



Monthly Climate Bulletin

December 2021

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Photo Credit: FRA 12pm 09 Jan 2022 Ba Main Street, Fiji



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- La Niña continues in the tropical Pacific with climate models suggest La Niña will persist until March 2022.
- The current Madden-Julian Oscillation (MJO) pulse is moderate to strong and is expected to remain in this region over the next week or two.
- The Intertropical Convergence Zone (ITCZ) was active over the western warm pool region and eastern Pacific with a shift to the north from its normal position, while the South Pacific Convergence Zone (SPCZ) was active and shifted southwest around New Caledonia, Vanuatu to New Zealand.
- The SSTs for December 2021 show weak cool SST anomalies were present across most of the equatorial Pacific, while weak warm SST anomalies were largely present across the remainder of the basin west of 150°E, including around the Maritime Continent and northern Australia.
- Coral bleaching status warning 'Alert Level 2' for parts of southeast PNG mainland while 'Alert Level 1' for other parts of southern and southeast PNG, and southern Solomon Islands. 'No stress' or 'watch' for the rest of COSPPac countries. Coral bleaching outlook remains 'Alert Level 2' shows 'Alert Level 2' for parts of southeast PNG mainland while 'Alert Level 1' for other parts of southern and southeast PNG, southern Solomon Islands and central Vanuatu.
- For January-March 2022, the dynamical models (including SCOPIC) agree on above normal rainfall for Palau, CNMI, FSM, RMI, western and southeastern PNG, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for northern PNG, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, American Samoa, northern and central Cook Islands, and the northern and central French Polynesia.
- The weekly tropical cyclone forecast from the ACCESS-S model shows significant increased risk in the weeks beginning 15 January and ending 28 January 2022 for the southwest Pacific, especially in areas around the Coral Sea region to New Caledonia and Vanuatu. There is no cyclone risk for the northwest Pacific region.



EL NIÑO–SOUTHERN OSCILLATION

La Niña likely to remain until early autumn

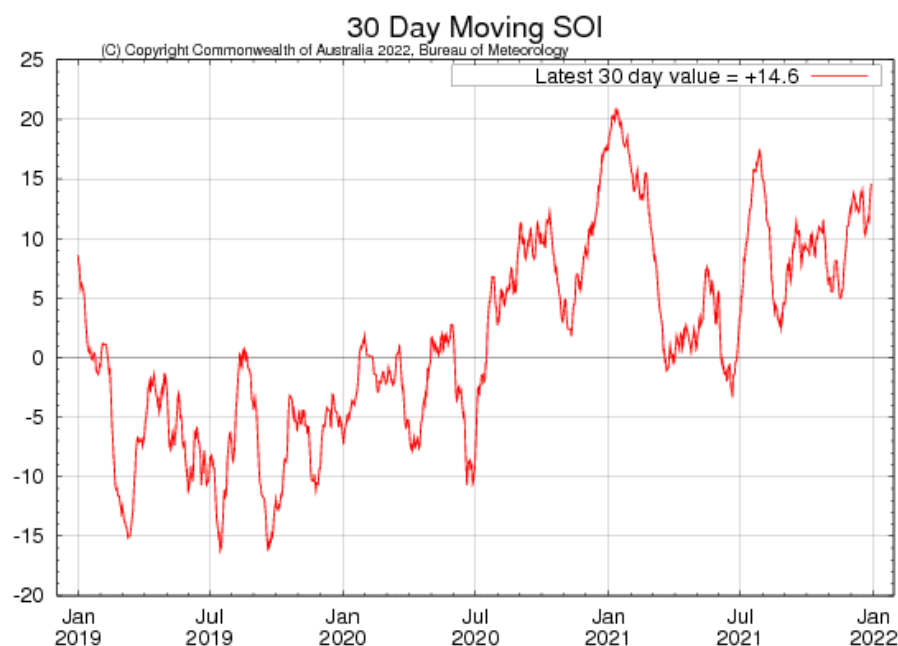
Click link to access [Climate Driver Update issued on 05 January 2022](#)

La Niña continues in the tropical Pacific. Climate models suggest the 2021-22 La Niña will persist until the early in the southern hemisphere autumn (March 2022). La Niña events increase the chance of above average rainfall across much of northern and eastern Australia and the western Pacific Islands countries during summer.

Sea surface temperatures in the central to eastern tropical Pacific are typical of a mature La Niña event. Cooler water is present beneath the surface, supporting the cooler waters at the surface. In the atmosphere, patterns are also broadly typical of La Niña, with decreased cloudiness near the Date Line, moderate to strong positive values of the Southern Oscillation Index (SOI), and generally increased trade winds. Both atmospheric and oceanic patterns are reinforcing each other in a positive feedback loop. This is known as "coupling" and allows La Niña patterns to be sustained for an extended period.

The Indian Ocean Dipole (IOD) remains neutral. The IOD typically has little influence on global climate from December to April.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 03 January was +12.7. The 90-day SOI value was +10.7. The 30-day SOI has remained relatively steady over the past month.



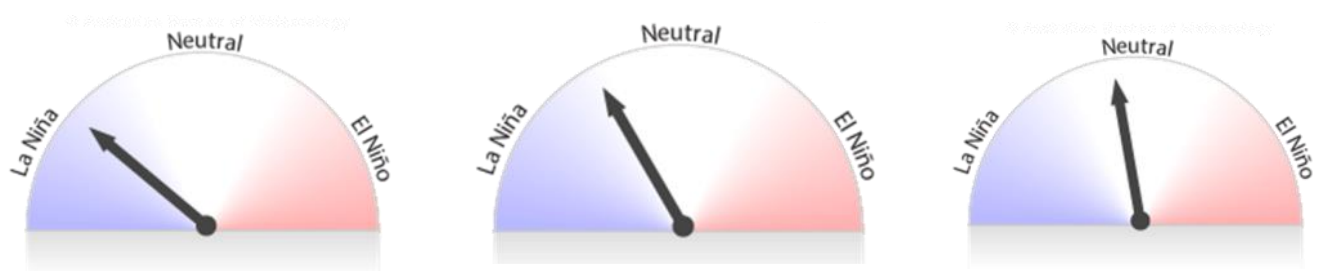


EL NIÑO–SOUTHERN OSCILLATION

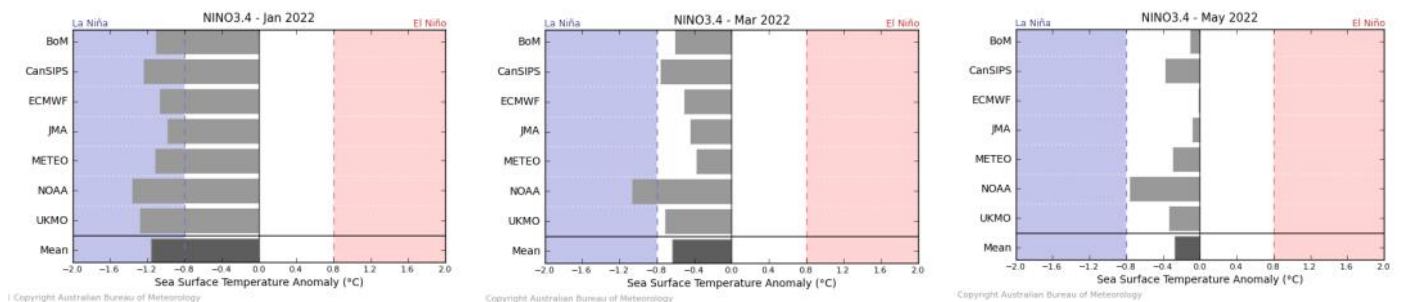
La Niña likely to remain until early autumn

Click link to access [Climate Driver Update issued on 05 January 2022](#)

