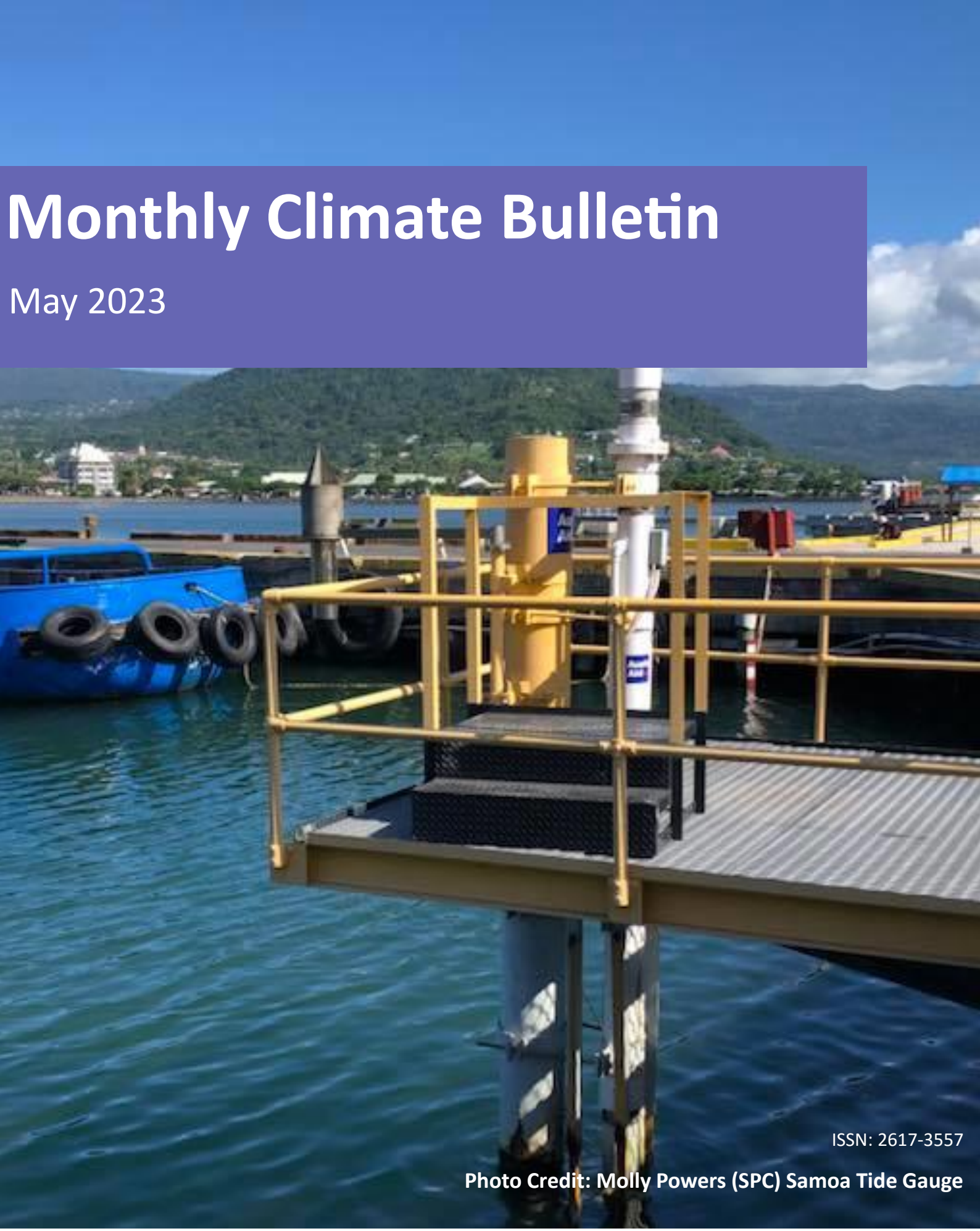
Monthly Climate Bulletin

May 2023



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

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Issued 13 June 2023

- The Bureau's ENSO Outlook has been shifted to El Niño ALERT, indicating a 70% chance of El Niño forming this year.
- A Madden Julian Oscillation (MJO) pulse, which had been moving steadily across the Western Pacific region during the past fortnight, has recently weakened.
- The ITCZ and SPCZ were both active in May 2023.
- Sea surface temperatures (SST) May 2023 were warmer than average over the eastern, southern and far west of the tropical Pacific Ocean.
- The Coral bleaching Outlook to 25 June shows patches of area of 'Alert Level 1' over Palau, far western FSM and north of PNG.
- For June-August 2023, the models agree on continued warming of the equatorial Pacific. They unanimously agree on above normal rainfall being likely or very likely for northern Palau, Guam, FSM, southern and western RMI, PNG's Momase Region, central Solomon Islands, Nauru, and Kiribati. The models also agree on below normal rainfall being likely or very likely for northern CNMI, Samoa, American Samoa, northern and central Cook Islands, and central to northern French Polynesia.
- The ACCESS-S weekly tropical cyclone outlook shows an increased risk between 17 and 30 June in the northwest Pacific, especially around Guam, FSM and the Marshall Islands from 17-23 June.

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EL NIÑO–SOUTHERN OSCILLATION

El Nino ALERT activated; positive Indian Ocean Dipole also possible

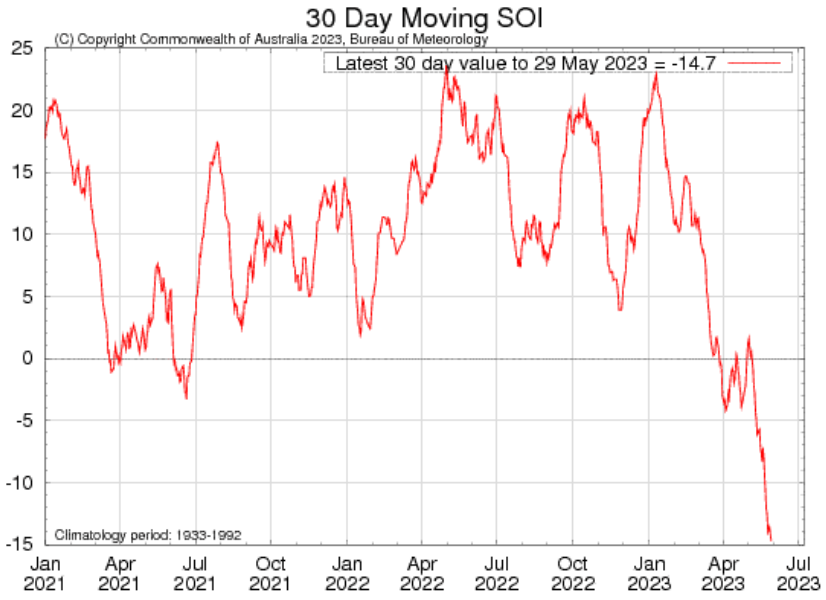
Click link to access Climate Driver Update issued on 6 June 2023

The Bureau's ENSO Outlook has been shifted to El Niño ALERT, indicating a 70% chance of El Niño forming this year. This equates to roughly three times the normal chance of an El Niño forming. Central and eastern Pacific sea surface temperatures (SSTs) have warmed to El Niño thresholds.

All models surveyed by the Bureau are forecasting the likelihood of further warming and that these SSTs will remain above El Niño thresholds at least into the southern hemisphere spring. Some atmospheric indicators such as the Southern Oscillation Index (SOI) have shifted towards El Niño thresholds, but wind, cloud and broad-scale pressure patterns indicate the Pacific Ocean and atmosphere are yet to reinforce each other, as occurs during El Niño events.

The Indian Ocean Dipole (IOD) is currently in a neutral phase, with the IOD index at +0.32 °C. All models suggest positive IOD event thresholds may be reached in winter. Long-range forecasts of IOD made at this time of the year have generally had low accuracy and thus should be viewed with caution beyond June.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 04 June 2023 was -21, while the values for the 60-day SOI was -11 and the while the 90-day SOI value was +7. The 30-day and the 90-day SOI have seen a steady decreasing trend over the past month.



EL NIÑO–SOUTHERN OSCILLATION

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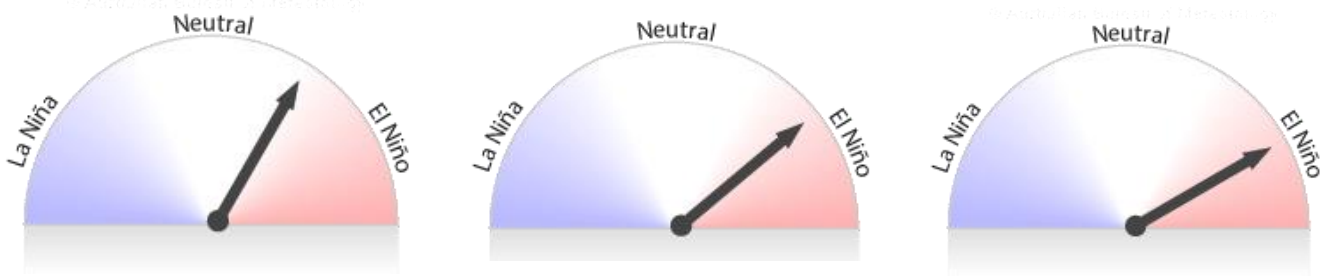
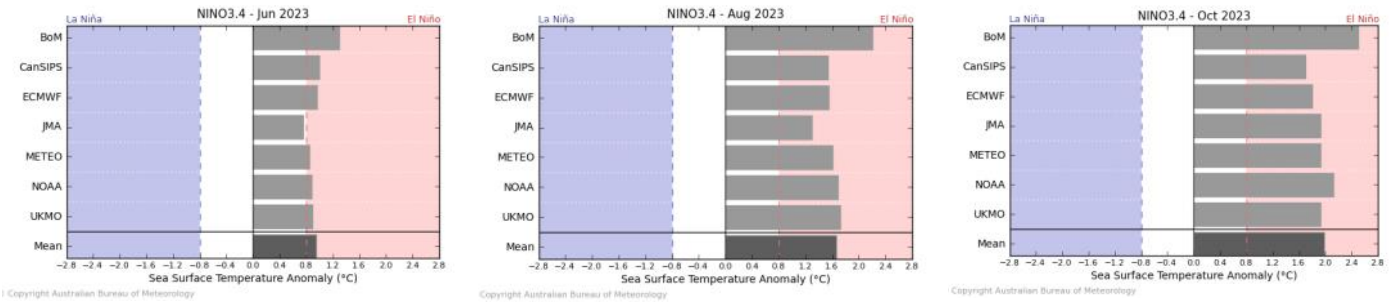
Bureau of Meteorology NINO3.4 ENSO Model Outlooks for June, August and November



