



Australian Government
Bureau of Meteorology



**Climate and Oceans Support
Program in the Pacific**

Monthly Climate Bulletin

February 2015



Summary

Issued on 4 February 2015

Issue Contents:

Summary	2
El Niño–Southern Oscillation	3
Madden–Julian Oscillation and	4-5
Cloud and Rainfall	6-8
Oceanic Conditions	9-10
Mean Sea Level Pressure	11
Model Outlooks	12-14
Cyclones and Other Information	15-16

- The Bureau's ENSO Tracker has been upgraded to El Niño WATCH. This is due to a combination of warmer-than-average temperatures in the tropical Pacific Ocean and models showing that further warming is likely in coming months. All international models surveyed by the Bureau indicate that central tropical Pacific sea surface temperatures (SSTs) are likely to remain warmer than average, but within the neutral range, until at least May. By mid-year, six of the eight models indicate SSTs will exceed El Niño thresholds. El Niño WATCH indicates about a 50% chance of El Niño forming in 2015.
- The latest approximate 30-day Southern-Oscillation Index (SOI) value to 4 March was +1.4.
- Sea surface temperatures (SSTs) were warmer than average over large areas of the Pacific in February. At the same time, sub-surface warm anomalies increased in the western and central equatorial Pacific and cool anomalies decreased in the eastern equatorial Pacific.
- The Madden-Julian Oscillation (MJO) has been weak recently, providing little guidance on tropical weather variability. It is possible that the MJO will remain weak. However, some models indicate a pulse of MJO activity may develop in the western tropical Indian Ocean in the coming days, move slowly eastwards and influence the Indonesian-PNG region later this week or early next week.
- The South Pacific Convergence Zone (SPCZ) was displaced southwest of its average February position and was largely suppressed with the exceptions of an area between Vanuatu and Niue, and over Samoa. The Intertropical Convergence Zone (ITCZ) was displaced northward in the northwest tropical Pacific, suppressed near the Date Line and marginally enhanced as a thin band east of the Date Line.
- The POAMA outlook for April to June 2015 favours below normal rainfall over the western Federated States of Micronesia, most of Papua New Guinea, the Solomon Islands, central and southern Tonga and the southern Cook Islands. Above normal rainfall is favoured over most of Samoa, northern Tonga, northern Tuvalu, southern Gilbert Islands, Phoenix Islands and northern Line Islands in Kiribati.

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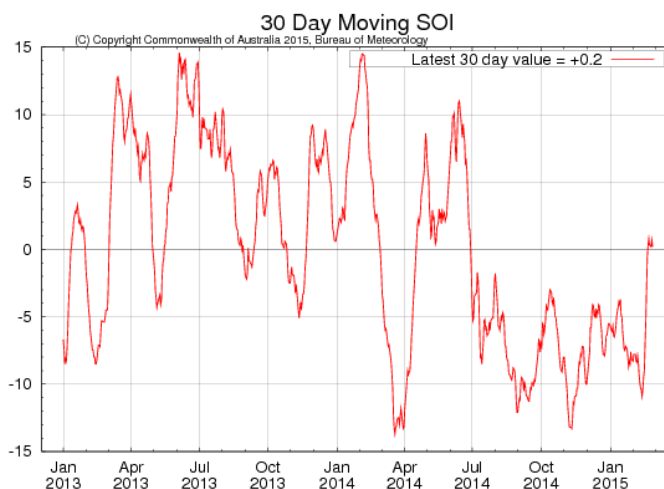
El Niño–Southern Oscillation

Renewed warming in the tropical Pacific Ocean

Bureau ENSO Wrap-Up issued on Tuesday 3 March 2015

The Bureau's ENSO Tracker has been upgraded to El Niño WATCH. This is due to a combination of warmer-than-average temperatures in the tropical Pacific Ocean and models showing that further warming is likely in coming months. El Niño WATCH indicates about a 50% chance of El Niño forming in 2015.

The central to western regions of the tropical Pacific Ocean have warmed by 0.2 °C to 0.3 °C over the past fortnight, while monthly sub-surface temperatures were more than 2 °C above average over a large area for February. This is largely the result of weakened trade winds and tropical surface currents in recent weeks. Weakened trade winds are forecast to continue, and this may induce further warming.

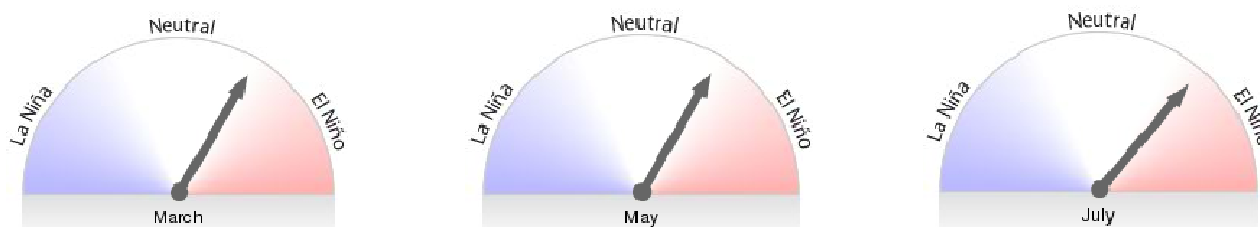


All international models surveyed by the Bureau indicate that central tropical Pacific sea surface temperatures (SSTs) are likely to remain warmer than average, but within the neutral range, until at least May. By mid-year, six of the eight models indicate SSTs will exceed El Niño thresholds. However, accuracy of forecasts made at this time are lower than those at other times of the year, and hence some caution should be exercised.