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



Bureau of Meteorology NINO3.4 International Model Outlooks



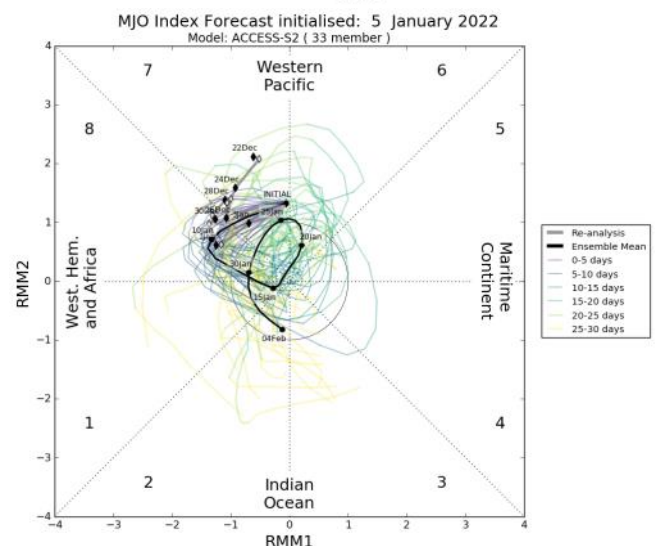
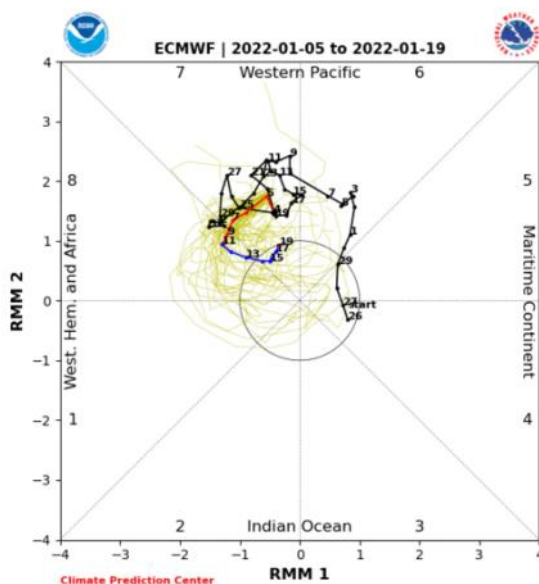
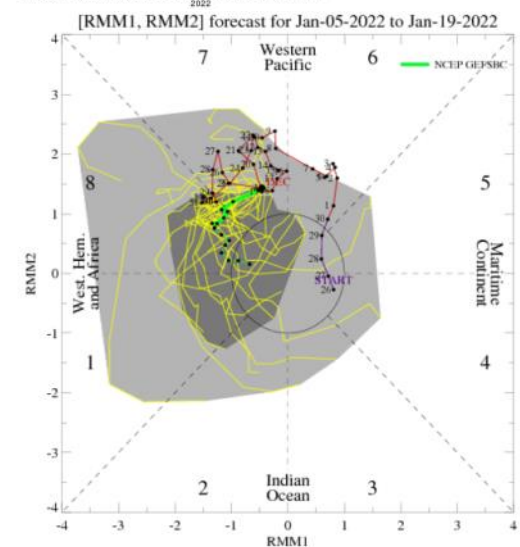
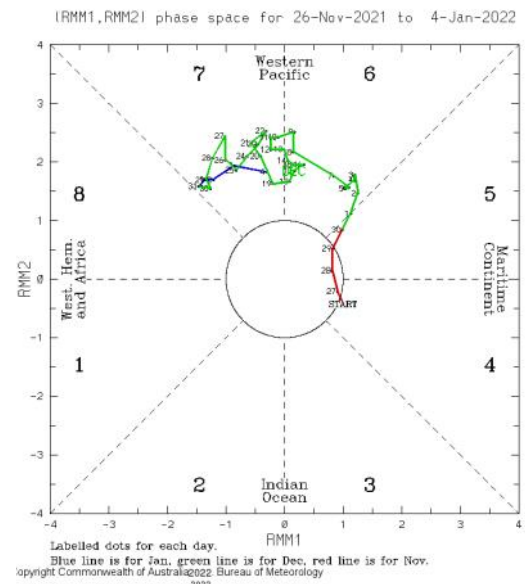
Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

MADDEN–JULIAN OSCILLATION

Click link to access [Tropical Climate Update](#) [Issued on Tuesday 14 December 2021]

During the month of December, a moderate to strong pulse of Madden-Julian Oscillation (MJO) tracked across the Maritime Continent. The Madden-Julian Oscillation (MJO) is currently in the Western Pacific at moderate to strong strength and is expected to remain in this region over the next week or two. This scenario may assist the development of monsoonal flow in the southern hemisphere. However, due to the firm mid-level ridge across northern Australia, it is unlikely the monsoon will develop over Australia this week.

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



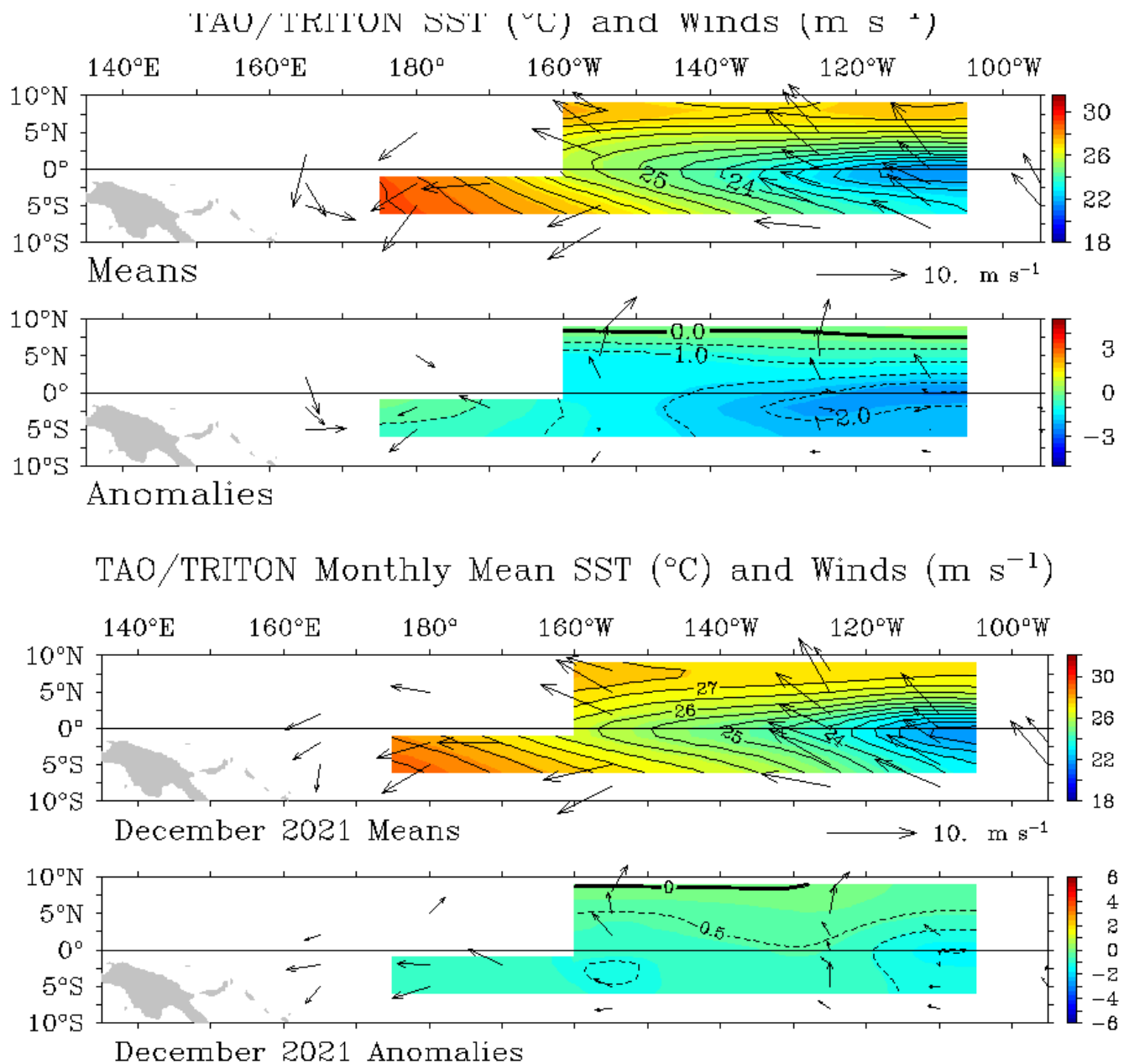
WIND



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

The trade winds in December were stronger over the west and close to average over the central and eastern equatorial Pacific for most of the month.

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

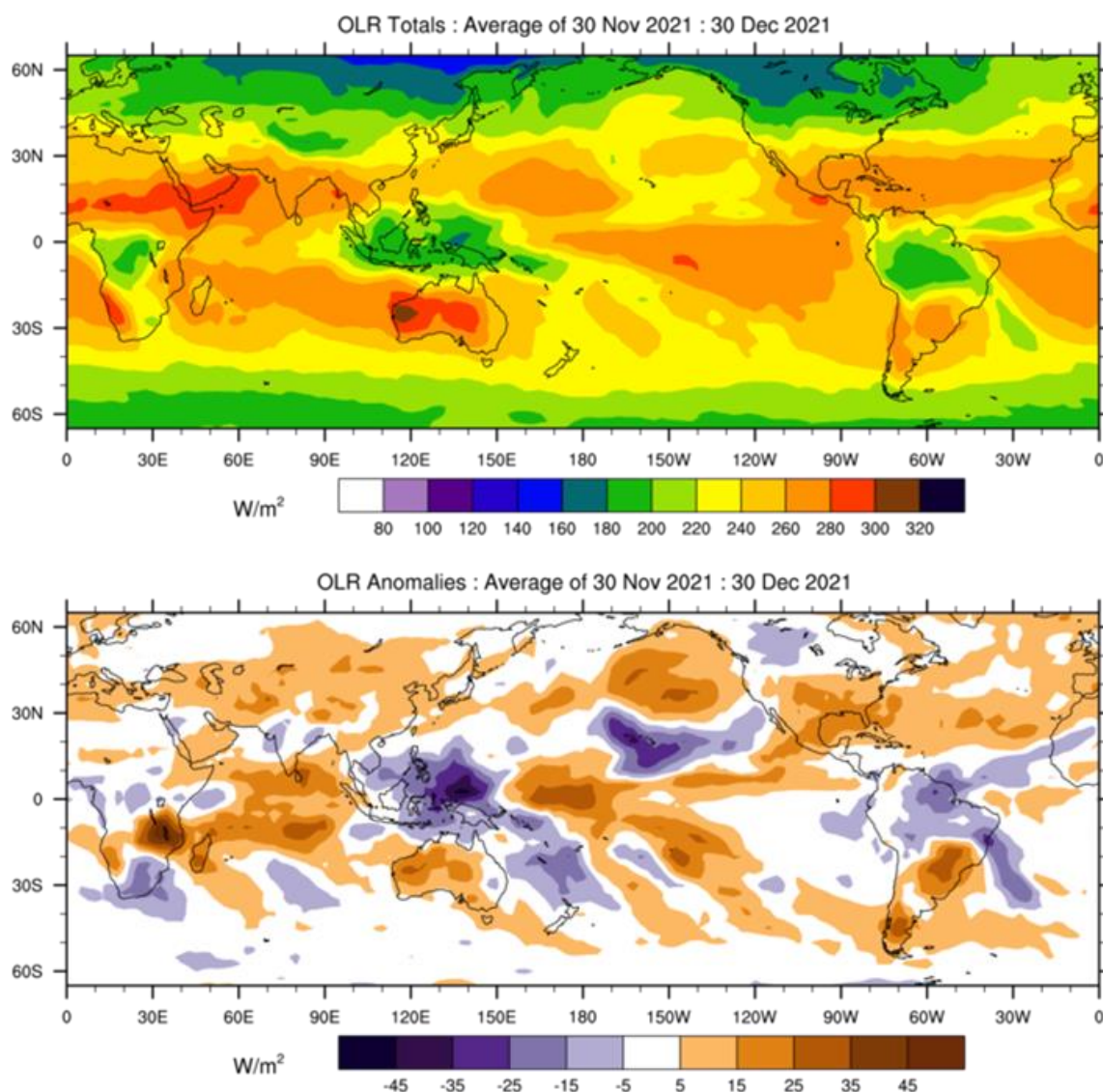
Click link to access [OLR](#)



