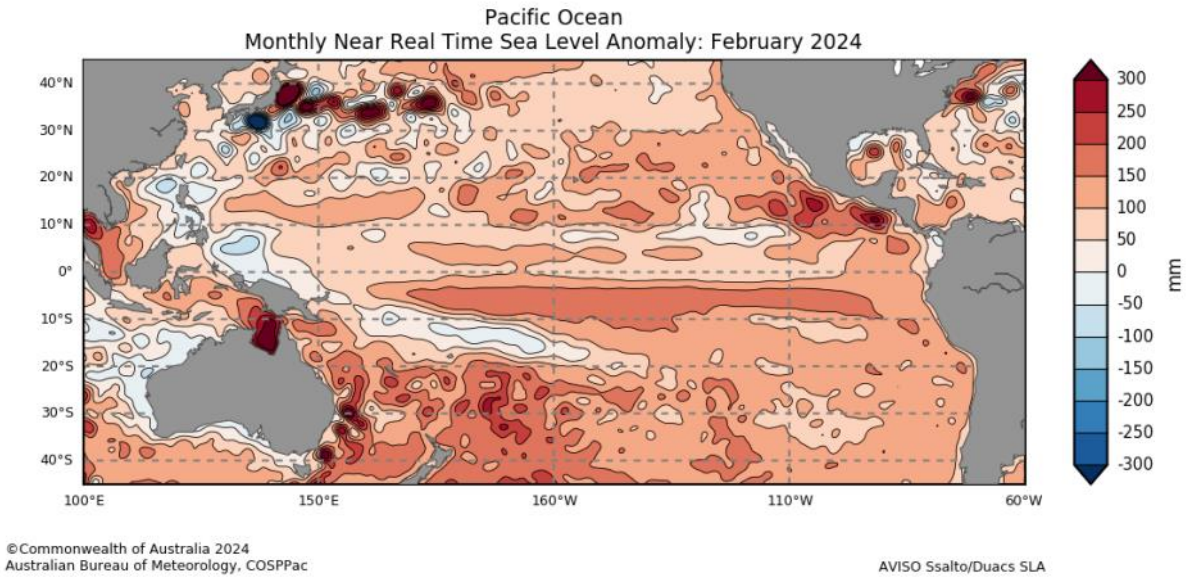
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea levels observed in February were above normal over most COSPPac countries. Patches of anomalies from +200 to +250 mm were observed along the eastern Australia coast, New Caledonia, southern Fiji, southern Tonga, southern Niue, southern Cook Islands, and southern French Polynesia. Anomalies from +100 to +200 mm were observed in Kiribati (far southern Gilbert, Phoenix, and central Line Islands), northern Tuvalu, Tokelau, and northern Cook Islands. Patches of +150 to +200 mm were observed for other COSPPac countries apart from patches of below normal sea level anomalies were observed in Palau, western FSM, and patches over PNG, central Solomon Islands, New Caledonia, Vanuatu, northern Fiji, northern Tonga, Wallis and Futuna, Samoa, American Samoa and central Cook Islands.