Link to the Bureau of Meteorology ENSO Tracker: <http://www.bom.gov.au/climate/enso/tracker/>

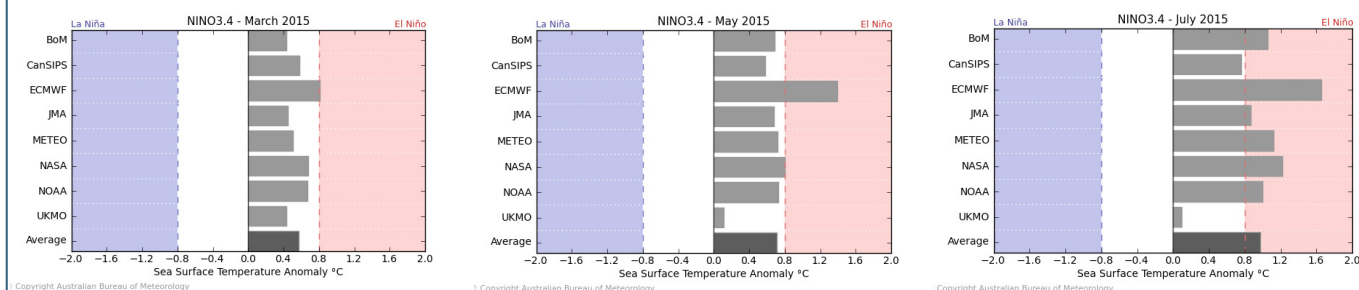
Link to the Bureau of Meteorology ENSO Wrap-Up for further information: <http://www.bom.gov.au/climate/enso/>

Bureau of Meteorology ENSO Model Outlooks for NINO3.4



Bureau of Meteorology Average of international model outlooks for NINO3.4 Link: <http://www.bom.gov.au/climate/ahead/model-summary.shtml#tabs=Overview>

Bureau of Meteorology NINO3.4 International Model Outlooks



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



Madden-Julian Oscillation and Wind

Bureau of Meteorology Weekly Tropical Note Issued on Wednesday 3 March 2015

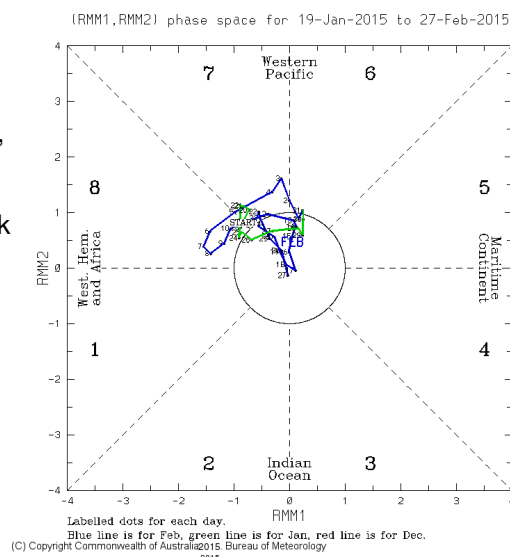
The Madden-Julian Oscillation (MJO) has been weak and indiscernible for almost three weeks, meaning that it has provided little guidance on recent tropical weather variability. It is most likely that the MJO will remain indiscernible. However, some models indicate a very weak pulse of MJO activity may develop in the western tropical Indian Ocean in the coming days, move slowly eastwards and influence the Maritime Continent later this week or early next week. If the MJO strengthens over the Maritime Continent, the north Australian monsoon trough is likely to become more active, although it is uncertain whether the monsoon trough will move over the continent or remain offshore to the north of the continent. The risk of tropical cyclone activity over Australia's northern waters will increase next week if the monsoon trough becomes more active.

Wind Summary

The equatorial trade winds were weaker than average over the western half of the Pacific for the 7 days ending 2 March. In the far western tropical Pacific, the westerly anomalies that are evident are also present on the 30-day anomaly map. Trade winds over the eastern half of the tropical Pacific on the other hand, are near-average in both the 7- and 30-day maps.

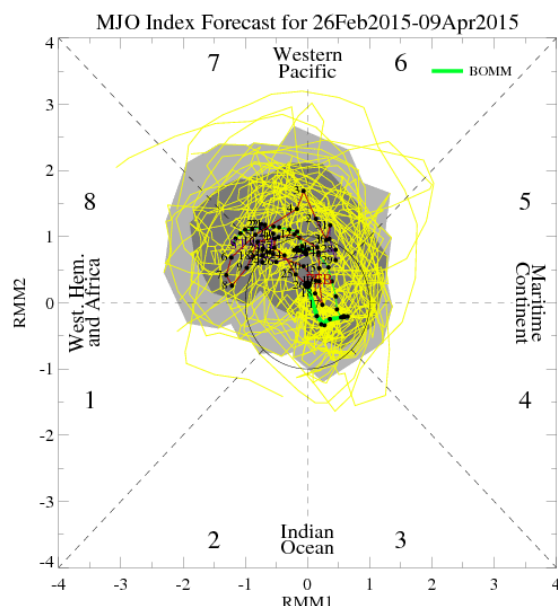
During La Niña, there is a sustained strengthening of the trade winds across much of the tropical Pacific, while during El Niño there is a sustained weakening of the trade winds.