The December 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was active over the western warm pool region and eastern Pacific with a shift to the north from its normal position, while the South Pacific Convergence Zone (SPCZ) was active and shifted southwest around New Caledonia, Vanuatu to New Zealand.

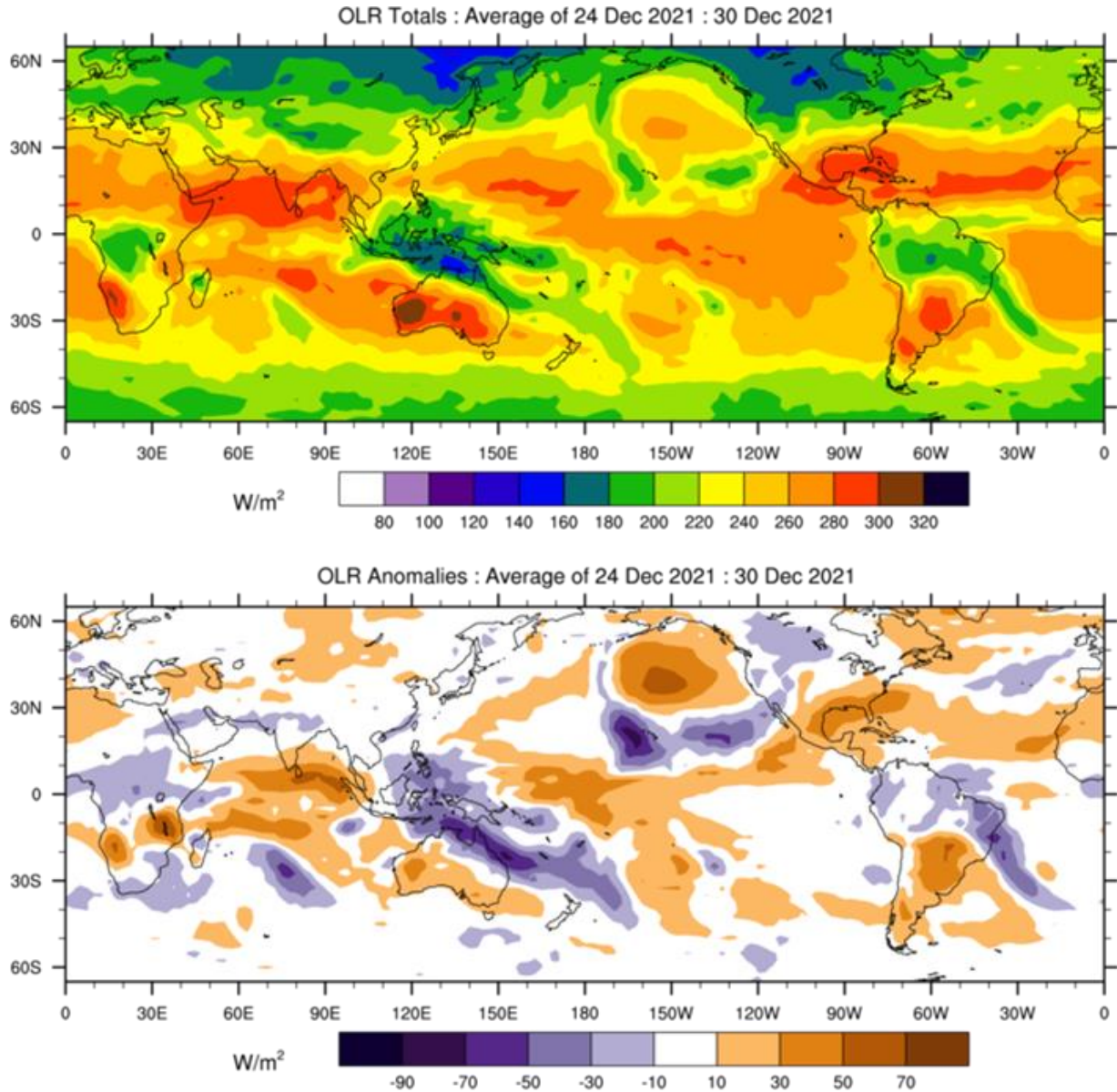
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

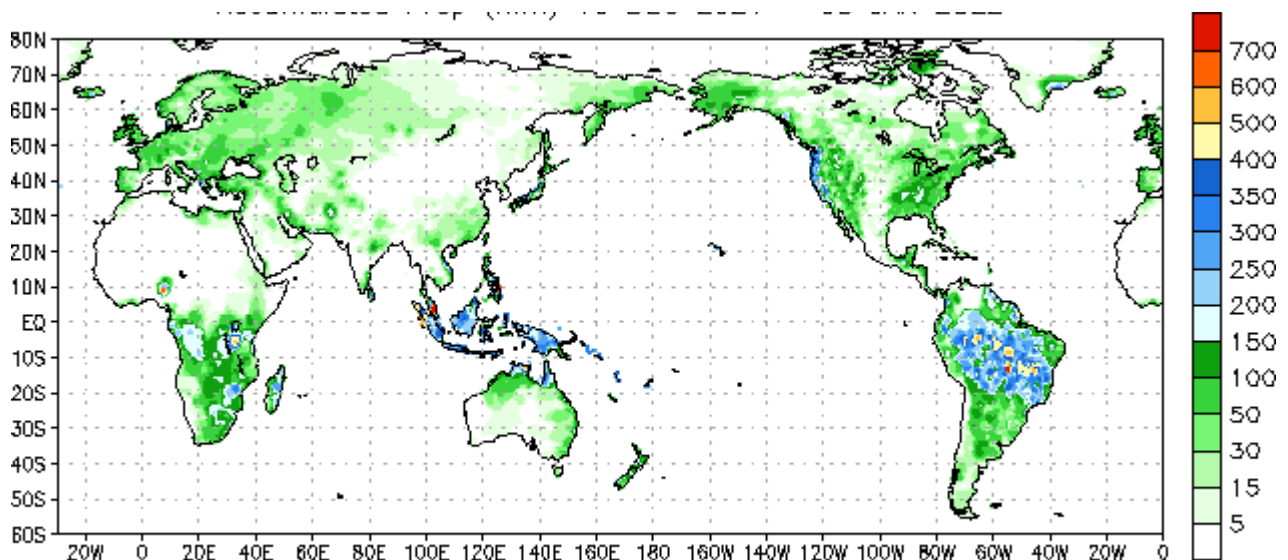


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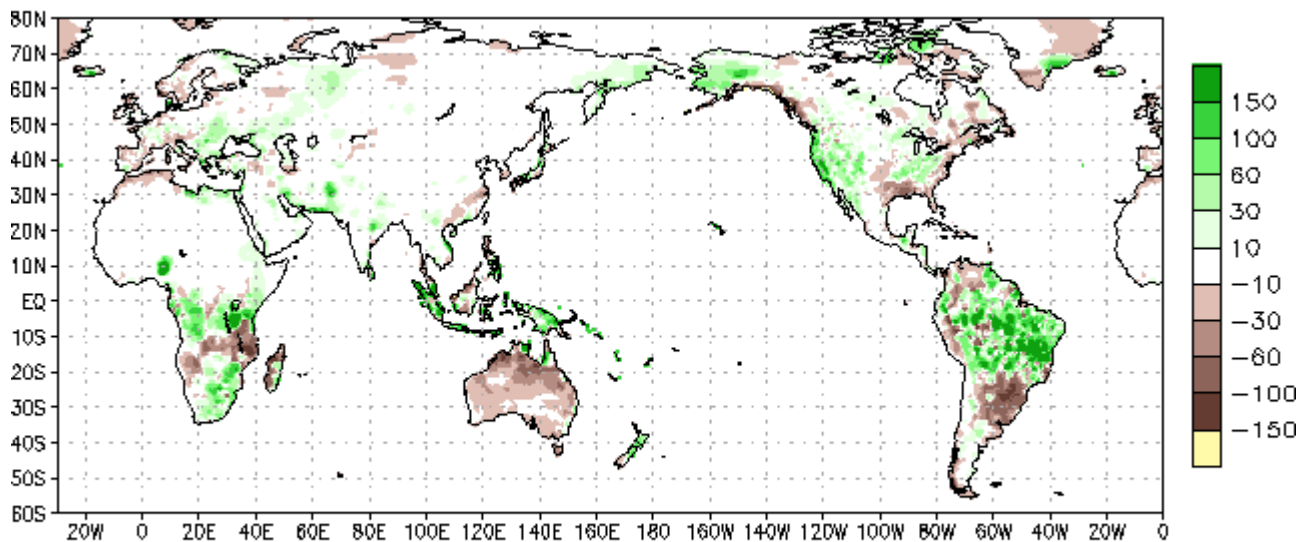
OLR Total and Anomalies, 7 Day OLR