Monthly Sea Level Anomalies

Source: Pacific Community COSPPac Ocean Portal

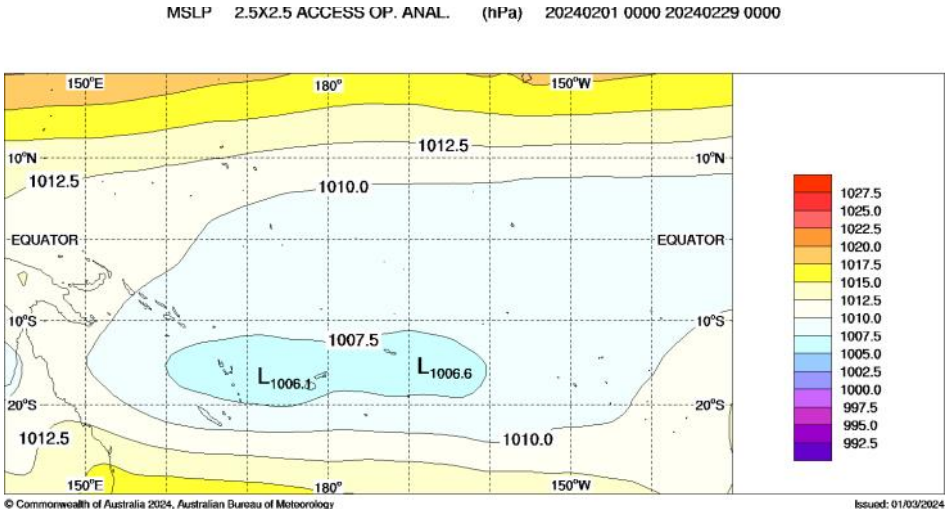


MEAN SEA LEVEL PRESSURE

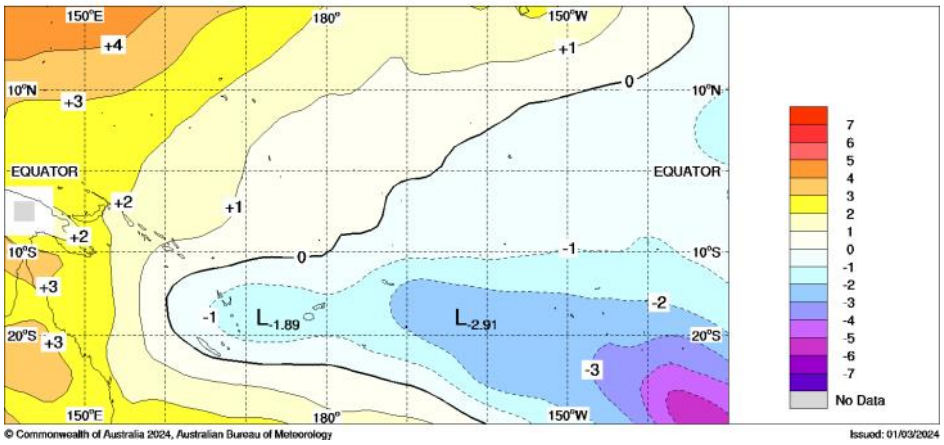
The February mean sea level pressure (MSLP) anomaly map shows negative anomalies of 1 hPa or greater east of 165 °W and south of 10° S. Positive anomalies of 1 hPa or greater were evident in the western tropical Pacific.

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

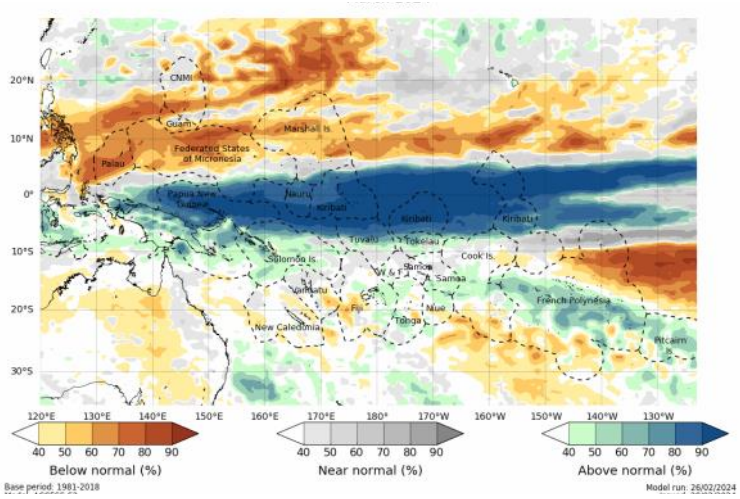
SEASONAL RAINFALL OUTLOOK

March—May 2024

The ACCESS-S model forecast for March 2024, shows below normal rainfall is likely or very likely for Palau, FSM, Guam, southern CNMI, northern and central RMI, in patches of New Caledonia's EEZ, eastern Vanuatu, southwest Fiji, central Tonga, southern Niue, southern Cook Islands, plus northeast and southern French Polynesia. Above normal rainfall is likely or very likely for PNG, Solomon Islands, Nauru, Kiribati (Gilbert, Phoenix, much of the Line Islands), eastern Fiji, parts of northern and southern Tonga, much of Tuvalu, Tokelau, southern American Samoa, northern Niue, northern and central Cook Islands, central French Polynesia and Pitcairn Islands.