40-Day MJO Phase Plot:

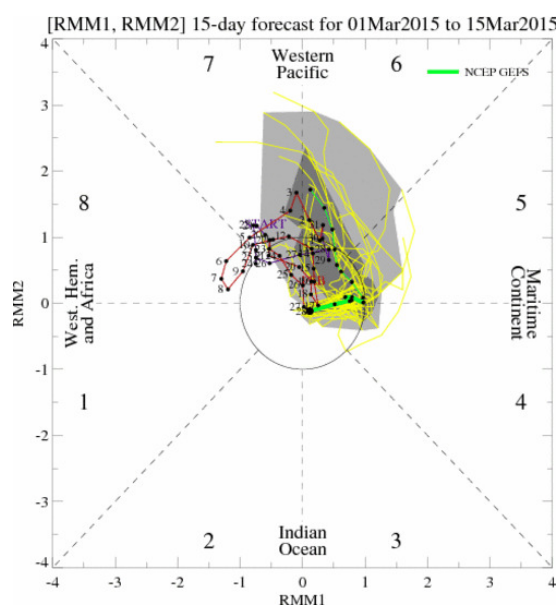


Link to the Bureau of Meteorology: Madden-Julian Oscillation for further information : <http://www.bom.gov.au/climate/mjo/>

MJO Phase Forecasts



Bureau of Meteorology MJO Forecast Link: <http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/bomm.shtml>



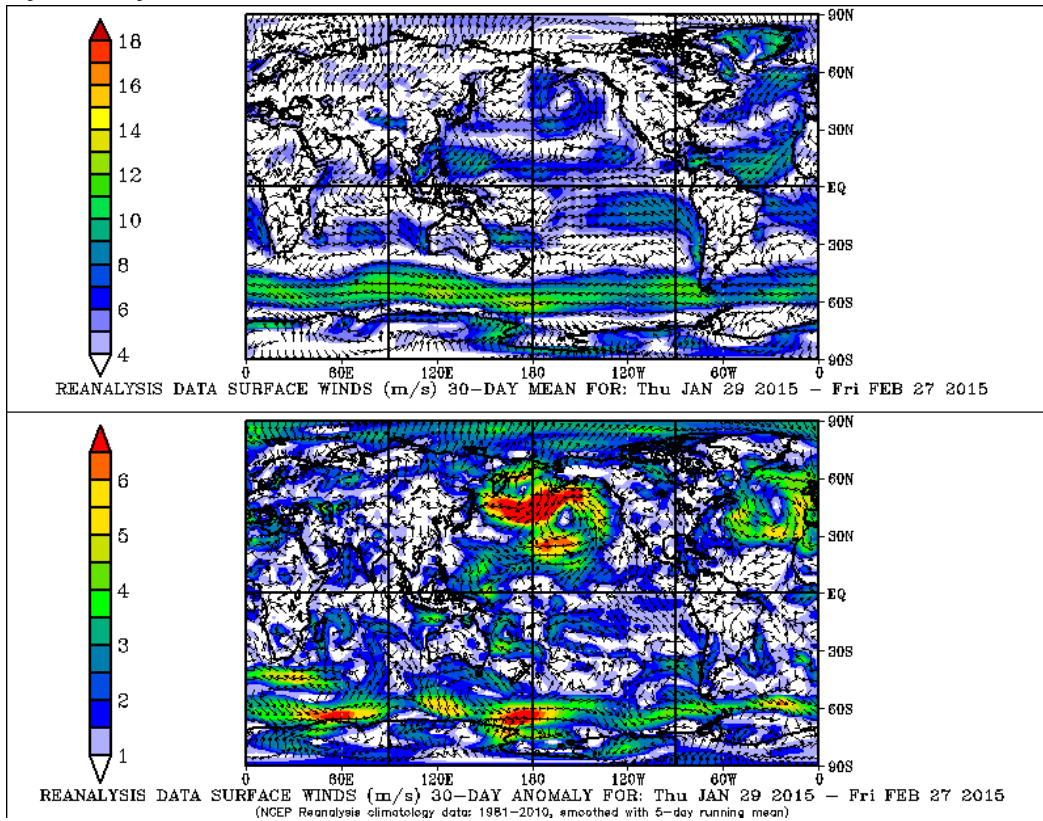
NOAA: MJO Model Forecasts Link: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar_wh.shtml

NOAA: MJO Page Link: <http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml>