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

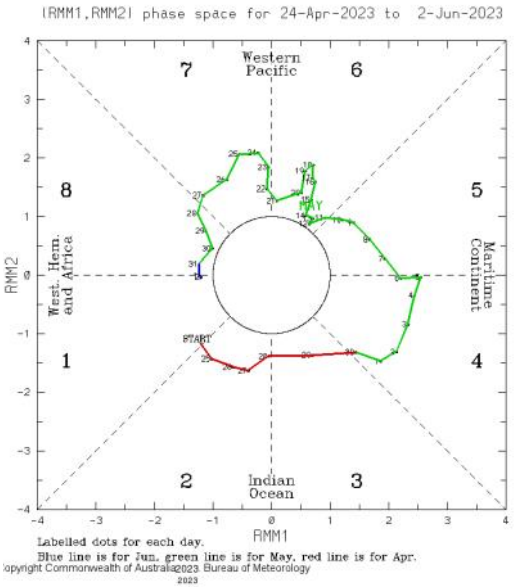
MADDEN–JULIAN OSCILLATION

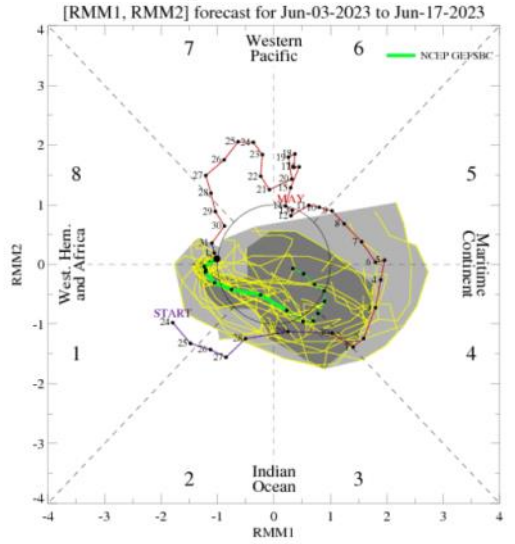
Click link to access *Tropical Climate Update* [Issued on Tuesday 30 May 2023]

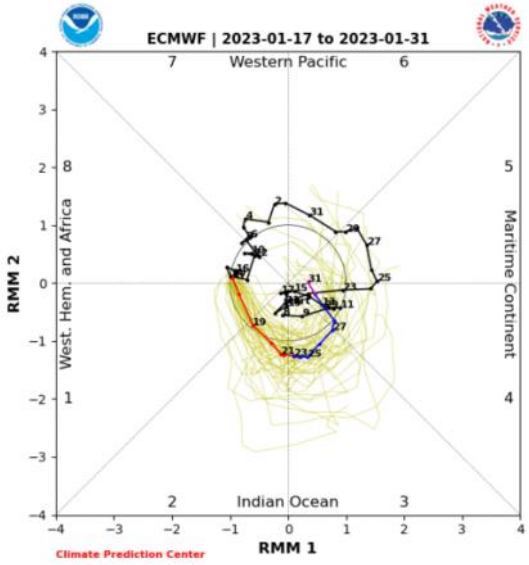
During May, the Madden Julian Oscillation (MJO) was active in the Maritime Continent to the Western Pacific.

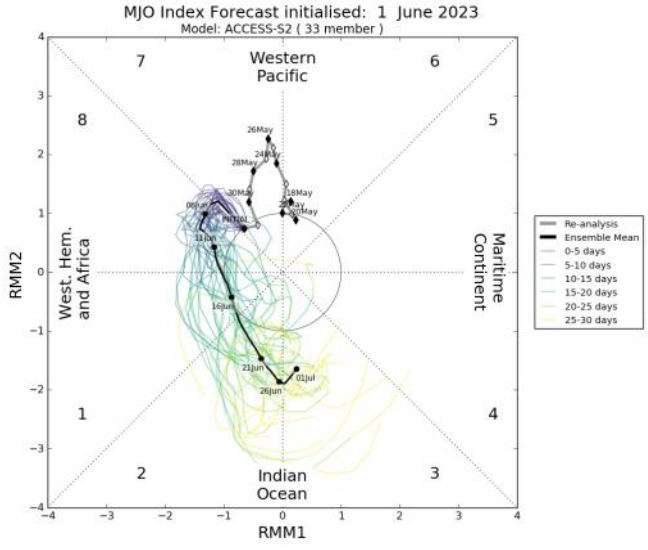
A Madden Julian Oscillation (MJO) pulse, which had been moving steadily across the Western Pacific region during the past fortnight, has recently weakened. There is some disagreement amongst international climate models as to the status of this MJO pulse in the coming week. Some indicate a continuation of the recent easterly track, with a relatively weak pulse moving into the eastern Pacific. Other models indicate it will weaken to a greater degree and become indiscernible in the coming days.

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







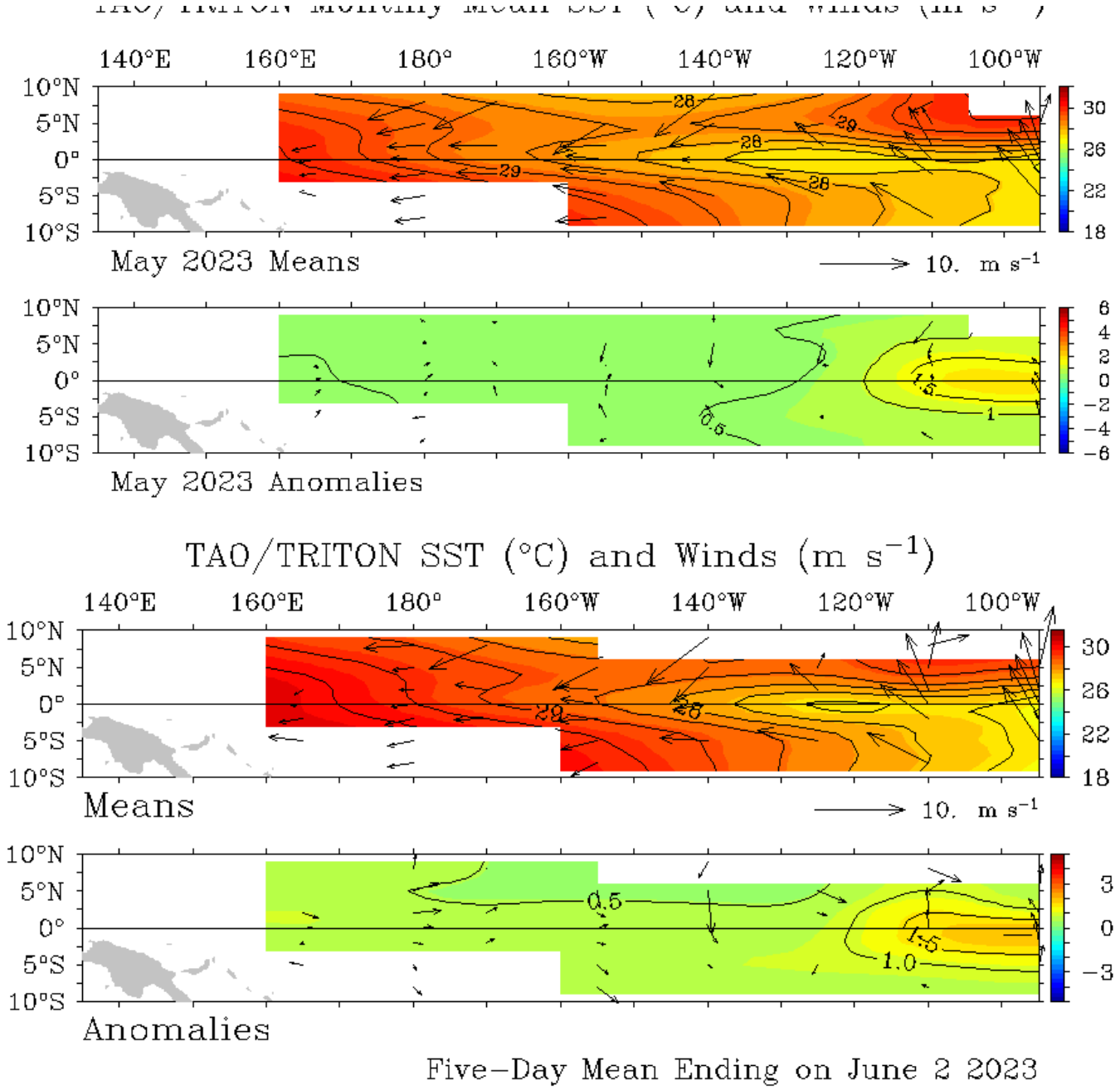


WIND

Click link to access Wind plots link

During May, the trade winds were close to normal across the equatorial Pacific. For the five days ending 02 June 2023, the trade winds were weaker than normal over most of the near-equatorial Pacific.