The ACCESS-S three-month rainfall outlook (March to May 2024) is very similar to the March outlook, but with the below normal rainfall region in the northern hemisphere being stronger and extending further to north. In the southern hemisphere, the below normal region is more intense and extensive over Australia and Coral Sea region, New Caledonia, Vanuatu, much of Fiji, central Tonga, eastern Niue, southern Cook Islands, and northern and southern French Polynesia. The above normal rainfall region extend further south in the three-months outlook, affecting Tuvalu, Wallis and Futuna, Samoa, and American Samoa.

Monthly ACCESS-S Maps



The Copernicus multi-model outlook for March to May 2024 is very similar to the ACCESS outlook, the main difference being a lack of wet signal over Wallis and Futuna, Samoa, and southeast FSM in C3S.

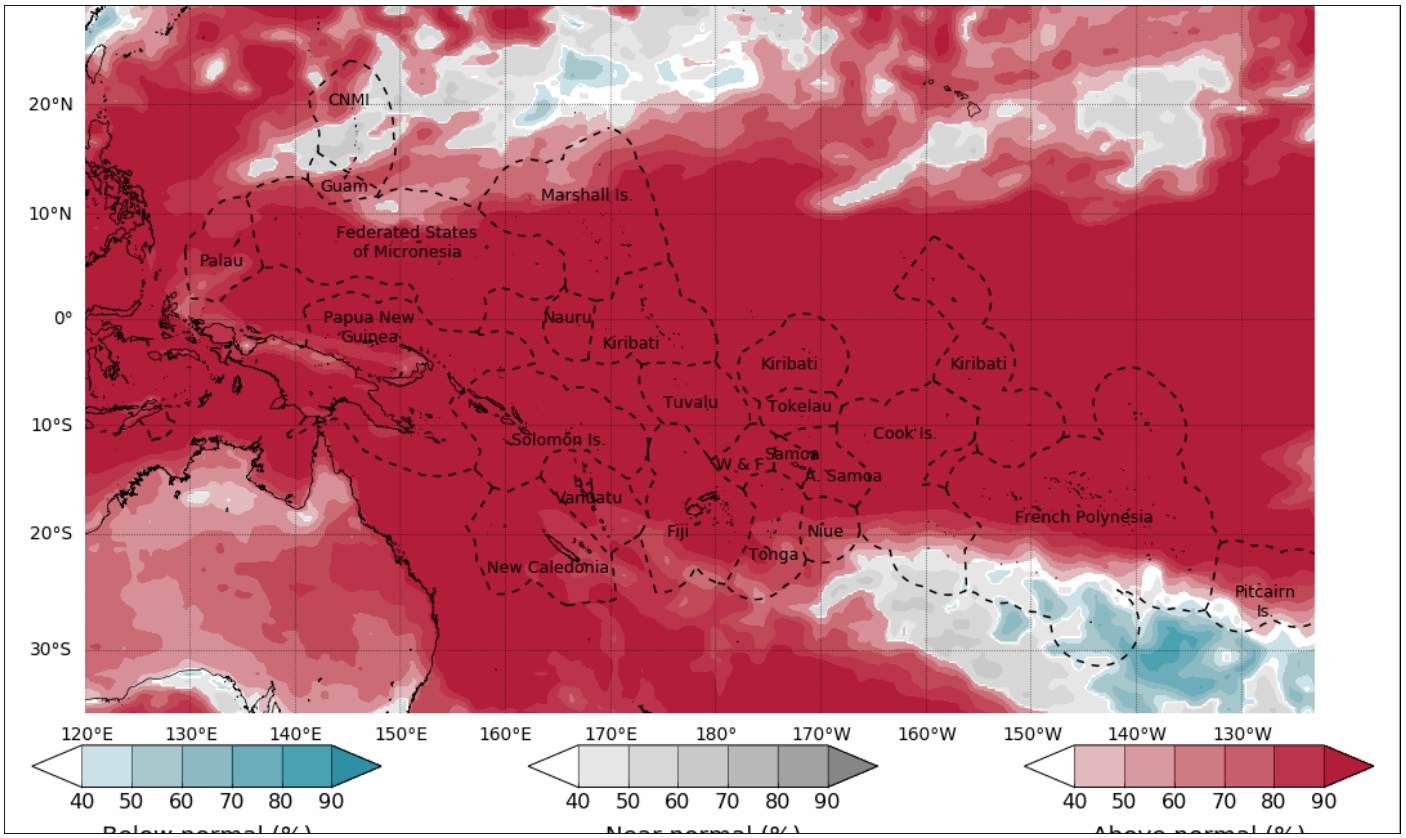
The APEC Climate Centre multi-model outlook (March to May 2024) has a much weaker and less extensive area where above normal rainfall is likely. The outlook for below normal rainfall, however, is similar to ACCESS-S and Copernicus, except of Australia and Pitcairn Islands.