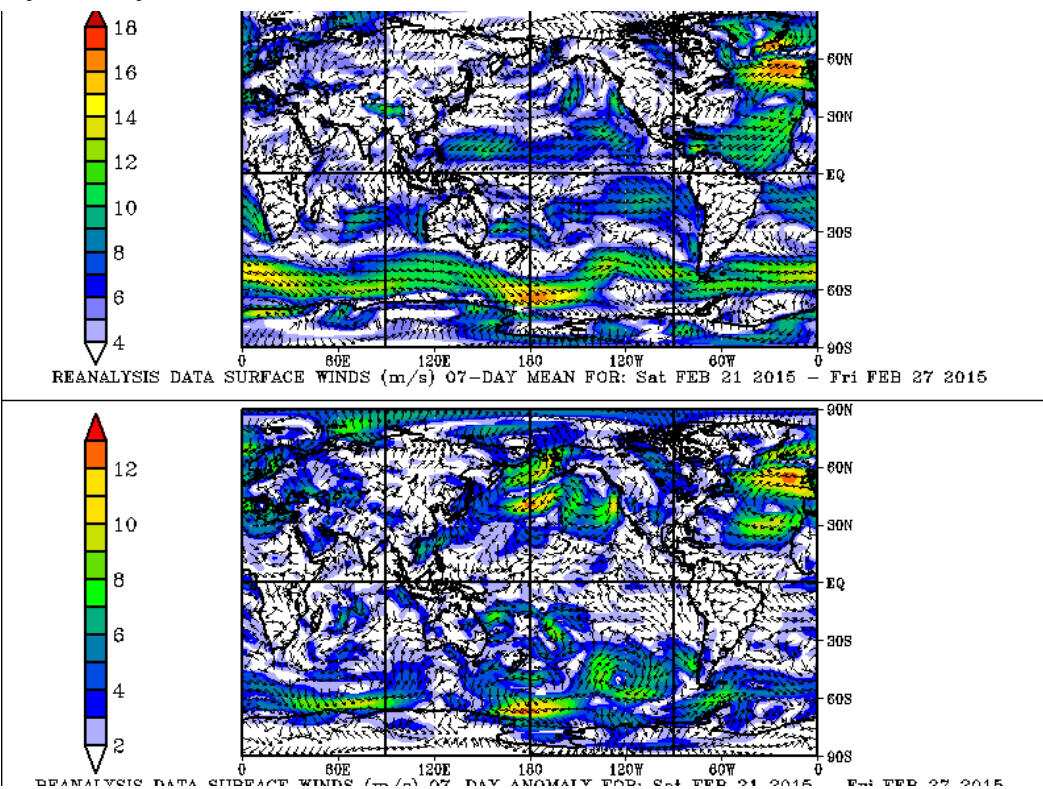


Madden–Julian Oscillation and Wind

30-Day Reanalysis Data Surface



7-Day Reanalysis Data Surface



7-Day ACCESS Model Prognostic Chart Link: <http://www.bom.gov.au/australia/charts/viewer/index.shtml?type=windbarb&level=10m&tz=AEDT&area=SWP&model=G&chartSubmit=Refresh+View>



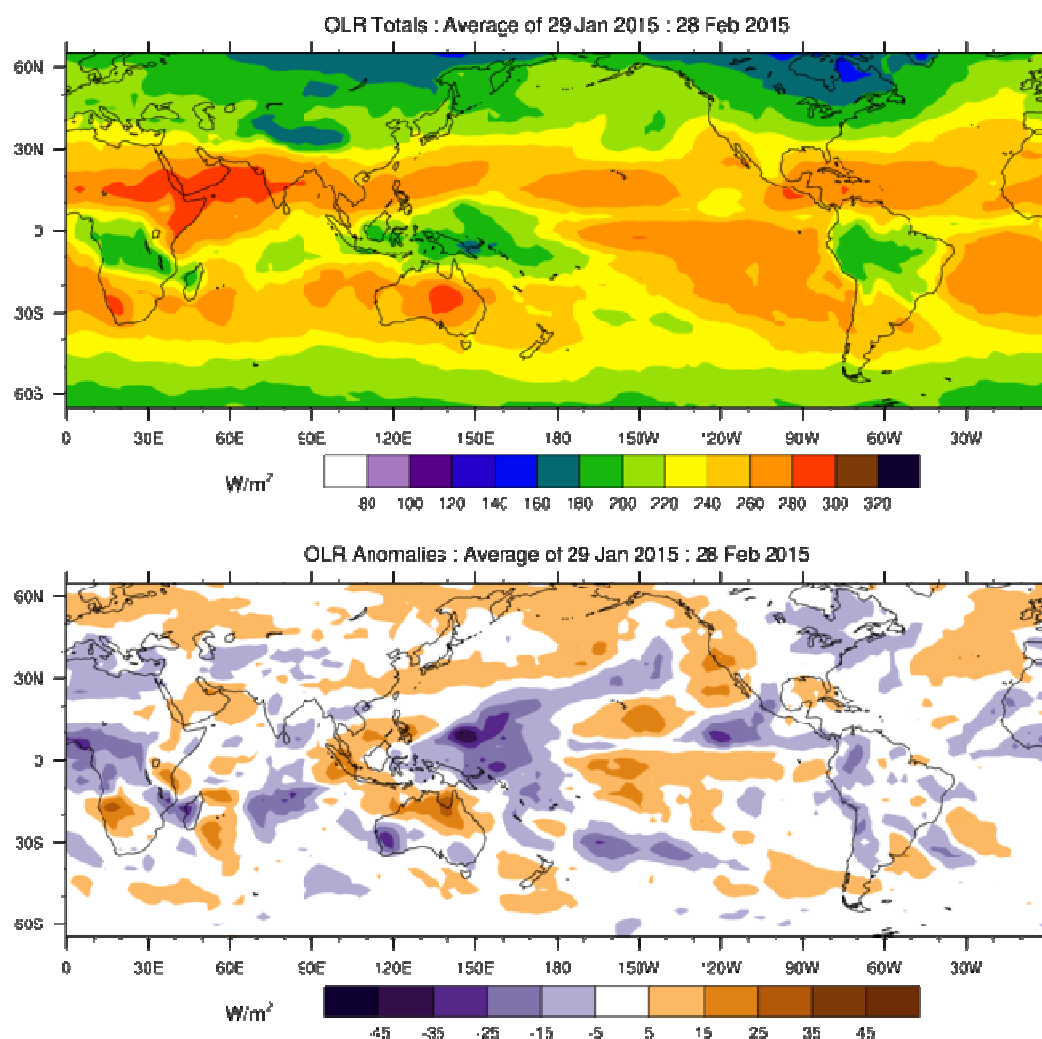
Cloud and Rainfall

The TRMM 30-day rainfall anomaly map to 2 March 2015 shows the ITCZ was displaced to the north in the northwestern tropical Pacific, suppressed near the Date Line and marginally enhanced as a thin band east of the Date Line. The SPCZ was displaced south-westward in February and largely suppressed with the exceptions of an area between Vanuatu and Niue and over Samoa. An area of enhanced rainfall was located to the west of the Date Line, centred on the equator that may be a combination of ITCZ/SPCZ activity.