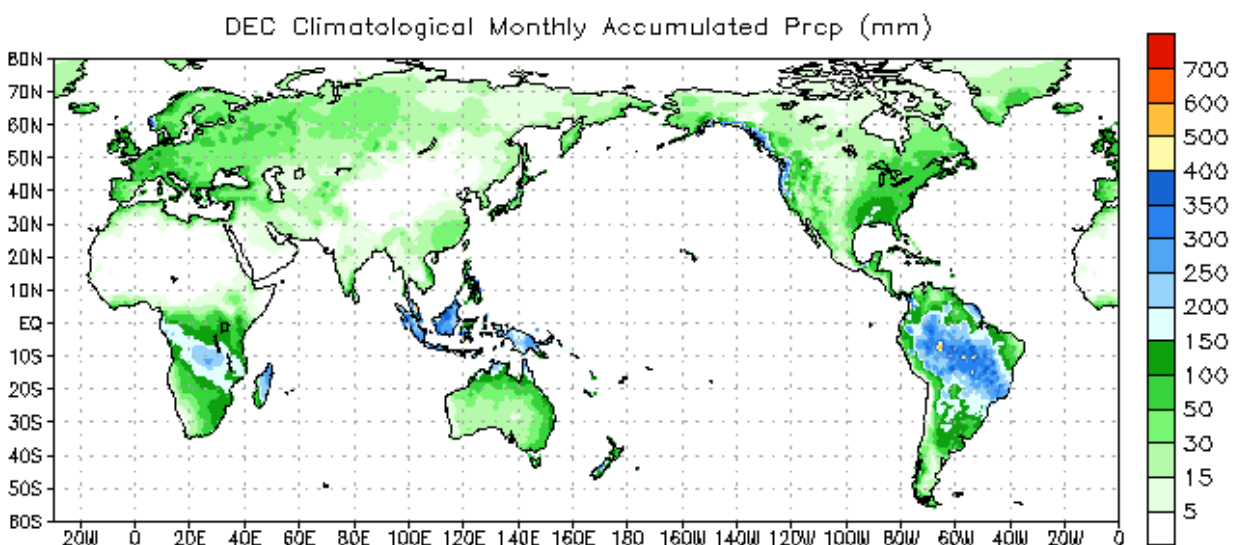
(C) Copyright Commonwealth of Australia 2021. Bureau of Meteorology



30-Day Rainfall Anomalies



Data Source: CPC Unified (gauge-based) Precipitation



Data Source: CPC Unified (gauge-based) Precipitation
Climatology (1979–1995)

NOAA Climate Prediction Centre - NCEP CMAP precipitation:

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

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE

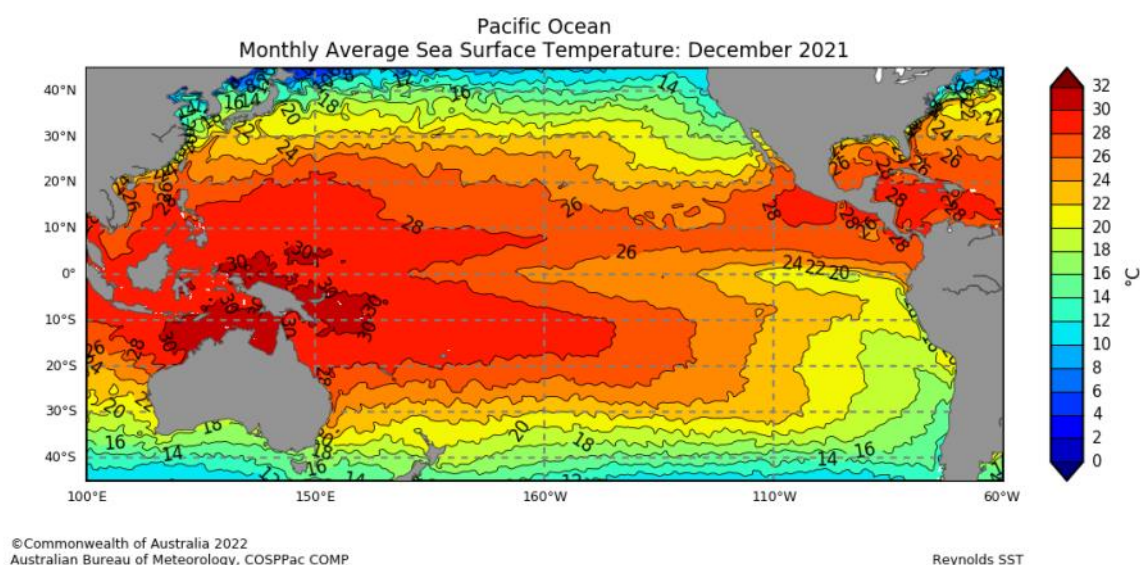


Click link to access [Pacific Community COSPPac Ocean Portal](#)

The SSTs for December 2021 show weak cool SST anomalies were present across most of the equatorial Pacific, while weak warm SST anomalies were largely present across the remainder of the basin west of 150°E, including around the Maritime Continent and northern Australia.

In terms of the deciles, highest on record occurred in northern Palau, central FSM, parts of eastern PNG, Coral Sea region, western and southern Solomon Islands, New Caledonia, central Vanuatu, southern Fiji, northern Tonga and New Zealand. Regions of very much above average (deciles 10) SSTs spanned across parts of Palau, FSM, western RMI, PNG, western and southern Solomon Islands, New Caledonia, Vanuatu, Fiji and Tonga. The regions of above average (deciles 8-9) for November occurred across majority of the COSPPac countries from Palau to southern Cook Islands. In contrast, below average (deciles 2-3) SSTs were observed in Nauru, northern Tuvalu, Kiribati with patches of very much below average (decile 1) over parts of eastern, central and western Kiribati.