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

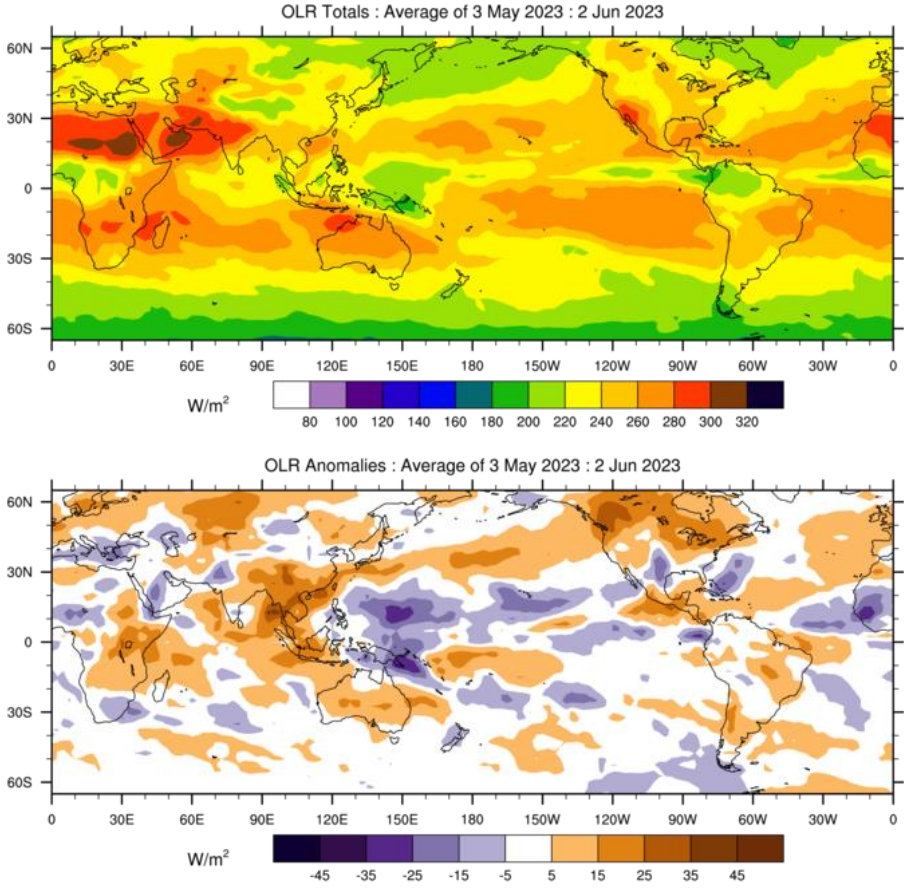
Click link to access OLR

The May 30-day OLR anomaly maps shows the last remnants of the recent La Niña, being a positive anomaly (reduced convection) along the 10° S, stretching between 160° E and 140° W. To the west of this was a much larger region of low OLR (increased convection), with one centre situated near PNG and another located a little north of the Federated States of Micronesia (FSM).

The weekly OLR to 2 June showed slightly reduced convection near the equatorial Date Line, while a centre of strongly increased convection was situated northeast of the Philippines, with an extension reaching eastward across CNMI and the northern Marshall Islands to Hawai'i.

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



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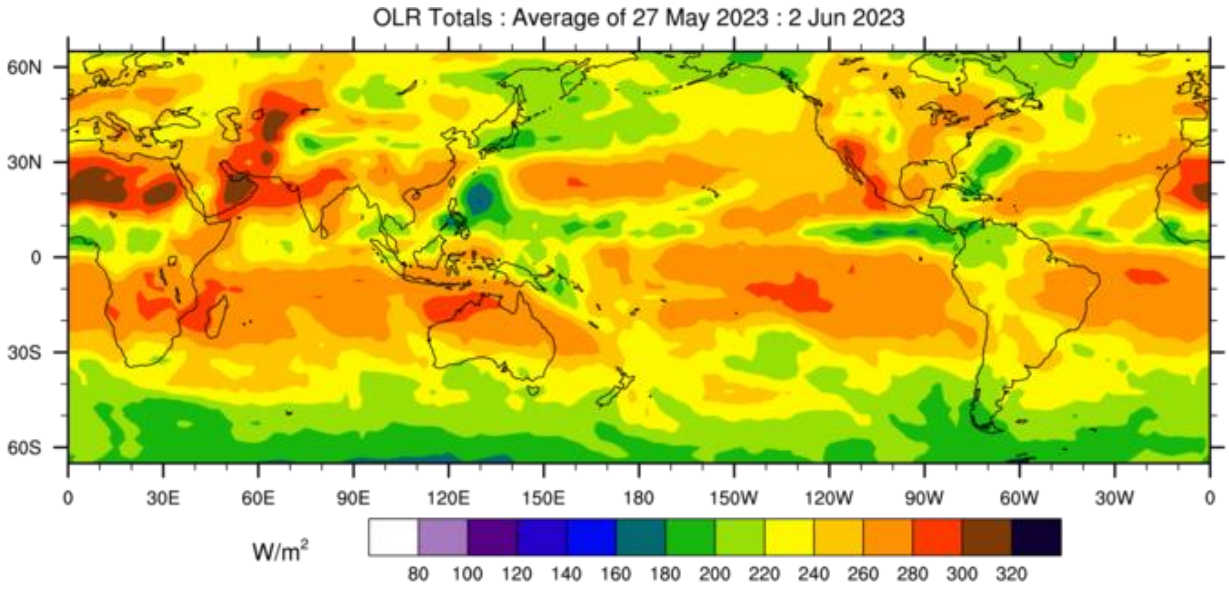
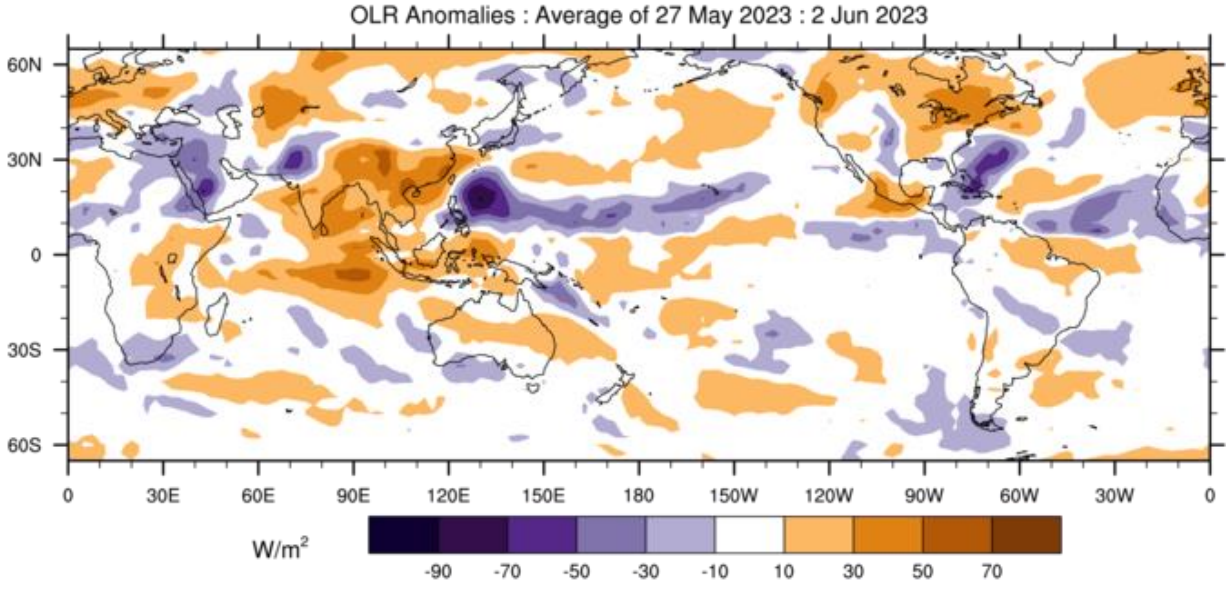
OLR Total and Anomalies, 7 Day OLR