The TRMM 7-day rainfall accumulation map shows the SPCZ has recently moved north-eastward and lies close to its mean March position. Enhanced rainfall is evident in the western Pacific around Papua New Guinea.

Note: Negative OLR anomalies indicate increased cloudiness and more rain; positive anomalies indicate reduced cloudiness and less rainfall.

OLR Totals and Anomalies, 30 Day OLR

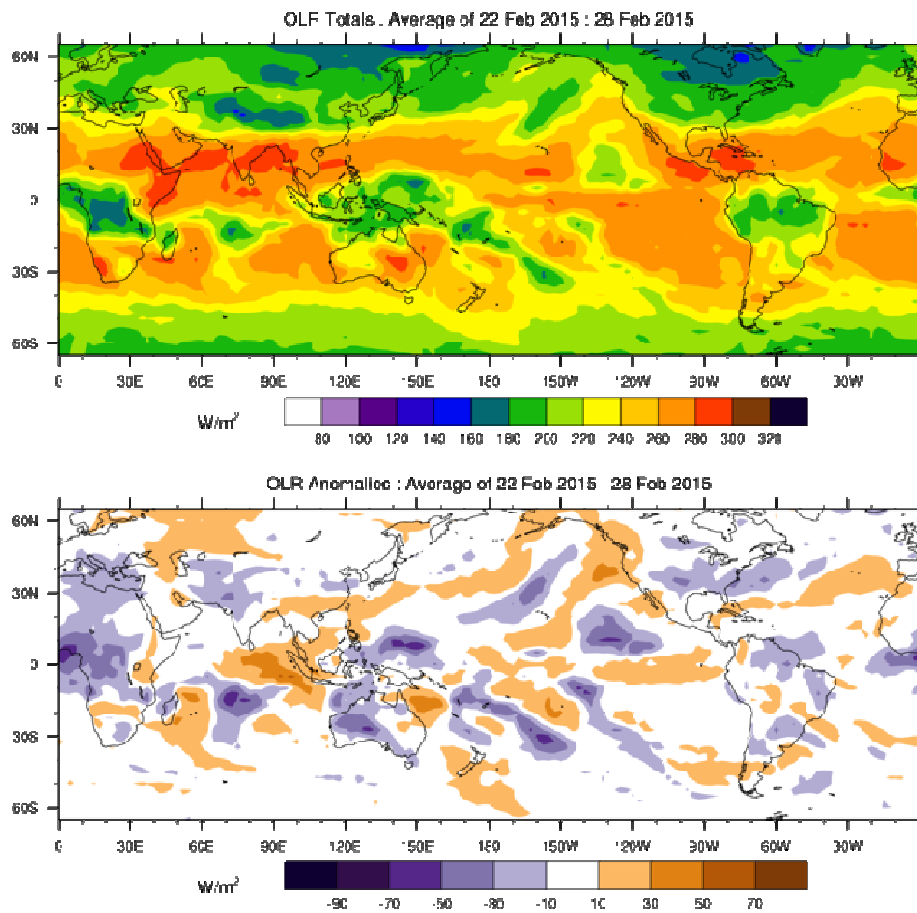


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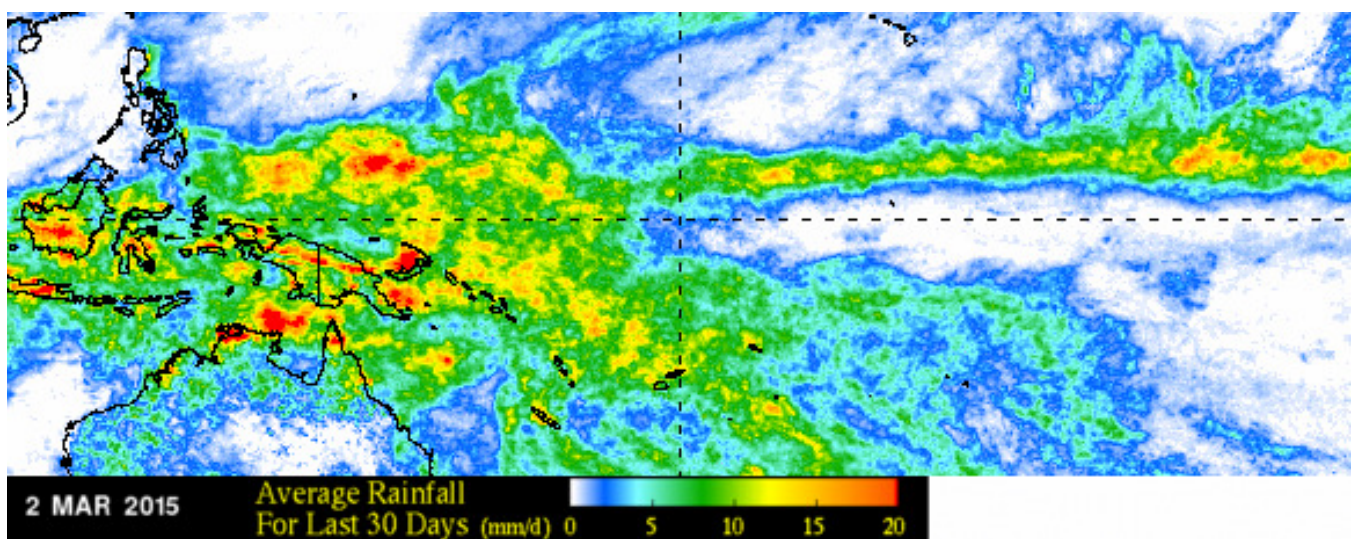
Cloud and Rainfall continued