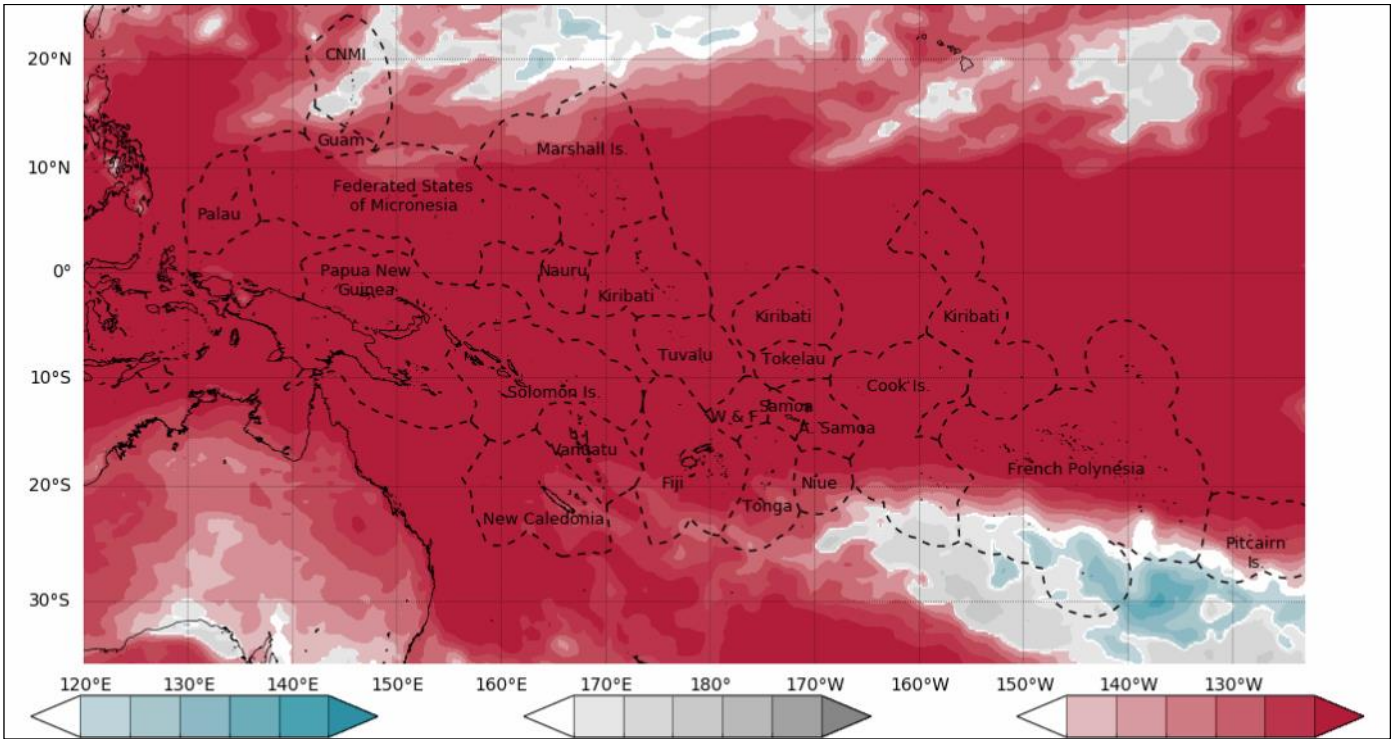
For March to May 2024, the models agree on below normal rainfall being likely or very likely for Palau, Guam, CNMI, northern FSM, northern RMI, New Caledonia, Vanuatu, northern and eastern Fiji, central Tonga, southern Cook Islands, plus northeast and parts of southern French Polynesia. In addition, there's model agreement on above normal rainfall being likely or very likely in near-equatorial regions from PNG eastward across the northern Solomon Islands, Nauru, Kiribati (mainly Phoenix and northern Line Is.), Tuvalu, Tokelau, north American Samoa, and the northern Cook Islands.