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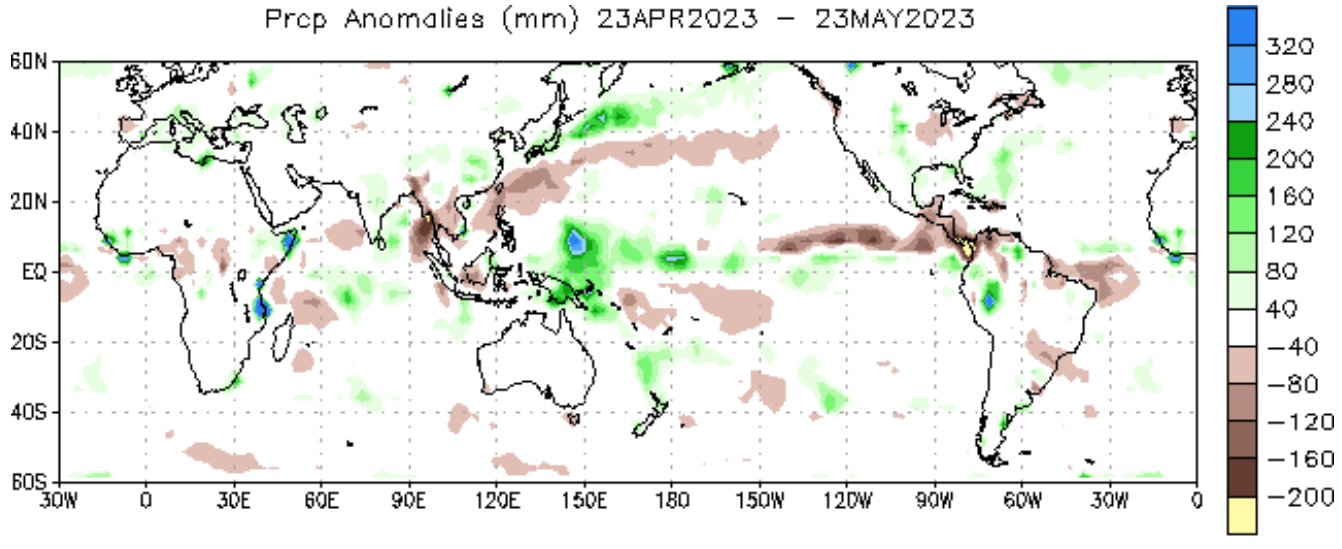
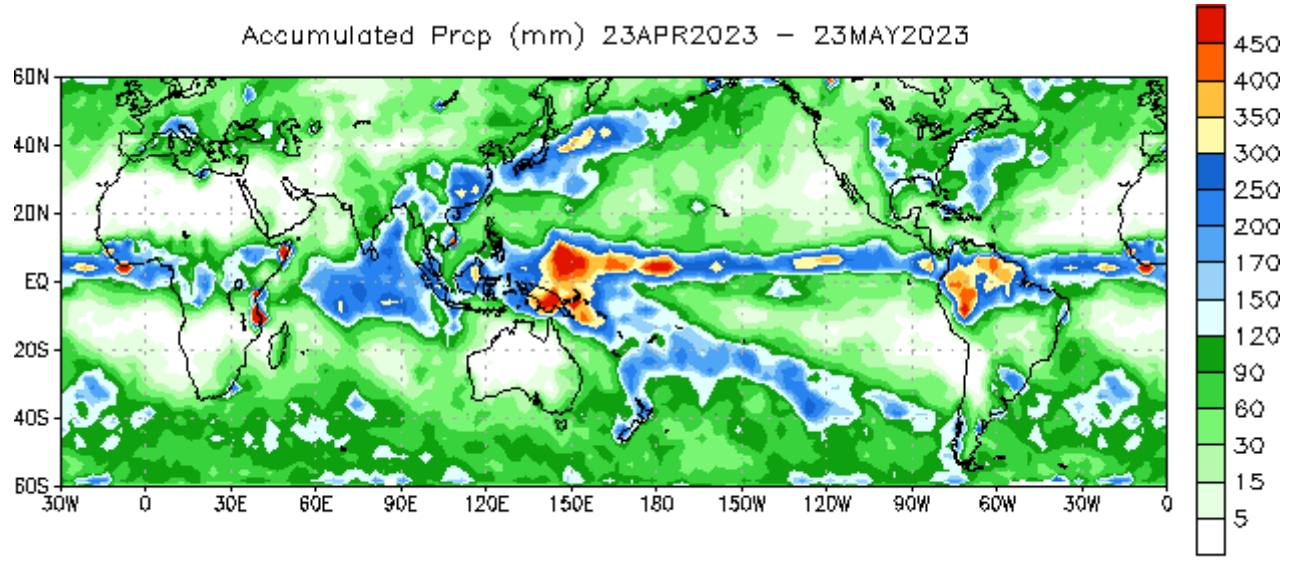
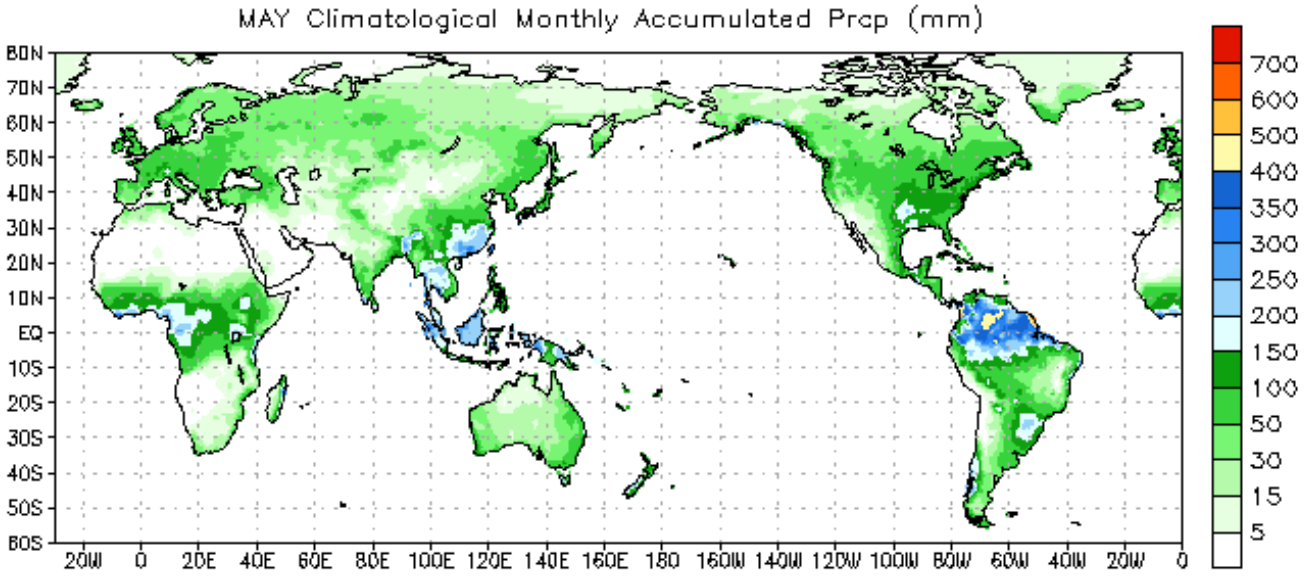


Data Source: NCEP CMAP Precipitation Climatology (1991–2020)

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

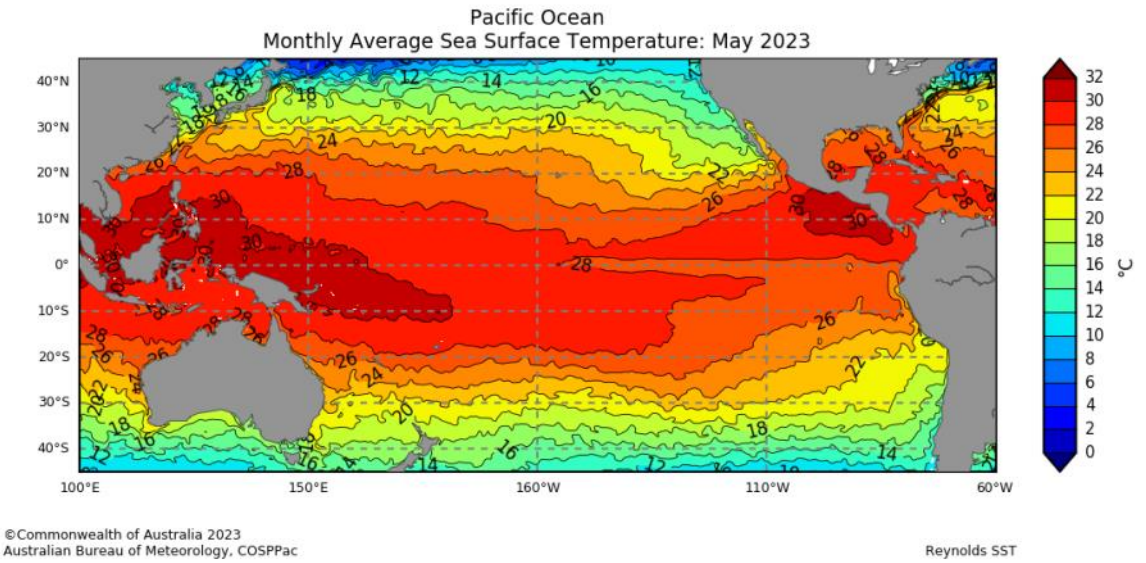
Click link to access Pacific Community COSPPac Ocean Portal

Sea surface temperatures (SST) in May 2023 were warmer than average over the eastern, southern and far west of the tropical Pacific Ocean. Warm anomalies up to 2°C warmer than average were present over parts of these regions, increasing to more than 4°C warmer than average off small, isolated parts of the South American coast.

Compared to April, warm anomalies in the east tropical Pacific Ocean have extended westwards. Large parts of the basin have cooled, especially in the southern central and eastern parts of the South Pacific Ocean. A band of warm anomalies in the south-west Pacific persists from the south-east of Papua New Guinea south-eastwards to around New Caledonia, Vanuatu, Fiji and the east of New Zealand. Warm SST anomalies also continued in the southern Tasman Sea, between south-east Australia and New Zealand, as well as to the south-west of Western Australia. Cool anomalies off the east coast of New South Wales increased in strength and spatial coverage during May.

Record-high May SSTs occurred in parts of Palau, Solomon Islands, Vanuatu and Fiji. Patches of Record-high SST also occurred in FSM, RMI, PNG, Tonga, French Polynesia and Pitcairn Islands. The SST in decile 10 (very much above average) and above average (8-9) span a region from Palau to Pitcairn Islands. Average SSTs (4-7) for May were observed in parts of Niue, parts of Kiribati, southern Cook Islands, and south French Polynesia.