OLR Totals and Anomalies, 7 Day OLR



Bureau of Meteorology: Madden-Julian Oscillation - Cloudiness Link: <http://www.bom.gov.au/climate/mjo/#tabs=Cloudiness>

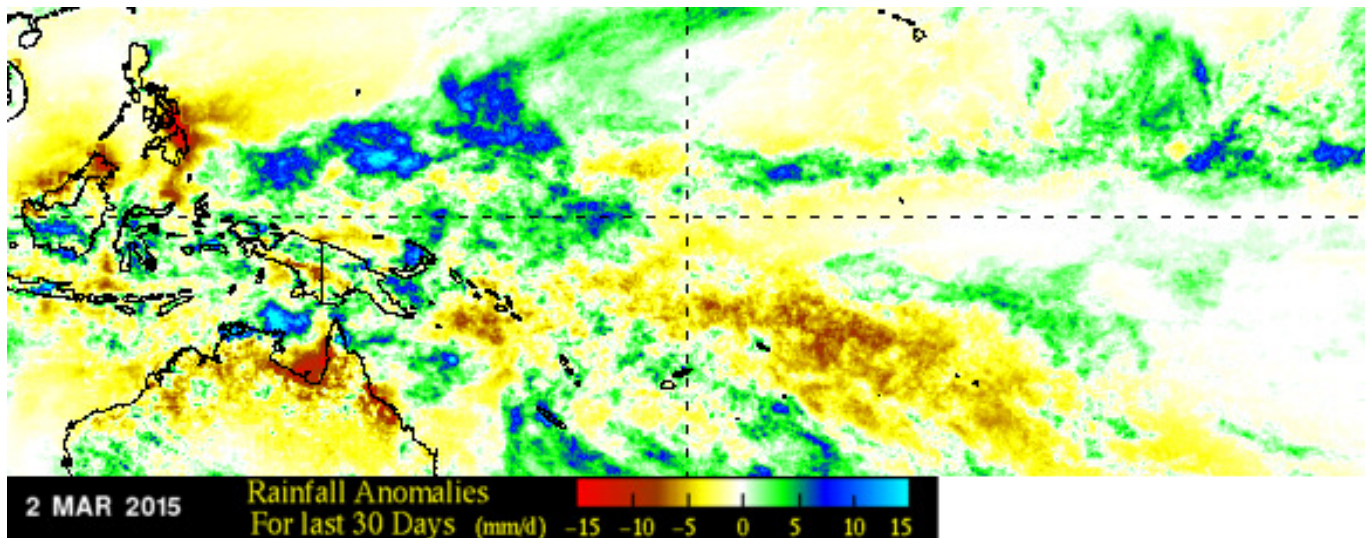
TRMM 30-Day Rainfall Averages



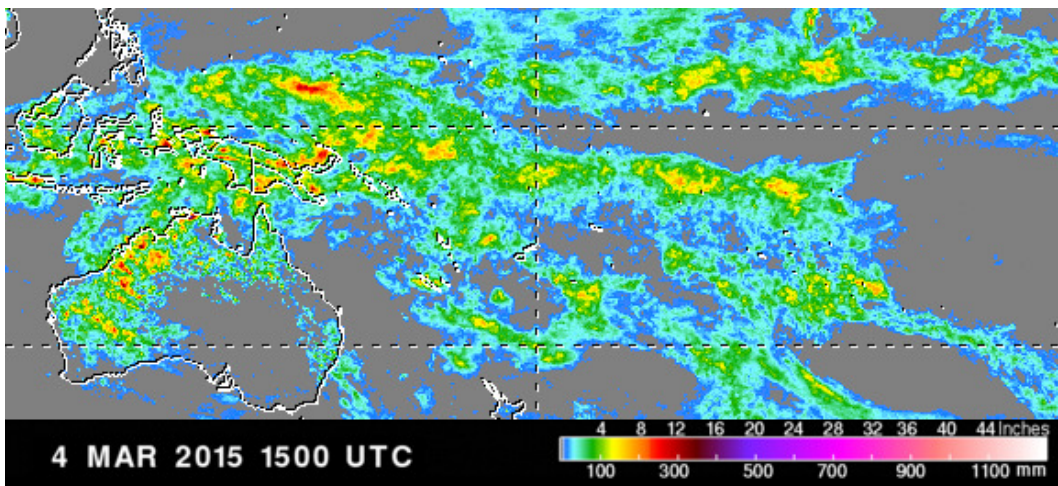


Cloud and Rainfall continued

30-Day Rainfall Anomalies

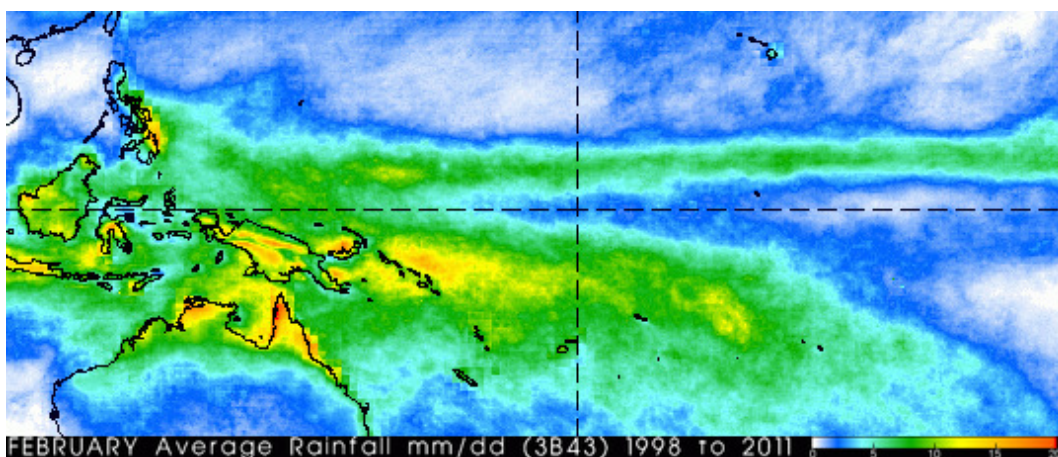


7-Day Rainfall Accumulation



Link to NASA Tropical Rainfall Measuring Mission - TRMM for further information: http://trmm.gsfc.nasa.gov/trmm_rain/Events/thirty_day.html

Current Month Rainfall Climatology





Oceanic Conditions

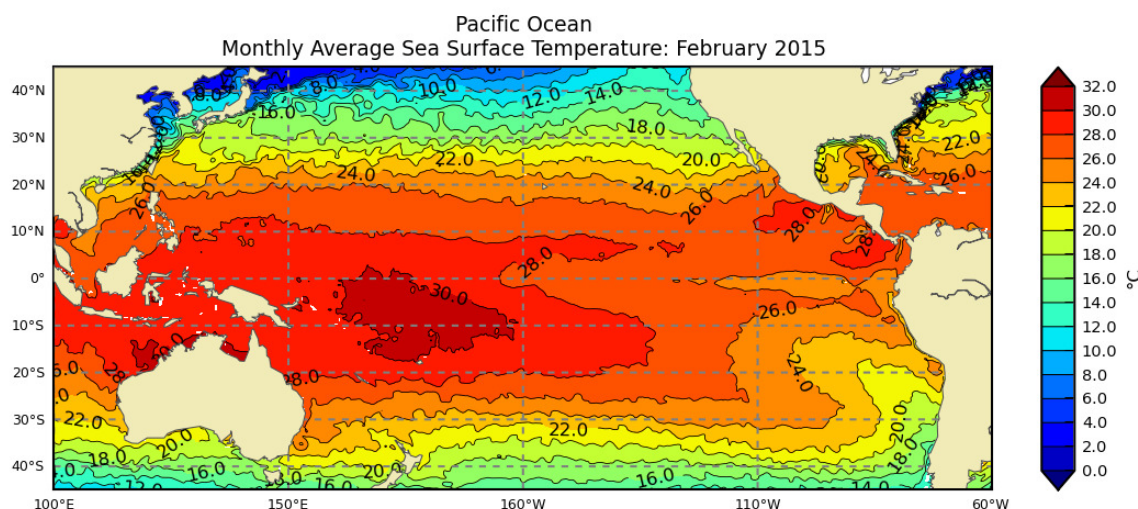
The area of warm sea surface temperature (SST) anomalies in the central and western equatorial Pacific has increased over the past fortnight. The SST anomaly map for February shows warm anomalies more than half a degree above normal between about 160 °E and 120 °W in the equatorial Pacific. Sea surface temperatures on the equator east of 120 °W were a mixture of near-average temperatures and cool anomalies. Warm anomalies remain across a large part of the northeast Pacific Basin. Waters are also warmer than average across most of the tropical southwest Pacific and in the Tasman Sea between southeastern Australia and New Zealand. Compared to January, positive anomalies have decreased slightly in the eastern equatorial Pacific and increased slightly in the western equatorial Pacific.