SEASONAL TEMPERATURE OUTLOOK

March—May 2024

Monthly Tmax and Tmin ACCESS-S Maps

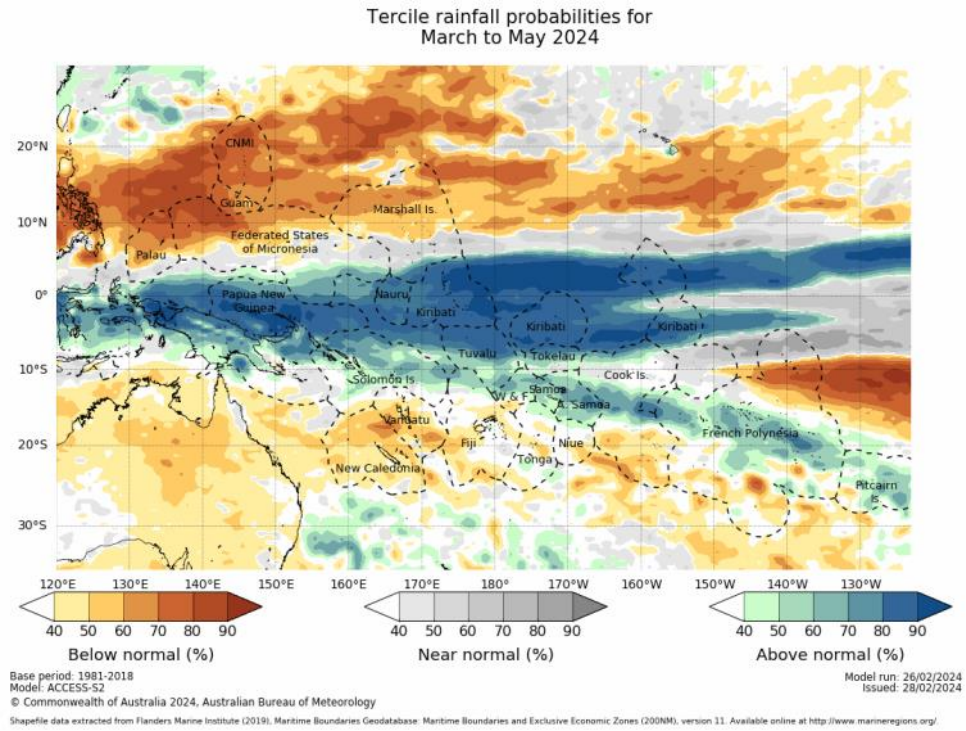


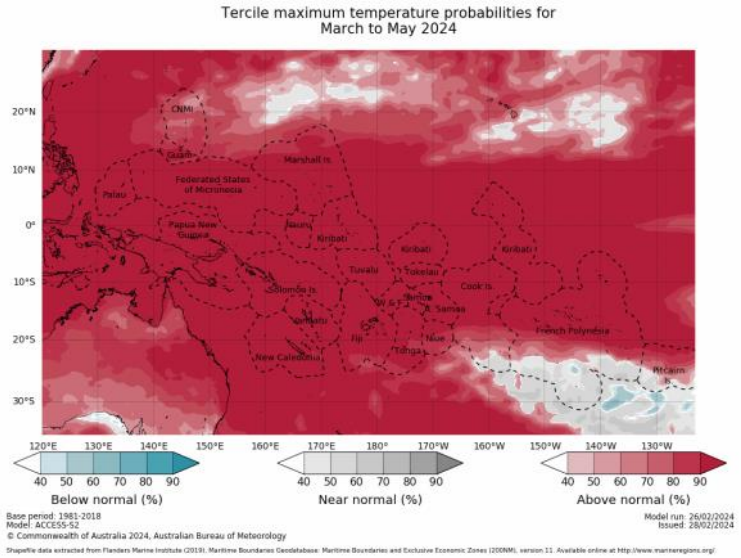


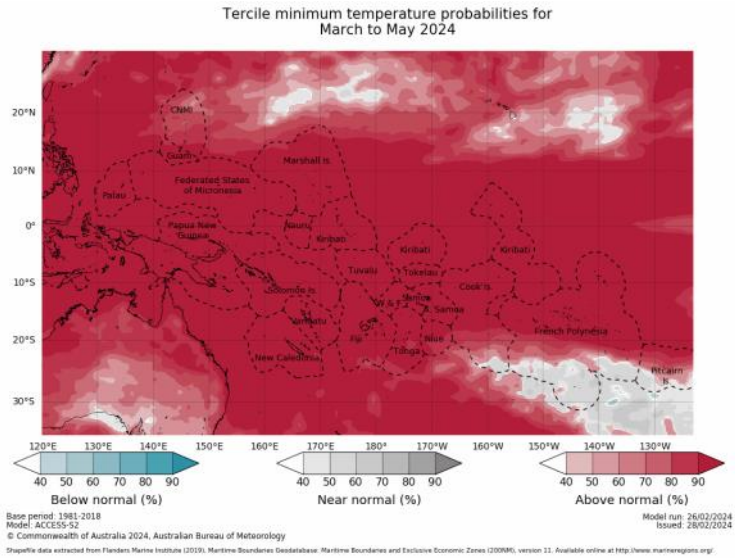
SEASONAL RAINFALL OUTLOOK