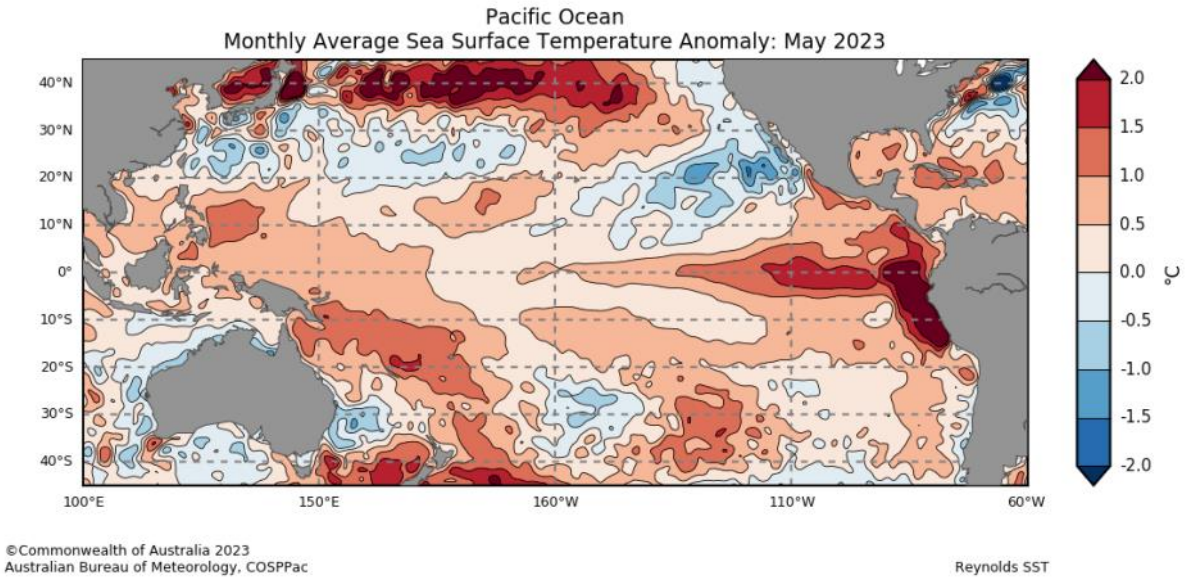
Mean Sea Surface Temperature



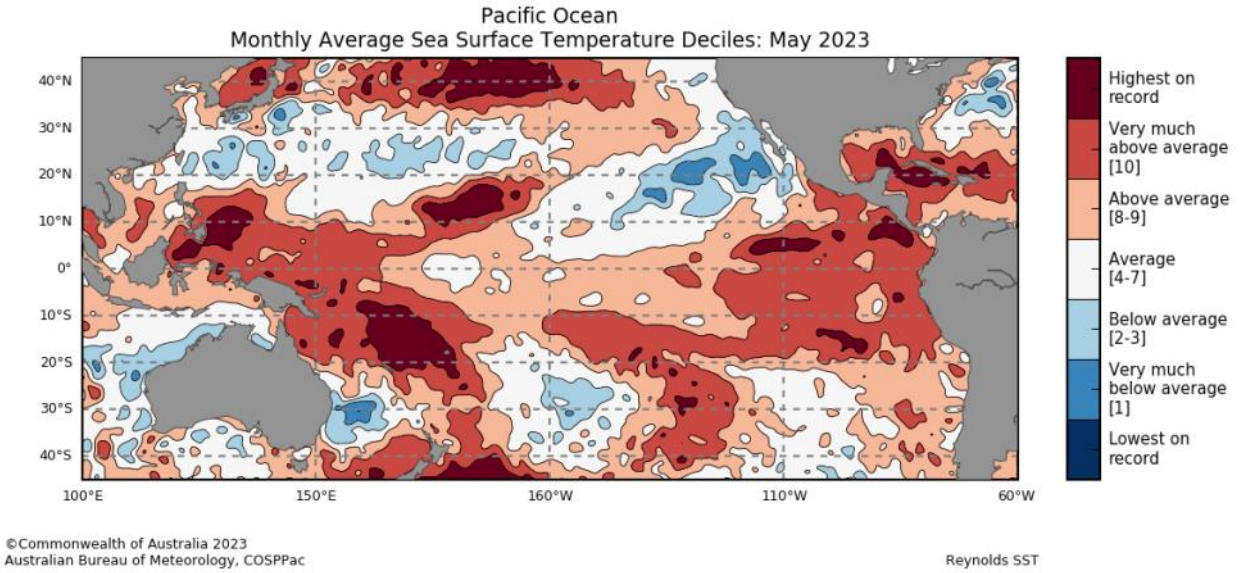
OCEAN CONDITIONS

Click link to access SEA SURFACE TEMPERATURE

Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles

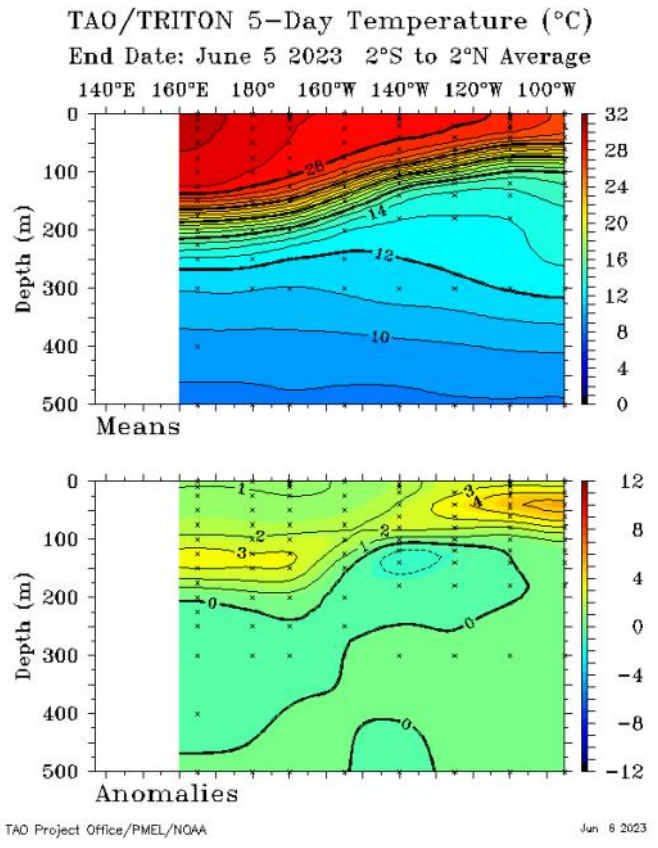


OCEAN CONDITIONS

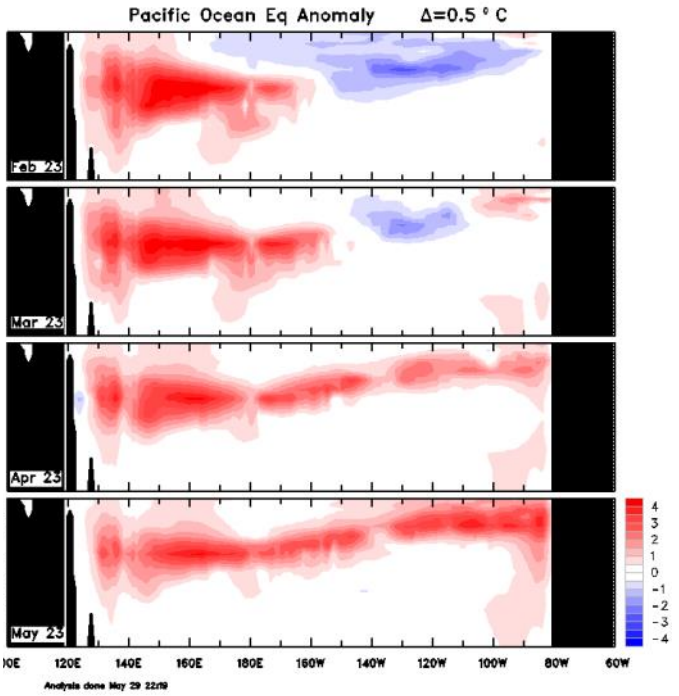
SUB SURFACE

The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 31 May 2023) shows warm anomalies warm anomalies are present for most of the top 175m of the equatorial Pacific band. Anomalies reached more than 2°C warmer than average across much of this region. Compared to previous months, cool anomalies have steadily decreased in extent, and are now absent. During April, warm anomalies expanded in extent to cover the whole basin, strengthening in the eastern Pacific during May.

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/

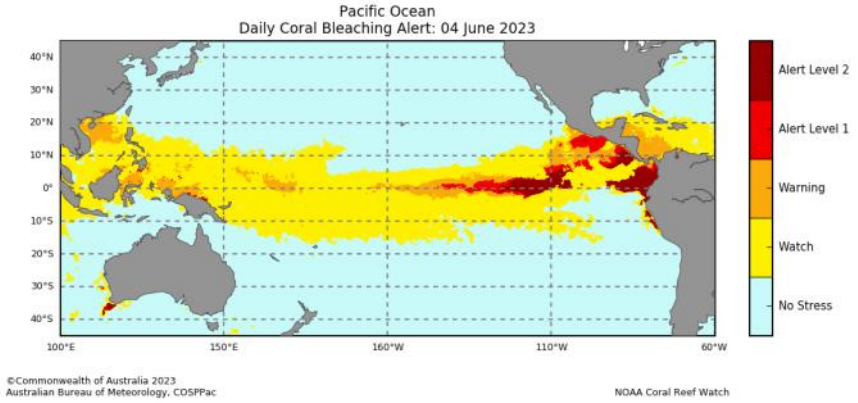
OCEAN CONDITIONS

CORAL BLEACHING

The daily Coral Bleaching Alert status for 04 June 2023 shows 'Alert Level 1' for north of PNG. Patches of 'Warning' over Palau, FSM, Nauru, RMI and Kiribati (Gilbert and Line Islands). The four-week Coral Bleaching Outlook to 25 June shows patches of area of 'Alert Level 1' over Palau, far western FSM and north of PNG. 'Watch to Warning' ratings extend east from Palau, FSM, northern PNG, Nauru, southern Marshall Islands, and Kiribati.

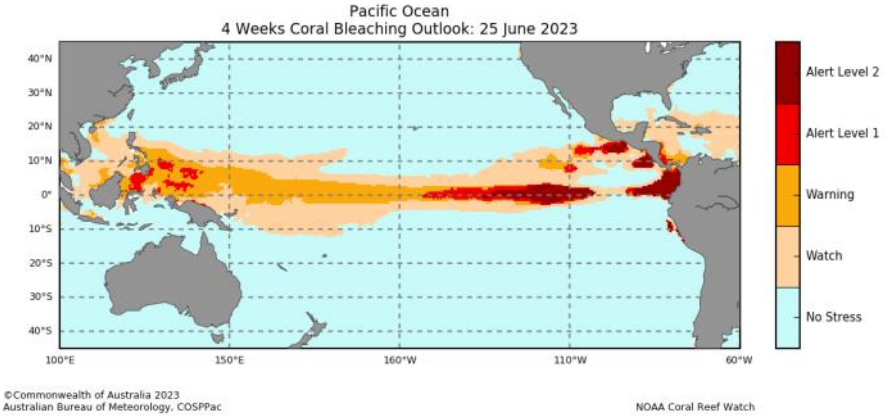
Daily Coral Bleaching Alert

(Source: Pacific Community COSPPac Ocean Porta Coral Bleaching)



4 Weeks Coral Bleaching Outlook

(Source: Pacific Community COSPPac Ocean Portal)



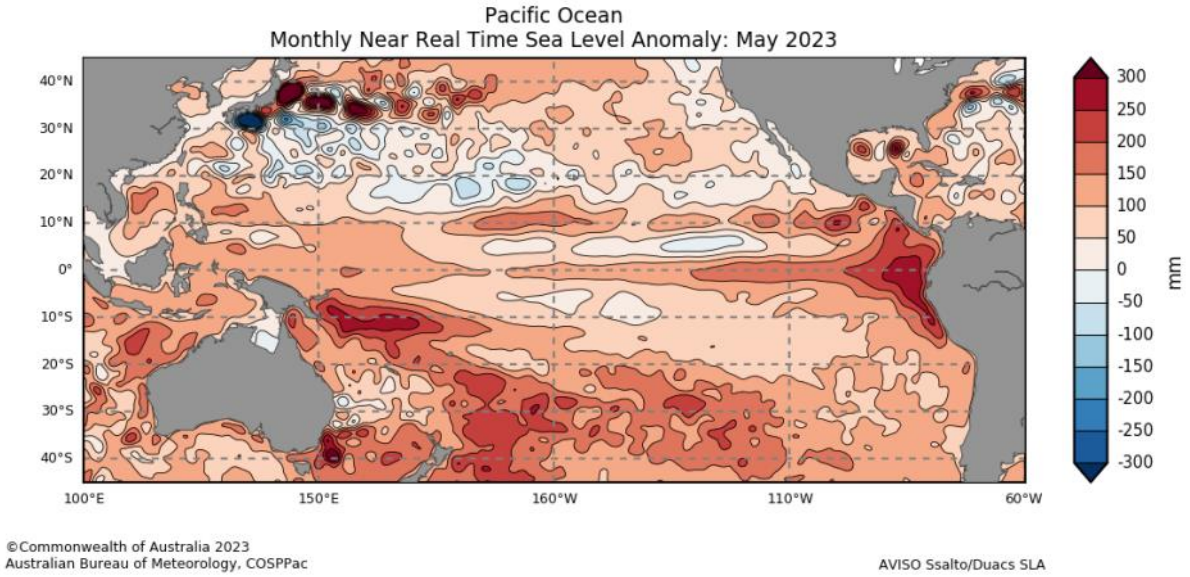
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea level in May was above normal over COSPPac countries. Anomalies above +250 mm were observed in eastern PNG to Solomon Islands. Anomalies of +150 to +200 mm were observed south-east from PNG to southern Tonga. Sea level between +50 mm +150 mm were observed in most of the COSPPac countries.