The February decile map shows SSTs in the above average to highest-on-record range (deciles 8-10) across much of the tropical north Pacific extending up and along North America. The above average to highest on record anomalies also extend over much of the tropical south Pacific, west of and just east of the Date Line and into the Tasman Sea. Sea surface temperatures in the far west Pacific and eastern south Pacific are near average.

The Bureau of Meteorology's four-month sequence of sub-surface water temperature anomalies plot to February shows cool anomalies in the sub-surface of the eastern equatorial Pacific have weakened, compared to last month, while warm anomalies in the western and central equatorial Pacific sub-surface have strengthened. Overall, the pattern of warm and cool anomalies has shifted slightly eastward compared to January. For February, warm anomalies were present in the top 150 m of the equatorial Pacific sub-surface between about 150 °E and 140 °W. Anomalies in western parts of this region reached more than +2.5 °C. Cool anomalies were present in much of the top 150 m of the equatorial Pacific sub-surface east of 140 °W, with anomalies reaching below -2.5 °C in the far eastern parts.

The TAO/TRITON 5-day sub-surface water temperature anomalies plot to 3 March shows near average temperatures across most of the sub-surface of the equatorial Pacific, with warm anomalies east of the Date Line to 120 °W at around 150 m depth. This pool of warmer-than-average water has progressed eastward (this is known as a downwelling Kelvin wave) and strengthened over the past fortnight. Anomalies in the centre of this region exceeded +4 °C.