March—May 2024

Seasonal ACCESS-S maps



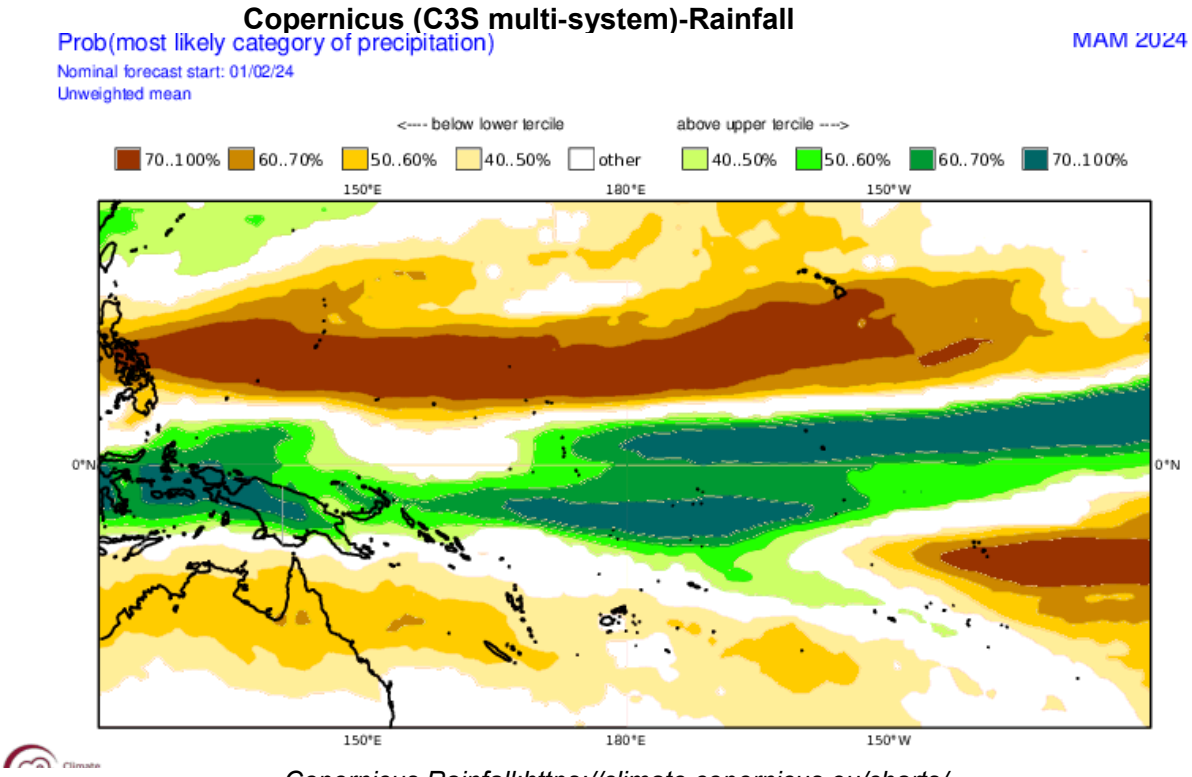




'About ACCESS-S http://access-s.clide.cloud/

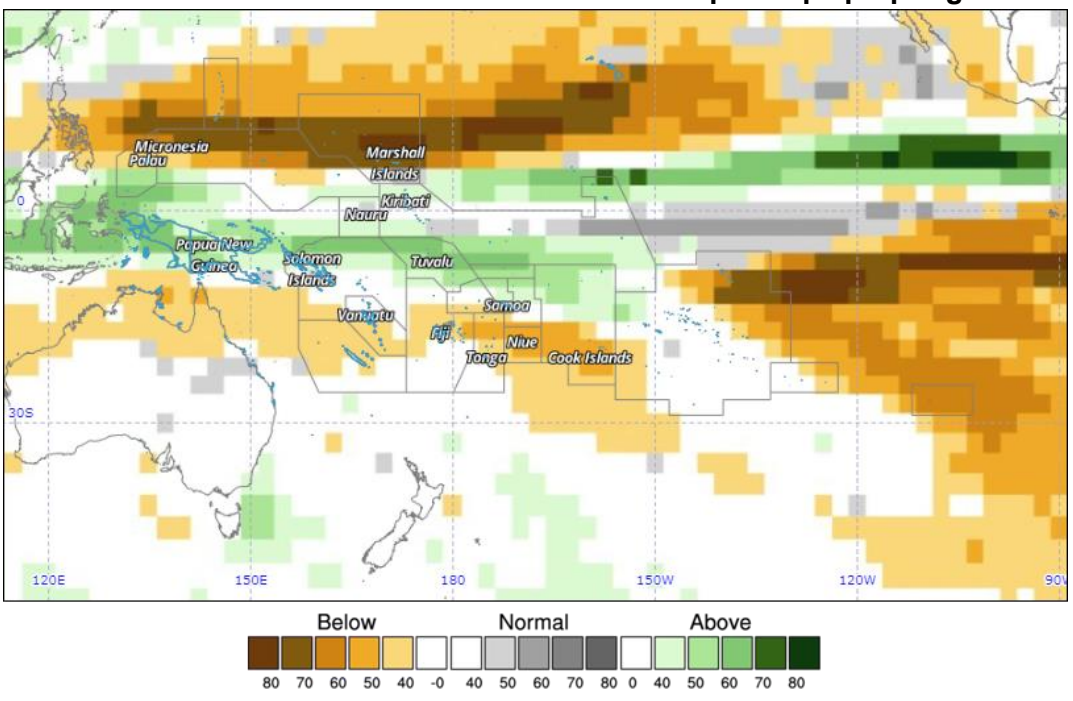
SEASONAL RAINFALL OUTLOOK

March—May 2024



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

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



Year: 2024, Season: MAM, Lead Month: 3, Method: GAUS
Model: APCC, BOM, CMCC, CWB, MSC, NASA, NCEP, PNU
Generated using CLIKP (2024-3-4)