Mean Sea Surface Temperature

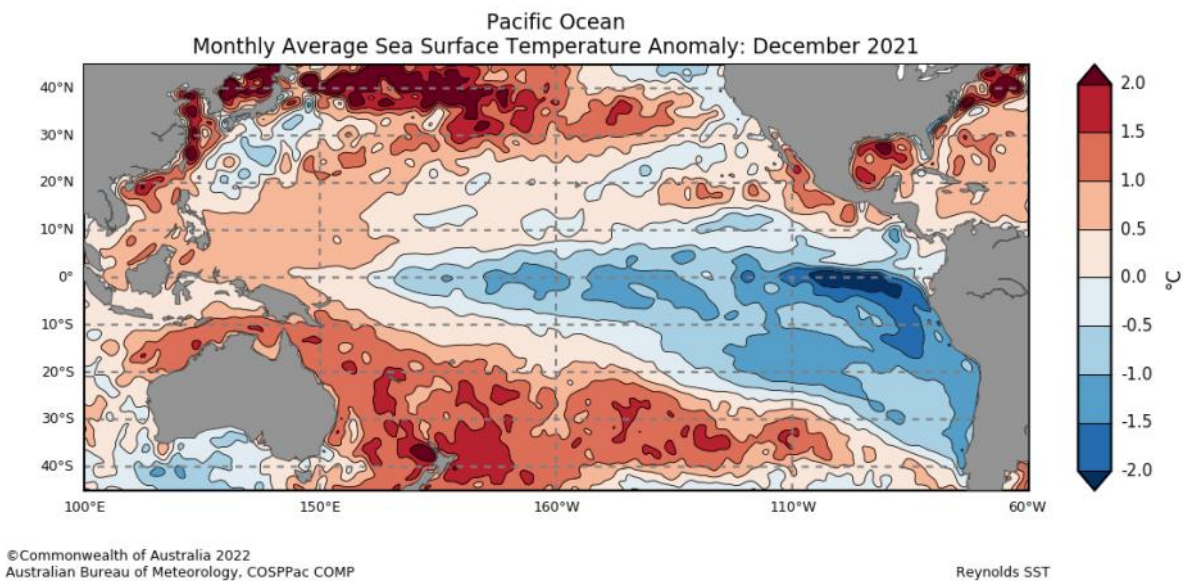


OCEAN CONDITIONS

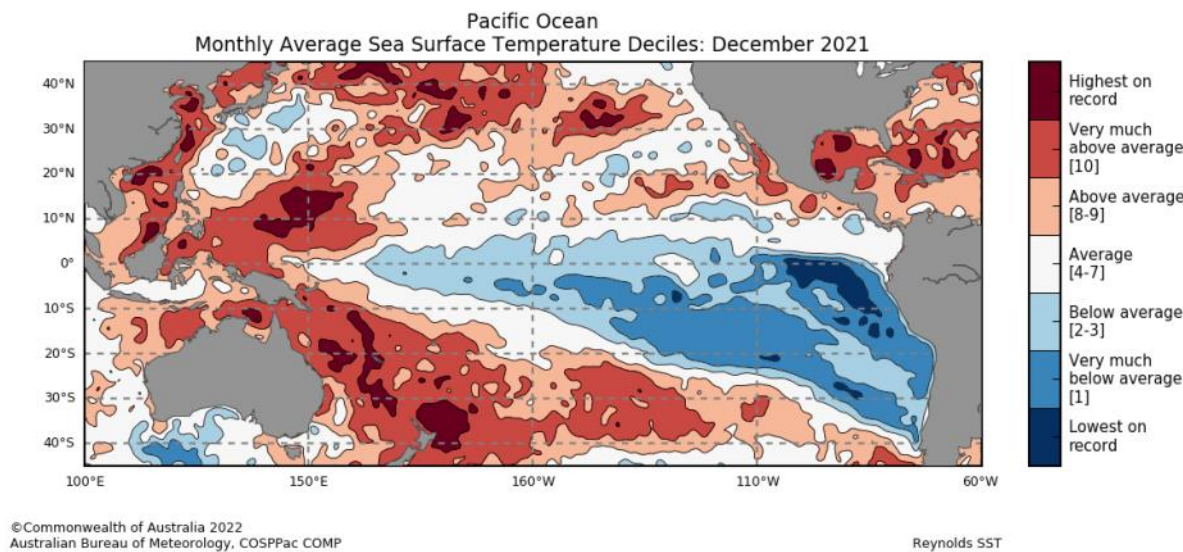
Click link to access [→ SEA SURFACE TEMPERATURE](#)



Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles



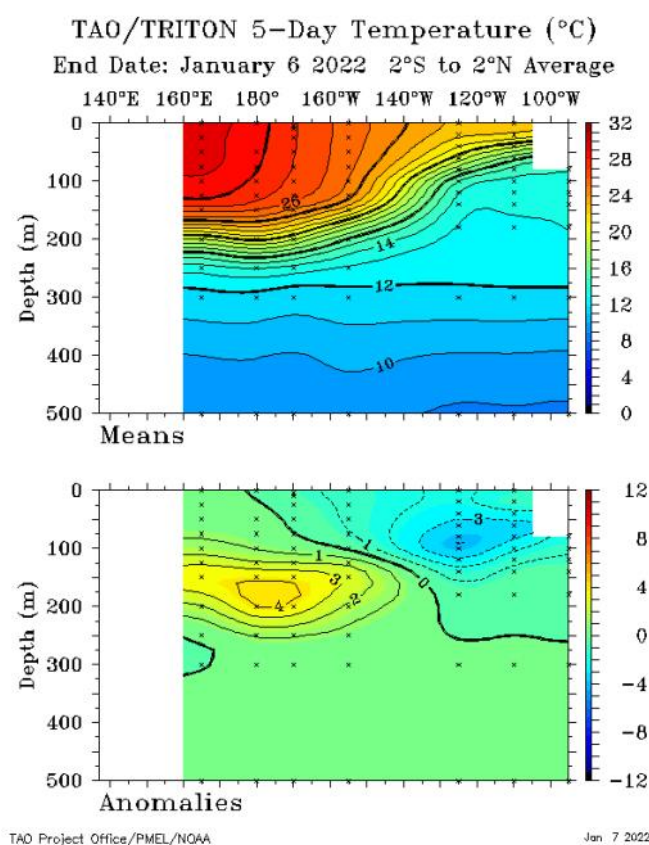
OCEAN CONDITIONS

SUB SURFACE

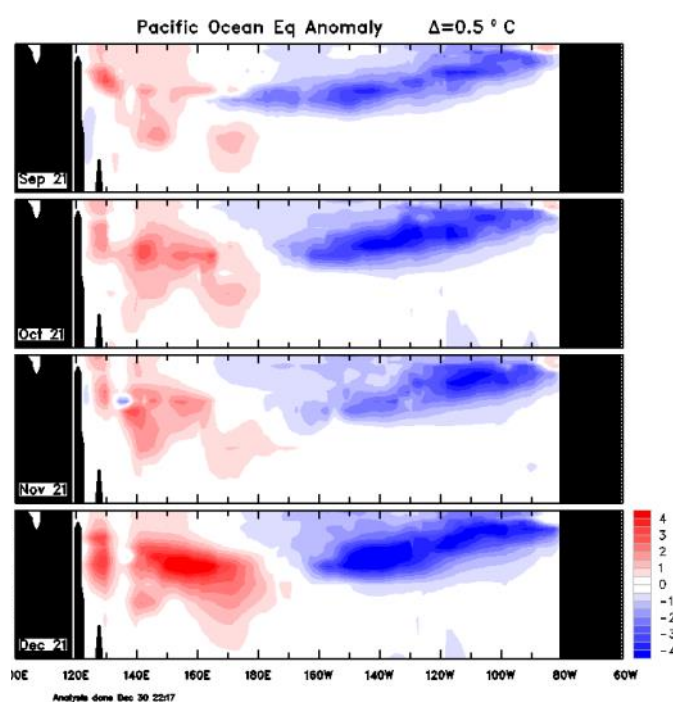


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to December 2021) shows cool anomalies across the sub-surface of the central to eastern equatorial Pacific, which have strengthened over the past four months. For December, waters were more than three degrees cooler than average across a large region east of 160°W, and more than four degrees cooler than average in some areas. Warm anomalies continue across parts of the column depth in the equatorial Pacific west of the Date Line. Weak warm anomalies continue across parts of the column depth in the far west of the equatorial Pacific.

Weekly Temperatures Mean and Anomalies



Monthly Temperatures Anomalies



Bureau of Meteorology Sea Temperature Analysis: <http://www.bom.gov.au/marine/sst.shtml>

TAO/TRITON Data Display: <http://www.pmel.noaa.gov/tao/jsdisplay/>

OCEAN CONDITIONS

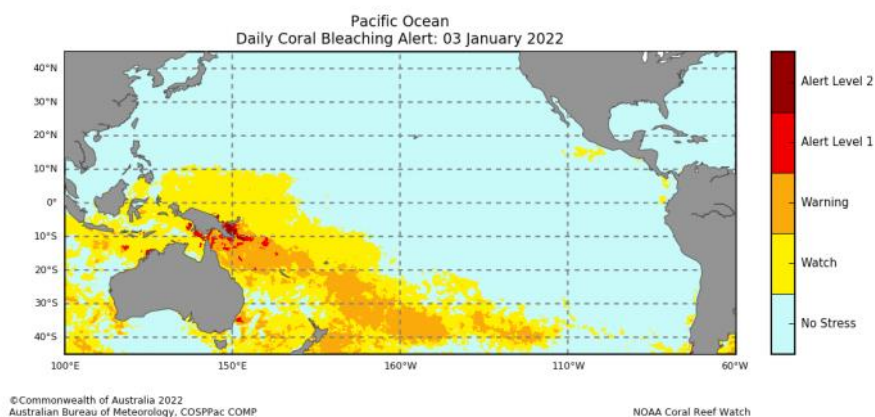
CORAL BLEACHING



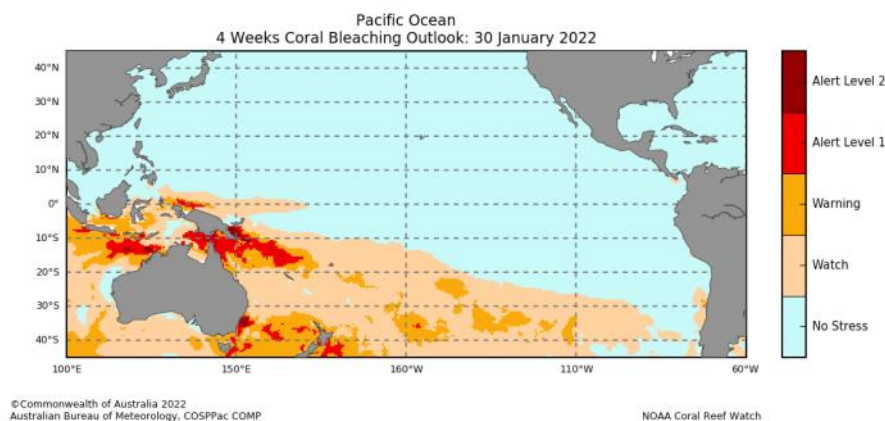
The daily Coral Bleaching Alert for 03rd January 2022 shows 'Alert Level 2' for parts of southeast PNG mainland while 'Alert Level 1' for other parts of southern and southeast PNG, and southern Solomon Islands. 'Warning' for southern PNG, southern Solomon Islands, Vanuatu, parts of northern New Caledonia, southern Fiji and southern Tonga. 'No Stress or Watch' for the rest of COSPPac partner countries. The four weeks Coral Bleaching Outlook to 30th January 2022 shows 'Alert Level 2' for parts of southeast PNG mainland while 'Alert Level 1' for other parts of southern and southeast PNG, southern Solomon Islands and central Vanuatu. 'Warning' for southern PNG, southern Solomon Islands, Vanuatu, southern Tonga and parts of central French Polynesia. 'No Stress or Watch' for the rest of COSPPac partner countries.