Monthly Sea Level Anomalies

Source: Pacific Community COSPPac Ocean Portal

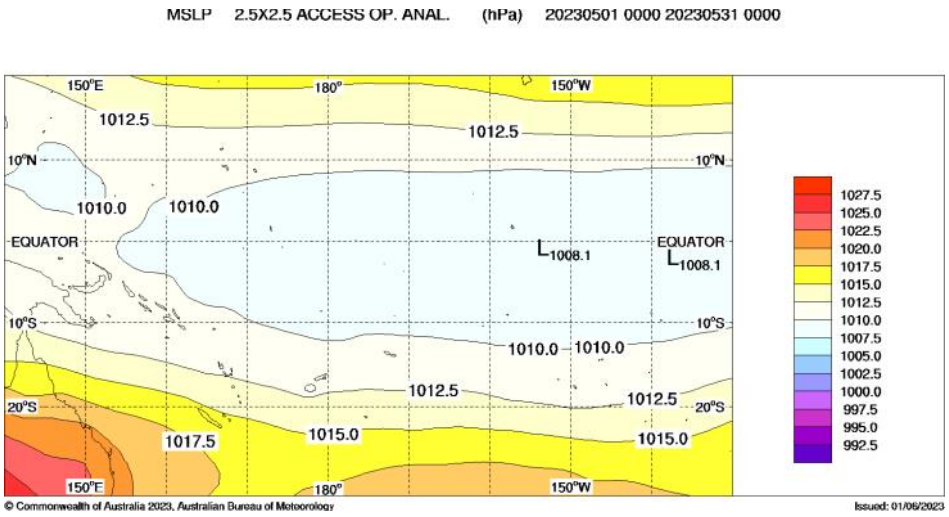


MEAN SEA LEVEL PRESSURE

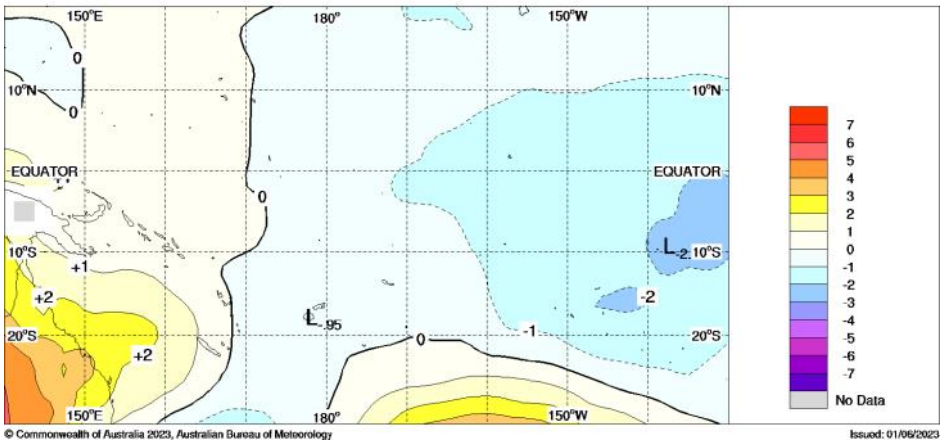
The May mean sea level pressure (MSLP) anomaly map shows mostly negative anomalies of -1 hPa or greater west of the Dateline. The positive anomalies of +1 hPa or greater west of New Caledonia, as well as across a large region south of Niue.

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

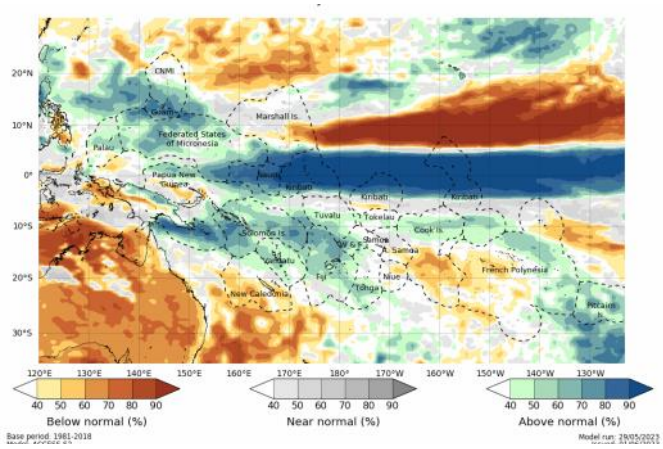
SEASONAL RAINFALL OUTLOOK

June—August 2023

The ACCESS-S model forecast for June 2023, favours below normal rainfall for parts of PNG's Highlands and Islands regions, central RMI, New Caledonia, parts of Kiribati (southern Phoenix Islands), and in a zone from American Samoa across the central and, southern Cook Islands to central and southern French Polynesia. Above normal rainfall is likely or very likely for Palau, southern CNMI, Guam, FSM, southern RMI, PNG's northern mainland and the southeast of its EEZ, Solomon Islands, Nauru, Vanuatu, Kiribati, Fiji, southern Tuvalu, southern Tonga, patches of Tokelau, northern Cook Islands, eastern French Polynesia, and Pitcairn Islands.

The three-month rainfall outlook (June-August 2023) is very similar to the June outlook as it favours below normal rainfall in southern Palau, northern CNMI, north RMI, Samoa and most of American Samoa, central to southern Cook Islands, and some of central and northern French Polynesia. Above normal rainfall is likely or very likely from northern Palau in the west, across Guam, southern CNMI, western and southern RMI, Nauru, western and northern Tuvalu, to Kiribati (Gilbert Is., north of both Phoenix and Line Is.). Similarly, above normal rainfall is likely or very likely from southeast PNG to southern Tonga, plus patches in Niue and Pitcairn Islands.

Monthly ACCESS-S Maps



The Copernicus multi-model outlook for June-August 2023 favours above normal rainfall for Palau, Guam, FSM, RMI, PNG, Solomon Islands, Nauru, and Kiribati. Below normal rainfall is likely or very likely for northern CNMI, southern Tuvalu, Wallis and Futuna, Samoa, Tokelau, American Samoa, northern and central Cook Island, and the northern half of French Polynesia.

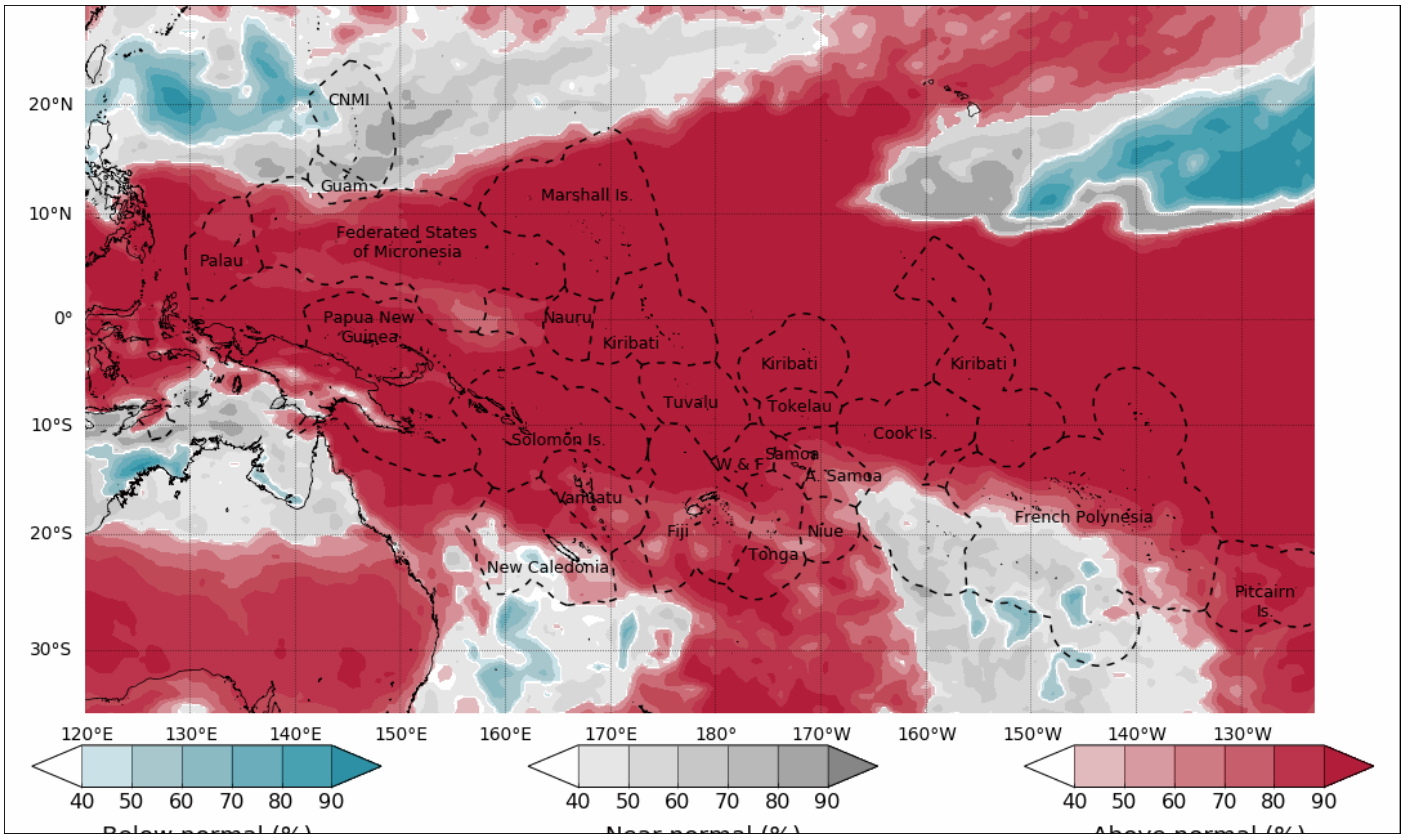
The APEC Climate Centre multi-model for June-August 2023 is also very similar to the ACCESS-S and Copernicus models. The main differences are a decreased wet signal in APEC over Palau to FSM, and the Solomon Islands, Vanuatu and Fiji, and increased dry signal in APEC for southern Tuvalu to French Polynesia in APEC.