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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 occurred as of 20 October 2023. In the southwest Pacific, the 2023-24 tropical cyclone season officially 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. The forecast remains the same for the second half of the session. Several severe TCs were considered possible anywhere in the basin. Six tropical cyclones have occurred in the south Pacific so far this season. TC Lola just formed before the start of the season on 22 October, followed by TC Mal which affected Fiji, and TC Jasper which affected the Solomon Islands before tracking slowly southwest to north Queensland, Australia, where devastating floods occurred in December. In January, TC Kirrily affected Australia, while TCs Nat and Osai affected the Cook Islands and French Polynesia in February

It's important to remember that history shows that tropical cyclones 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 forecasts from the ACCESS-S model shows near-normal or reduced risk in the southwest Pacific for the fortnight from 16 to 22 March. The risk is reduced in the northwest Pacific for the same period.

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

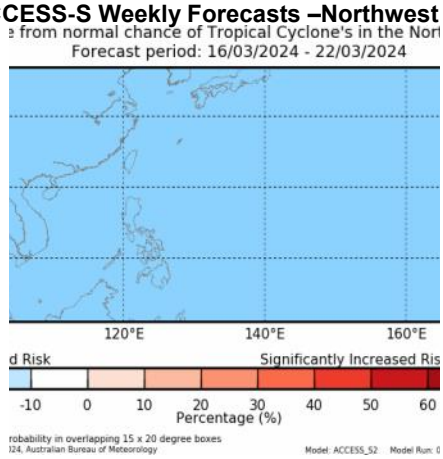
POAMA Pacific Seasonal Prediction Portal: http://poama.bom.gov.au/experimental/pasap/index.shtml

APEC Climate Center (APCC): http://www.apcc21.org/eng/service/6mon/ps/japcc030703.jsp

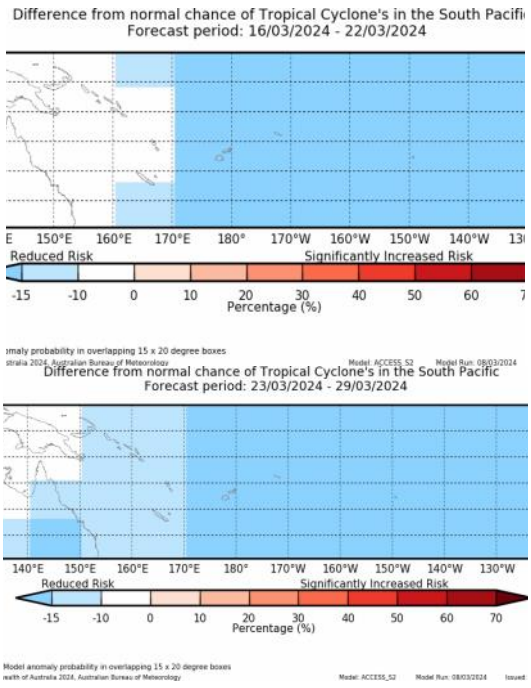
NASA GMAO GEOS-5:http://gmao.gsfc.nasa.gov/research/ocean/

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

ACCESS-S Weekly Forecasts –Northwest Pacific



ACCESS-S Weekly Forecasts –Southwest Pacific



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.

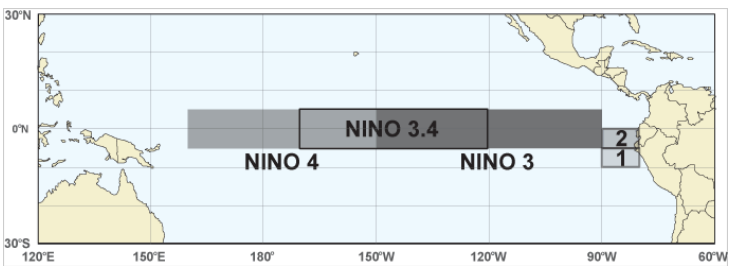
20 degrees Celsius Isotherm Depth

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