Daily Coral Bleaching Alert

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



4-Weeks Coral Bleaching Outlook

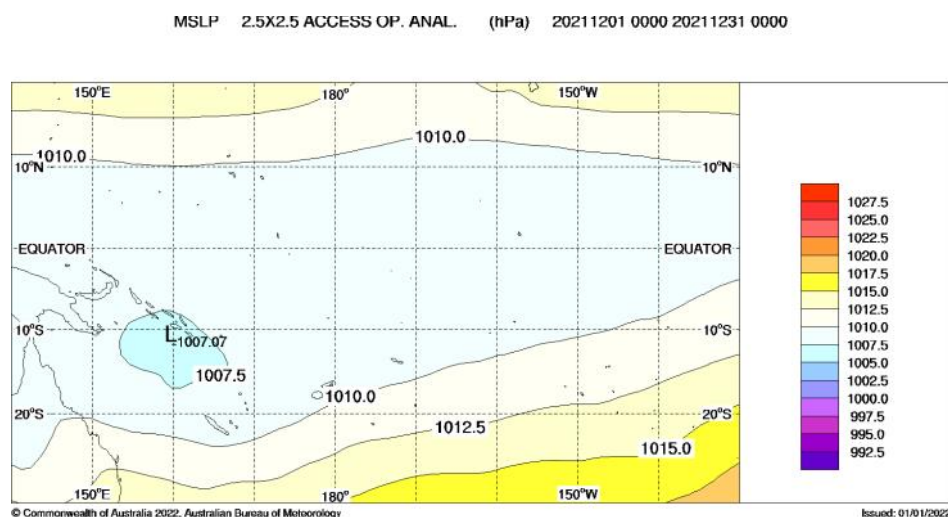


MEAN SEA LEVEL PRESSURE

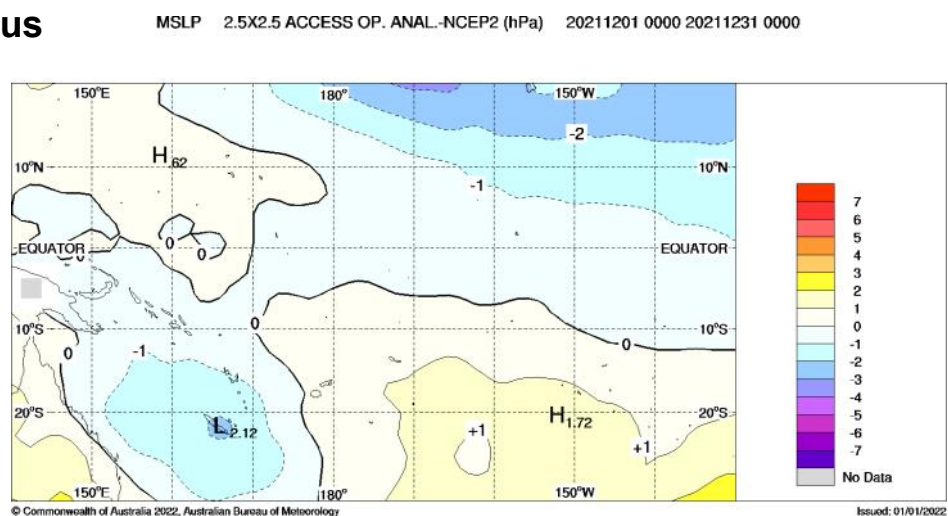
The December mean sea level pressure (MSLP) anomaly map shows negative anomalies of -1 or greater over the Coral Sea region, New Caledonia and Vanuatu and further north around 180°E and extending eastwards. Positive anomalies of +1 or more were present over the southern Cook Islands and French Polynesia.

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

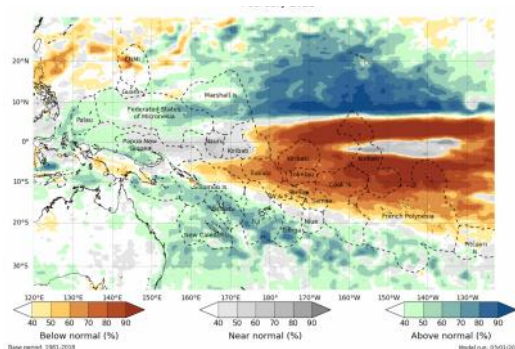
January—March 2022



The ACCESS-S model forecast for January 2022 is very likely to be below normal rainfall for CNMI, Western, Central and Highlands region of PNG, Western Solomon Islands, Kiribati, Wallis and Futuna, Tuvalu, Tokelau, American Samoa, Samoa, the northern Cook Islands, northern and central French Polynesia and Pitcairn Island. Above normal rainfall is very likely for Palau, FSM, RMI, northern PNG, southern Solomon Islands, Vanuatu, New Caledonia, Fiji, central and southern Tonga, and parts of southern Cook Islands and French Polynesia.

The three-month rainfall outlook (January-March 2022) shows a strong dry signal very likely to affect mainland PNG, northern Solomon Islands, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern and central Cook Islands, northern and central French Polynesia and Pitcairn Island. In contrast, the models show an increased chance of wetter very likely in central FSM, RMI, southeast PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and French Polynesia. Above normal maximum and minimum temperatures are very likely for most COSPPac countries, except for some areas east of 165°E, namely Nauru, Kiribati, northern Tuvalu, Tokelau, northeastern Cook Islands, and northern French Polynesia, where near-normal to below normal temperatures are favoured.

Monthly **ACCESS-S** Maps



The Copernicus multi-model outlook for January-March 2022 is very likely to be below normal rainfall for the north-eastern PNG Islands, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, American Samoa, Samoa, northern and central Cook Islands, French Polynesia, and Pitcairn Island. Above normal rainfall is very likely for Palau, FSM, Guam, CNMI, Marshall Islands, western and southeastern PNG, southern and eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands.

The SCOPIC statistical model forecast for January-March 2022 is very likely to be above normal rainfall for most of the COSPPac countries except for northern PNG, Kiribati, Tuvalu, and northern Cook Islands very likely to have below normal rainfall.

The APEC Climate Centre multi-model for January-March 2022 forecast is very likely to be below normal rainfall for northern PNG, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, American Samoa, northern Cook Islands, and central to northern French Polynesia. Above normal rainfall is very likely for Palau, most of FSM, CNMI, RMI, western and southeastern PNG, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia.