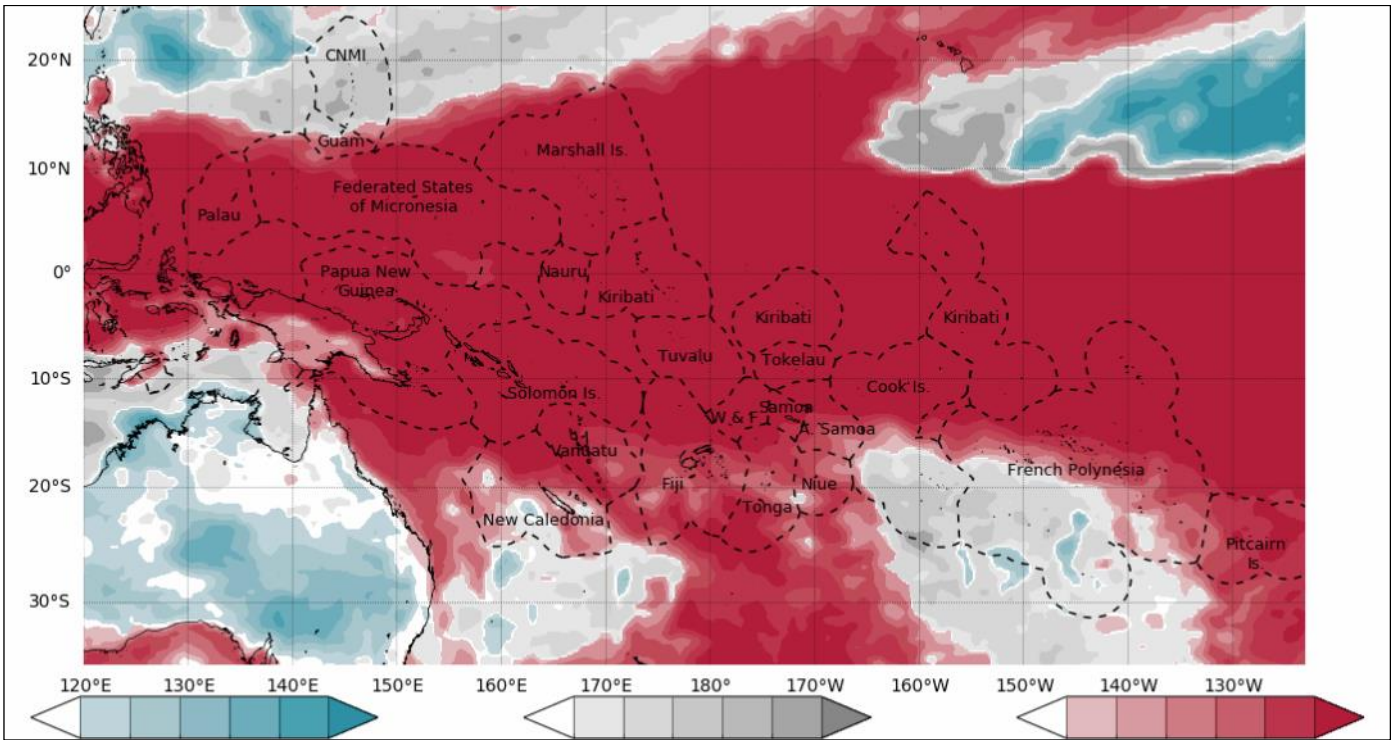
For June-August 2023, the models agree on continued warming of the equatorial Pacific. They unanimously agree on above normal rainfall being likely or very likely for northern Palau, Guam, CNMI, FSM, southern and western RMI, PNG's Momase Region, central Solomon Islands, Nauru, and Kiribati. The models also agree on below normal rainfall being likely or very likely for northern CNMI, Samoa, American Samoa, northern and central Cook Islands, and central and northern French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