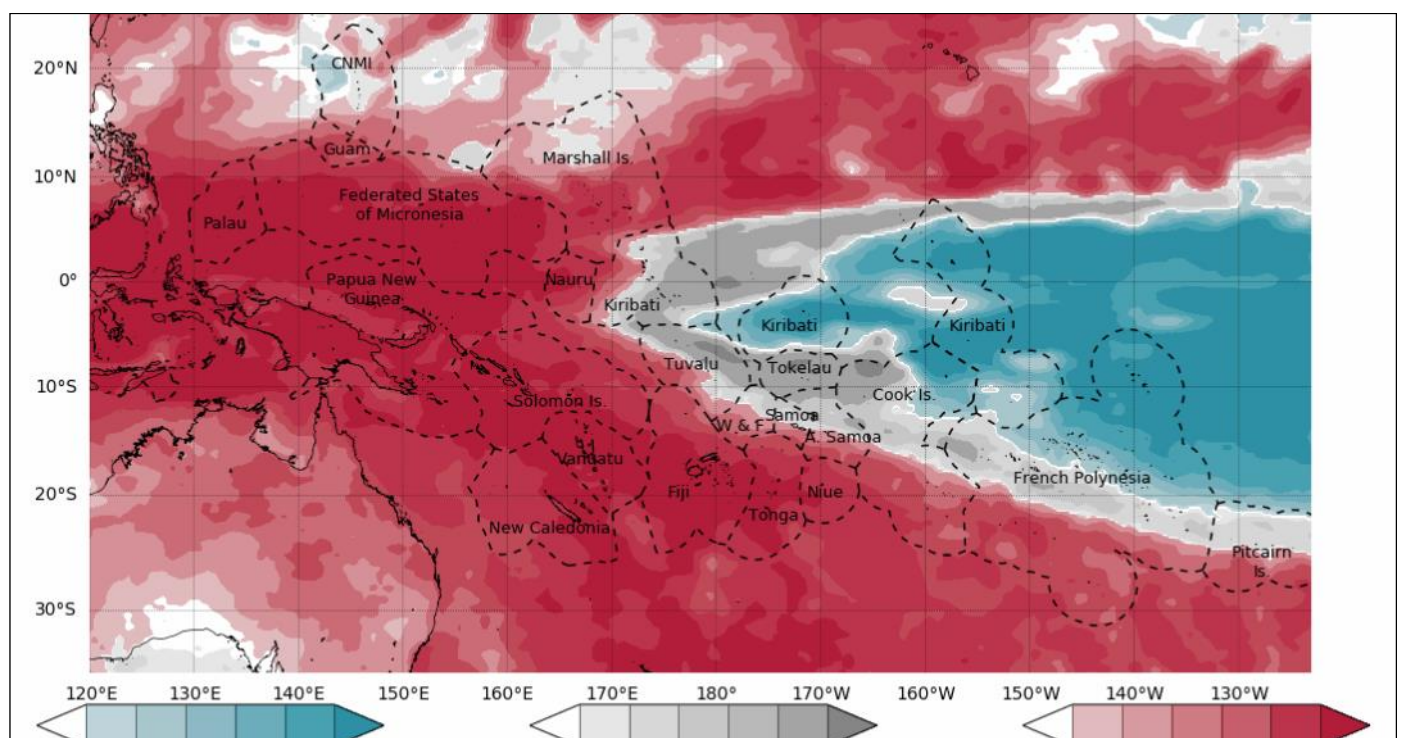
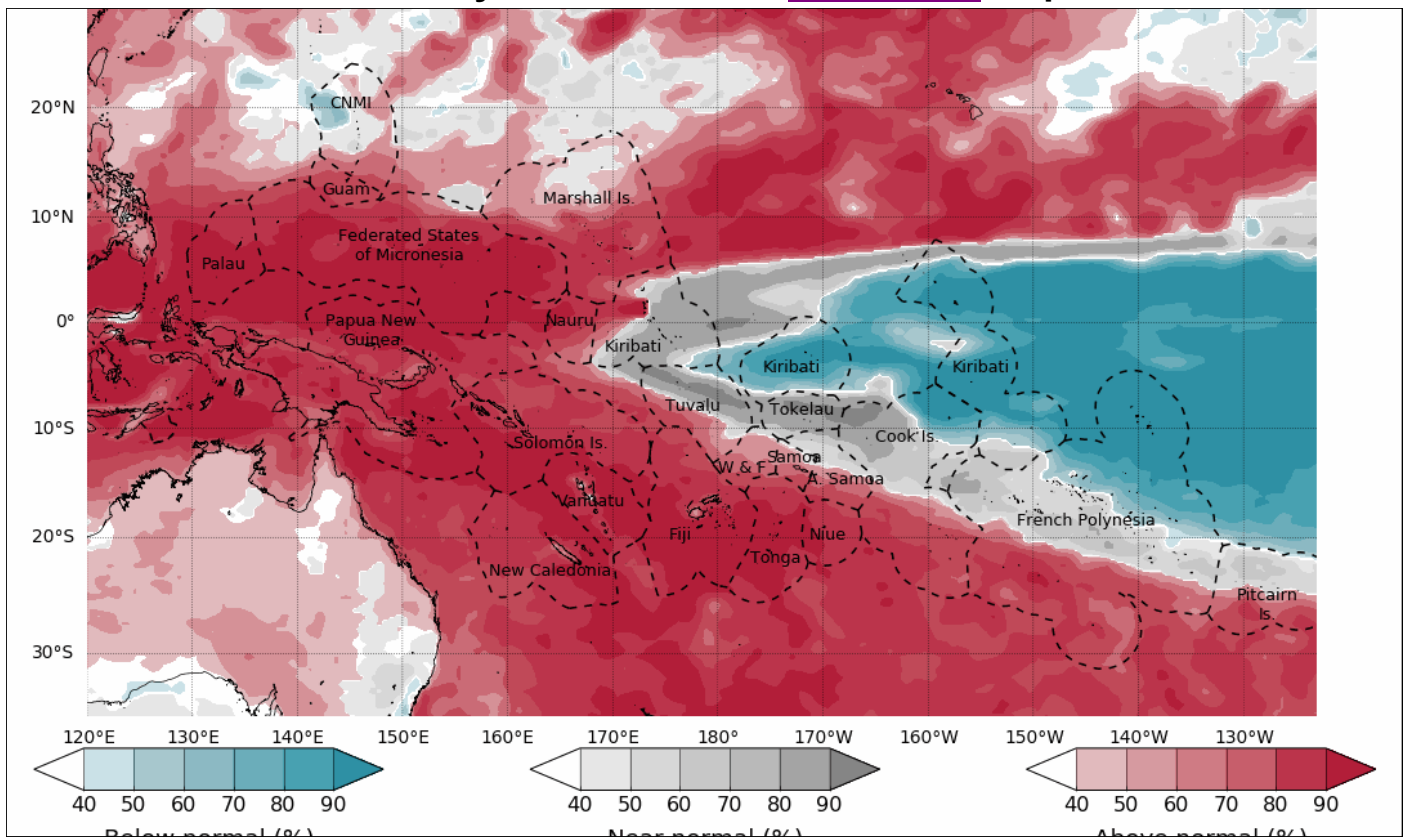
For January-March 2022, the dynamical models (including SCOPIC) agree on above normal rainfall for Palau, CNMI, FSM, RMI, western and southeastern PNG, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for northern PNG, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, American Samoa, northern and central Cook Islands, and the northern and central French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

January—March 2022



Monthly Tmax and Tmin [ACCESS-S](#) Maps



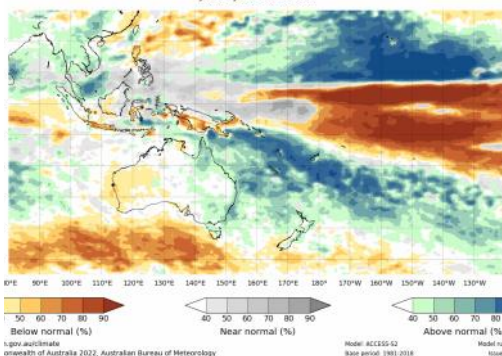
SEASONAL RAINFALL OUTLOOK

January—March 2022

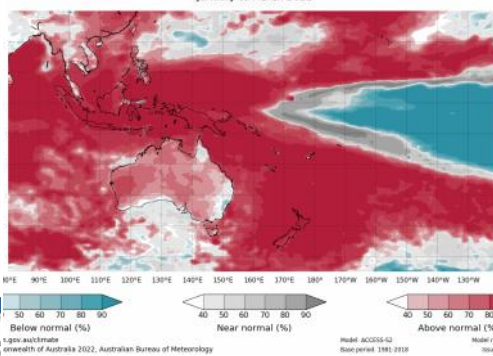


Seasonal ACCESS-S maps

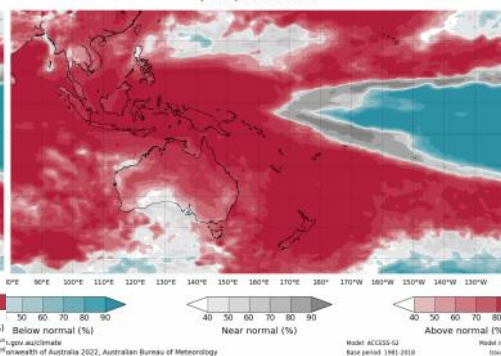
Tercile rainfall probabilities for January to March 2022



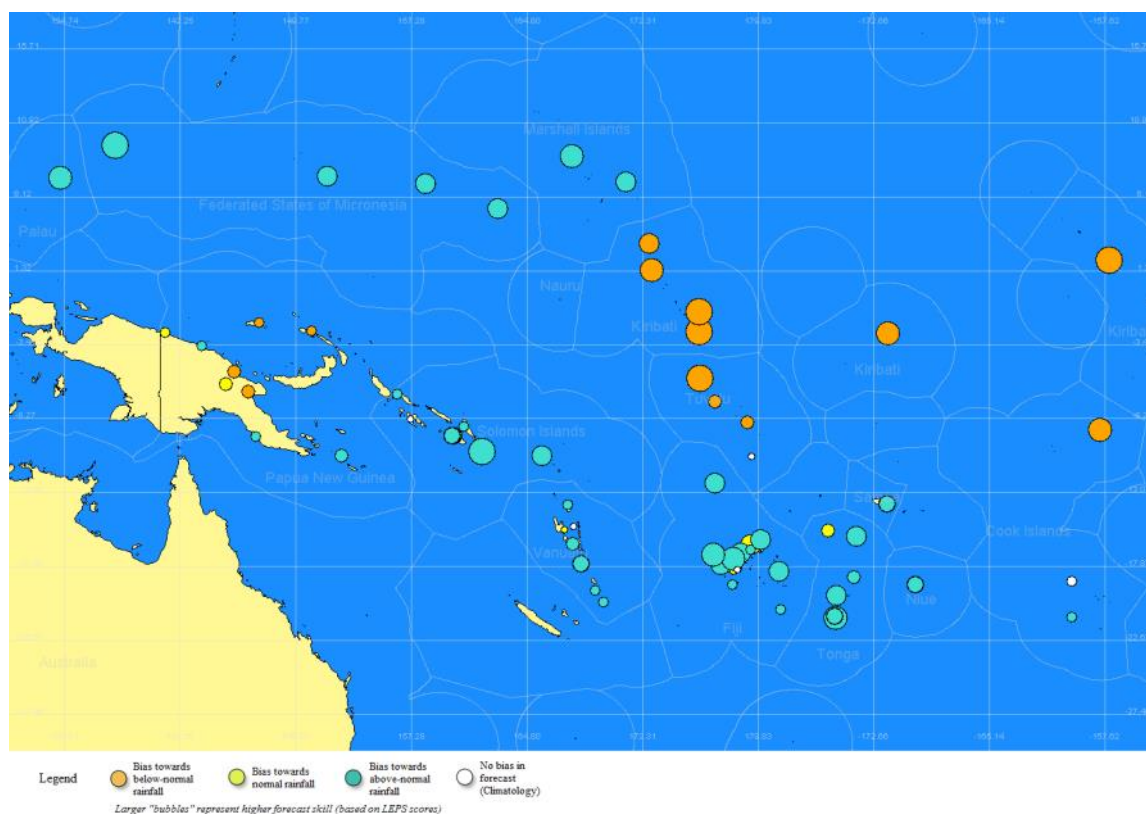
Tercile maximum temperature probabilities for January to March 2022