June—August 2023

Monthly Tmax and Tmin ACCESS-S Maps

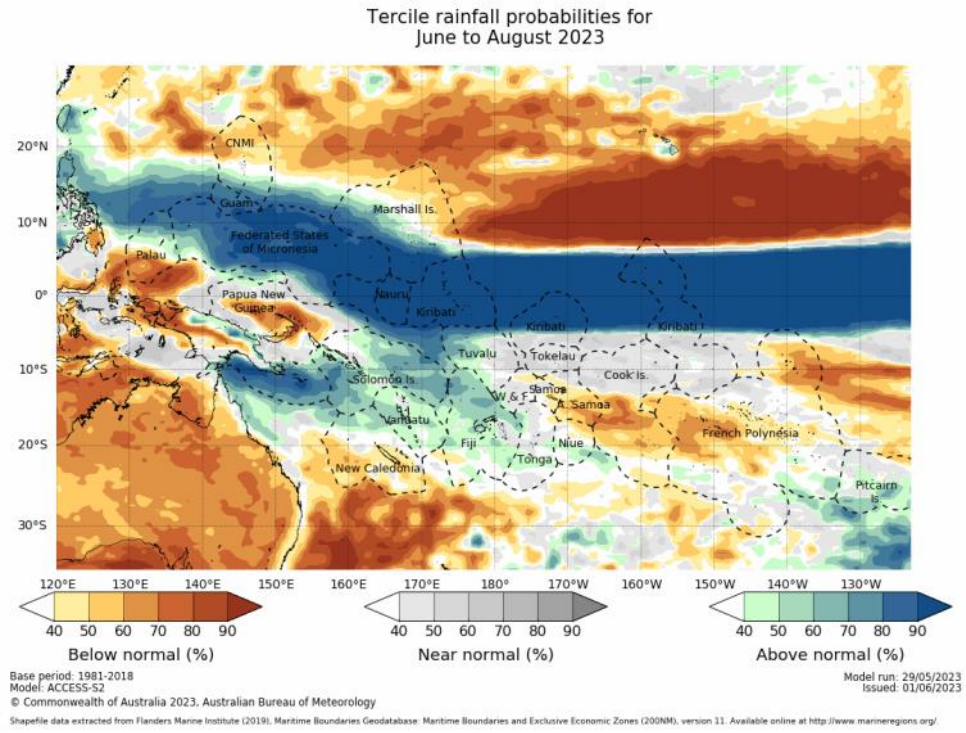


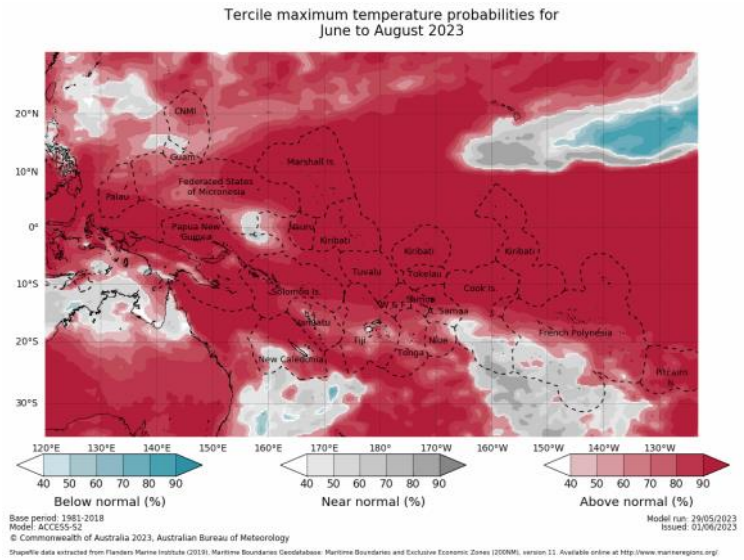


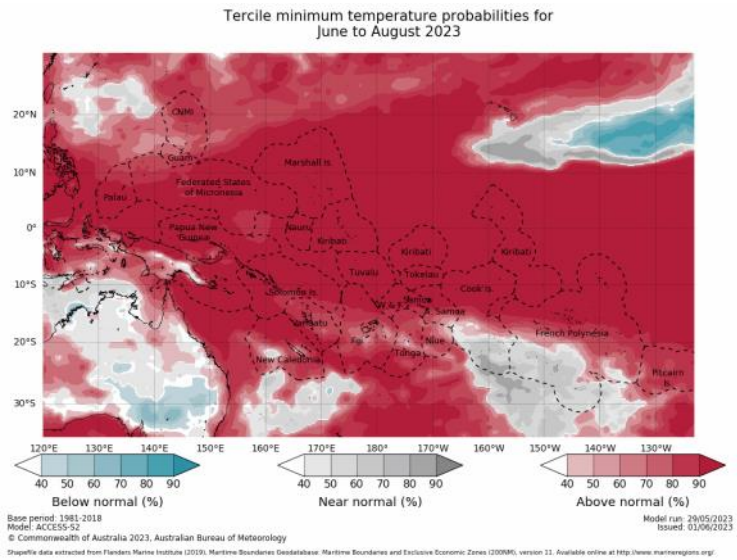
SEASONAL RAINFALL OUTLOOK

June—August 2023

Seasonal ACCESS-S maps





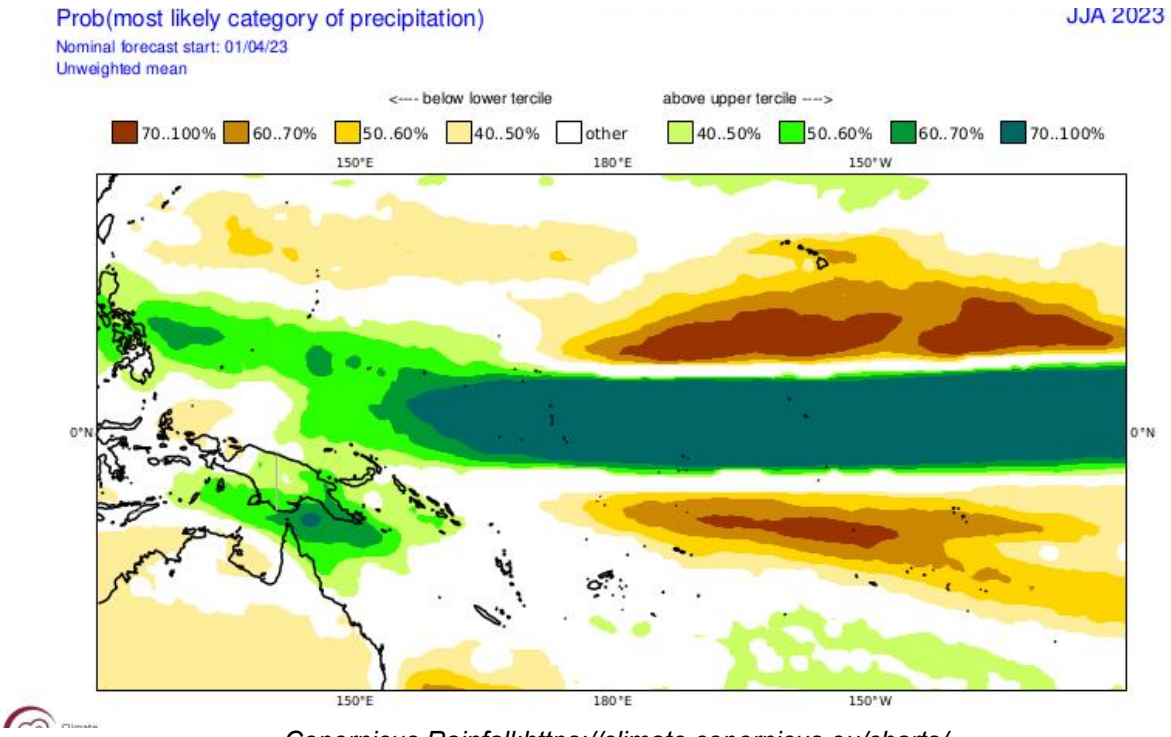


'About ACCESS-S http://access-s.clide.cloud/

SEASONAL RAINFALL OUTLOOK

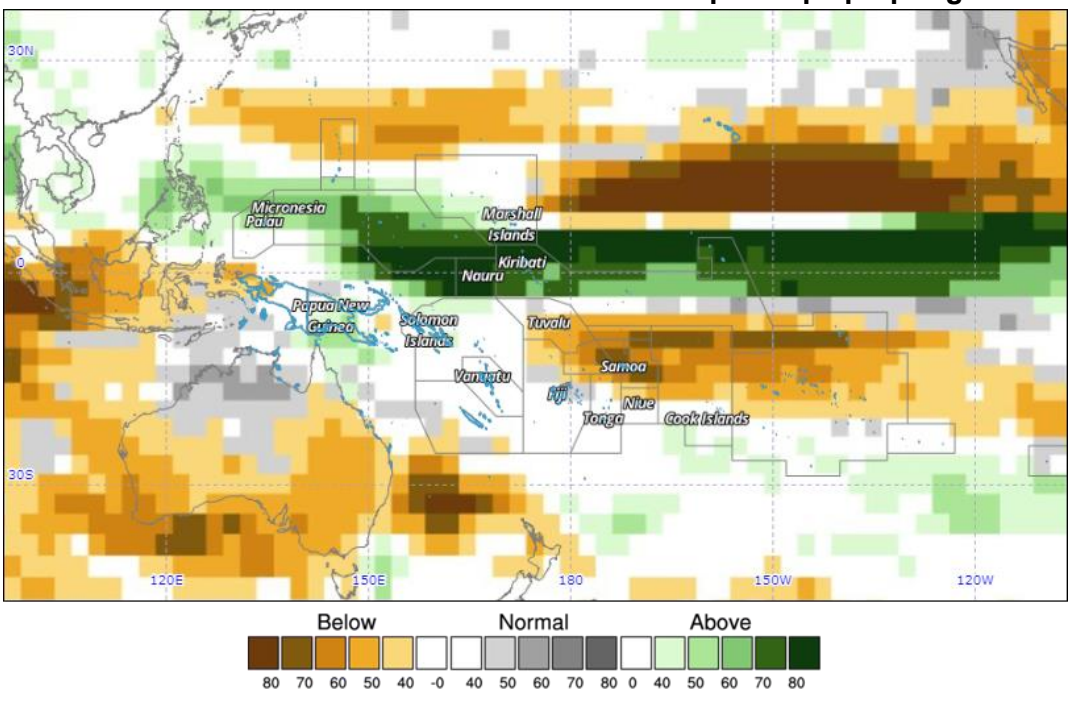
June—August 2023

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: JJA, Lead Month: 3, Method: GAUS
Model: APCC, BOM, CMCC, MSC, NASA, NCEP
Generated using CLIKP (2023-6-12)

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TROPICAL CYCLONE

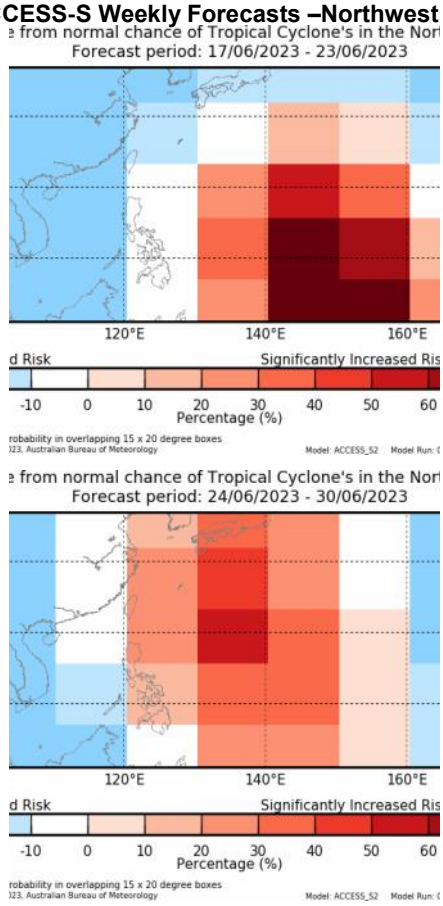
2022/2023 Season

In the southwest Pacific, the 2022-23 tropical cyclone ended on 30th April 2023. The outlook for the season favoured enhanced risk for tropical cyclone activity in the western part of the basin. In the central part of the region, cyclone risks were considered to be generally near-normal to below normal. There were five cyclones (Hale, Irene, Gabrielle, Judy, Kevin) over the southwest Pacific, with three (Gabrielle, Judy and Kevin) reaching severe status, affecting Australia, New Caledonia, Vanuatu, Fiji and New Zealand. TC activity in the western north Pacific occurs year around and with the possible development of El Niño, an increase in TC activity is supported, as stated in the PICOF 12 regional statement.

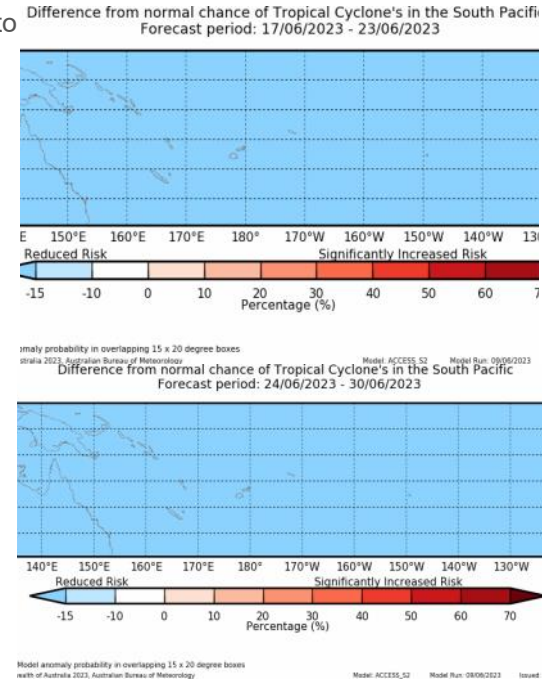
It's important to remember that history showed that TC can happen outside the normal cyclone season and it does not take a severe cyclone to produce severe impacts. Coastal and river flooding rainfall can occur with a distant, weak or former cyclone, especially if the system is slow-moving. Communities 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 strongly increased risk in the northwest Pacific between 17 and 23 June around Guam, FSM and the Marshall Islands. For the 24 to 30 June a moderate to significantly increased risk extends from the FSM and the Marshall Islands to the Philippines in the west and Japan in the north.

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.

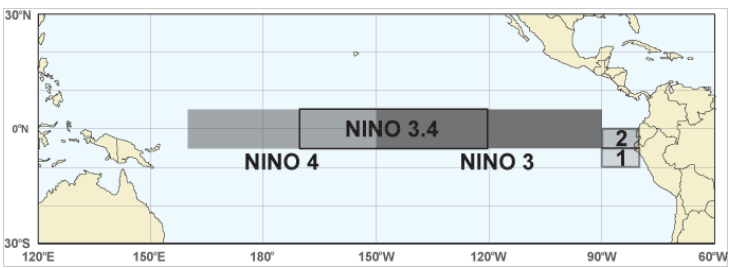
20 degrees Celsius Isotherm Depth

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