Tercile minimum temperature probabilities for January to March 2022



SCOPIC



'About SCOPIC' www.pacificmet.net/project/climate-and-ocean-support-program-pacific-cosppac

SEASONAL RAINFALL OUTLOOK

January—March 2022



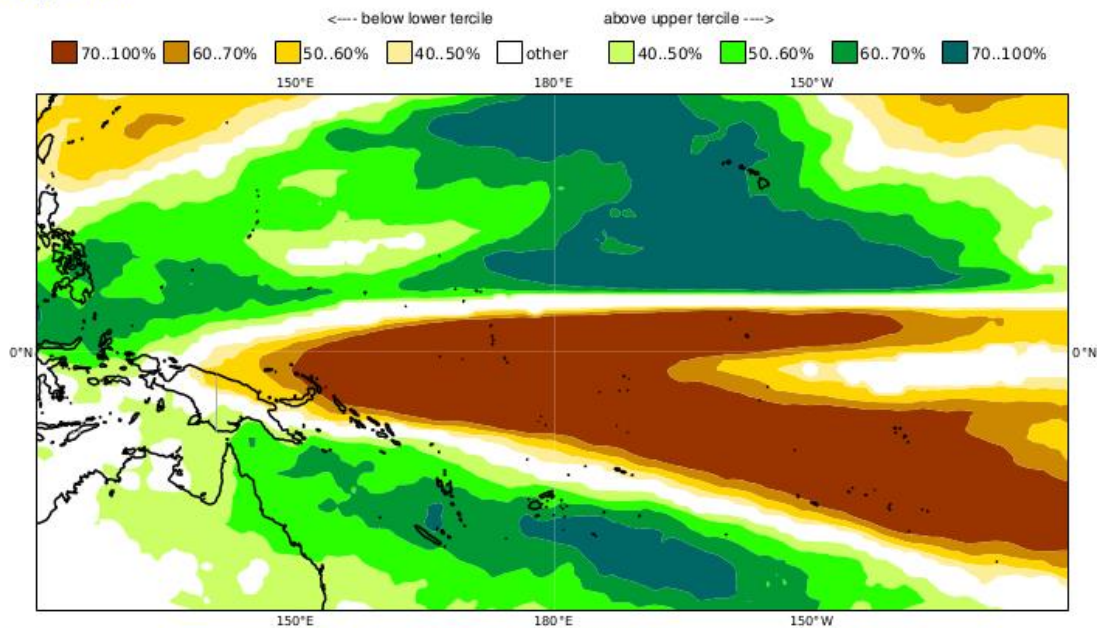
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

Nominal forecast start: 01/12/21

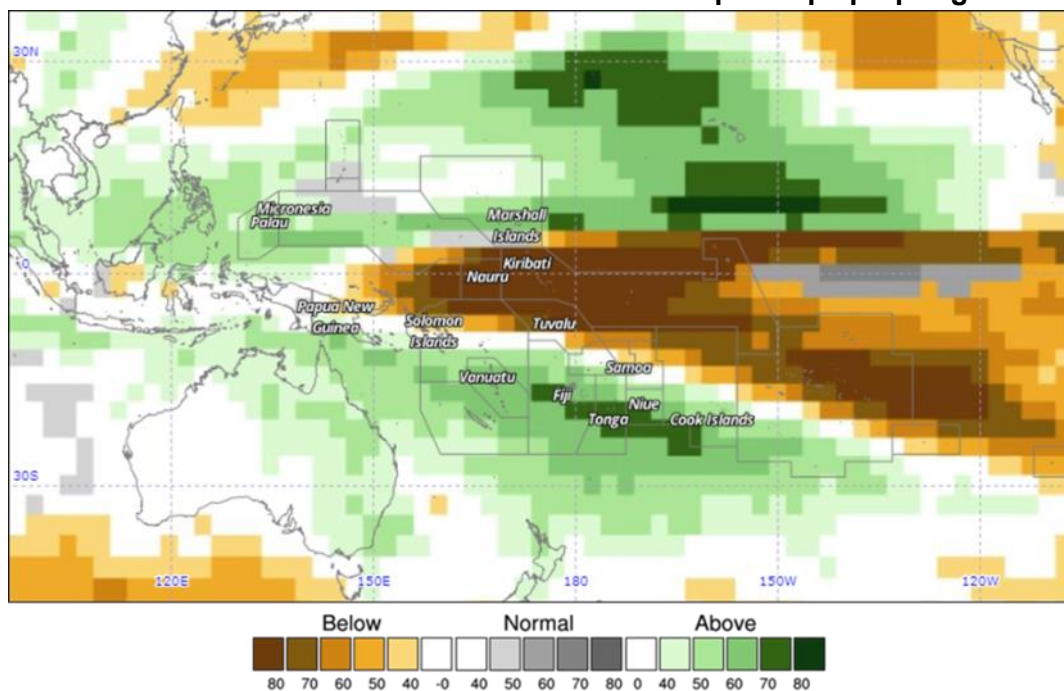
Unweighted mean

J-F-M 2022



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

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



Year: 2022, Season: JFM, Lead Month: 3, Method: GAUS

Model: APCC, CMCC, CWB, NASA, NCEP, PNU, POAMA

Generated using CLIK® (2022-1-8)

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TROPICAL CYCLONE

2021/2022 Season



The cyclone activities in the western north Pacific occurs year around with near normal to below normal numbers of TCs anticipated. So far in 2021, there have been 24 typhoons in the western North Pacific. There were 4 tropical depressions, 13 tropical storms, 4 typhoons and 3 super typhoons affection Palau, FSM, RMI, Guam, Saipan and CNMI. In the southwest Pacific, the tropical cyclone season 2021-22 started on the 01 November, 2021. The outlook for the season is enhanced risk for tropical cyclone activity in the western part of the basin over November to April. In the central part of the region, cyclone risks are generally near normal, with reduced chances farther east.

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 significant increased risk in the weeks beginning 15 January and ending 28 January 2022 for the southwest Pacific, especially in areas around the Coral Sea region to New Caledonia and Vanuatu. There is no cyclone risk for the northwest Pacific region.

Individual Model Links

UKMO Global long-range model probability maps: <http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/glob-seas-prob>

ECMWF Rain (Public charts) - Long range forecast: <http://www.ecmwf.int/en/forecasts/charts/seasonal/rain-public-charts-long-range-forecast>

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

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

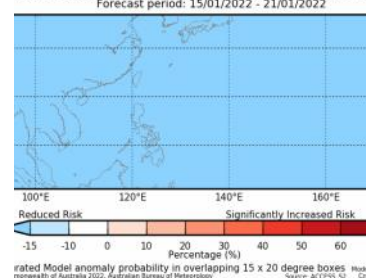
NASA GMAO GEOS-5: <http://gmao.gsfc.nasa.gov/research/ocean/>

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

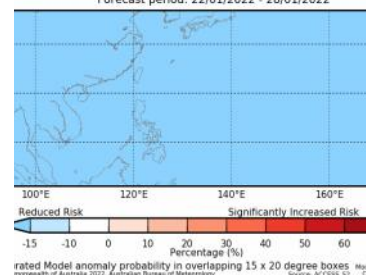
IRI for Climate and Society: <http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/>

ACCESS-S Weekly Forecasts –Northwest Pacific

Difference from normal chance of Tropical Cyclone's in the Northern
Forecast period: 15/01/2022 - 21/01/2022

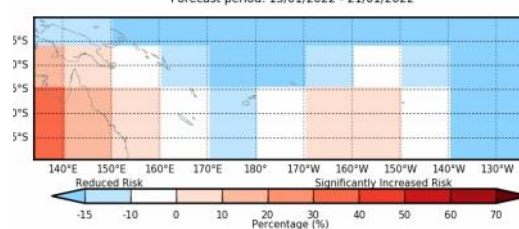


Difference from normal chance of Tropical Cyclone's in the Northern
Forecast period: 22/01/2022 - 28/01/2022



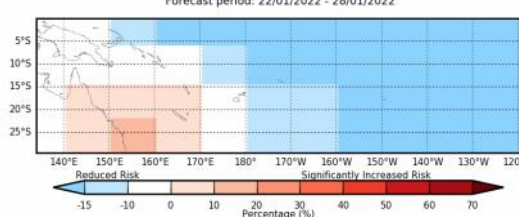
ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the South Pacific
Forecast period: 15/01/2022 - 21/01/2022



Calibrated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2022, Australian Bureau of Meteorology Source: ACCESS_S2 Model run: 07/01/2022 Created: 09/01/2022

Difference from normal chance of Tropical Cyclone's in the South Pacific
Forecast period: 22/01/2022 - 28/01/2022



Calibrated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2022, Australian Bureau of Meteorology Source: ACCESS_S2 Model run: 07/01/2022 Created: 09/01/2022

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.

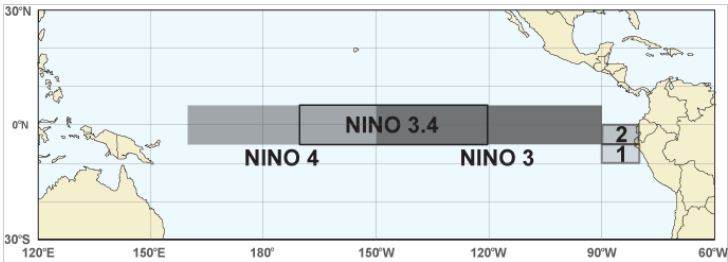
20 degrees Celsius Isotherm Depth

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