Monthly Mean SST

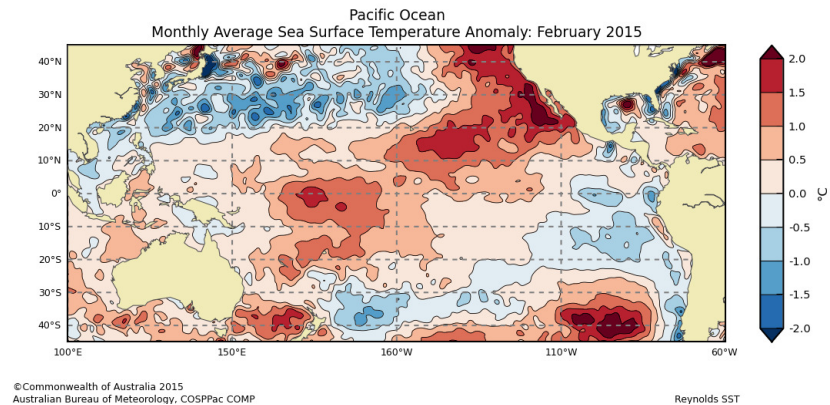


Reynolds Data 'About' file Link: http://www.bom.gov.au/cosppac/comp/ocean-portal/about_reynolds.pdf

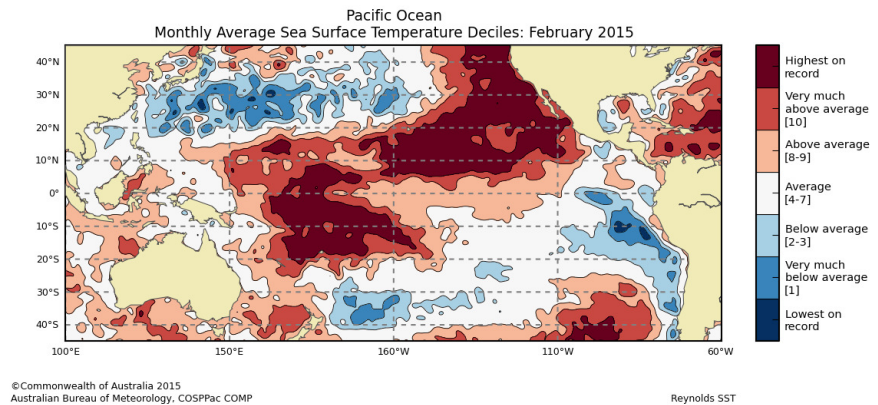


Oceanic Conditions Continued

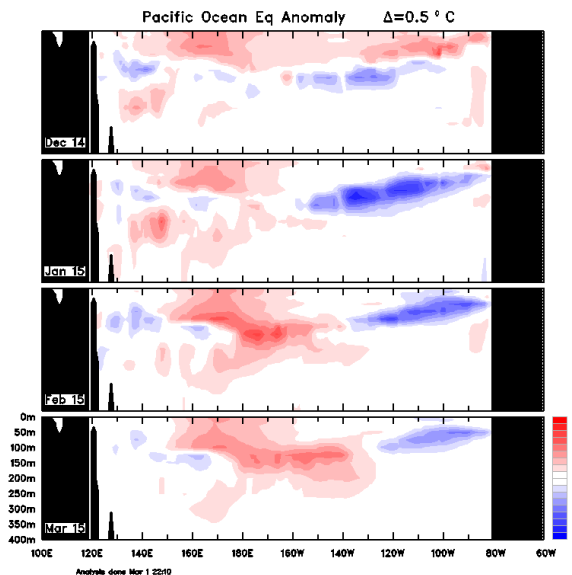
Monthly Average SST Anomaly



Monthly Average SST Deciles

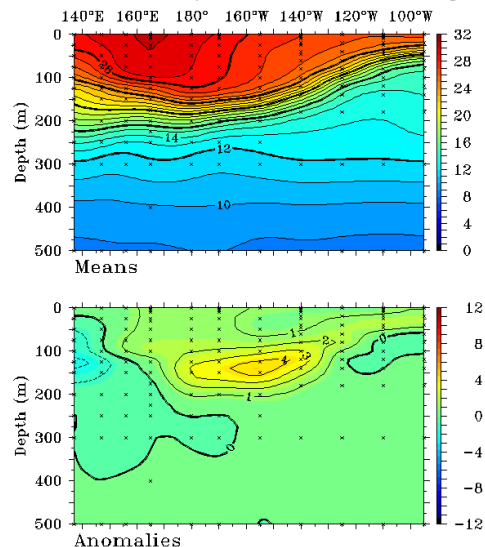


Ocean Sub-surface temperatures



Monthly Temperature Anomalies Link: http://www.bom.gov.au/climate/enso/sub_surf_mon.gif

TAO/TRITON 5-Day Temperature ($^\circ\text{C}$) End Date: February 28 2015 2°S to 2°N Average



TAO Project Office/PMEL/NOAA

Mar 1 2015

Weekly Temperatures Link: http://www.pmel.noaa.gov/tao/jsdisplay/plots/gif/Dep_Sec_EQ_5d.gif

Pacific Sea Level Monitoring Information

Sea level data products, including tide prediction calendars and archives of quality-controlled weather and ocean measurements, are available from the Pacific Sea Level Monitoring page at: <http://www.bom.gov.au/pacific/projects/pslm/>



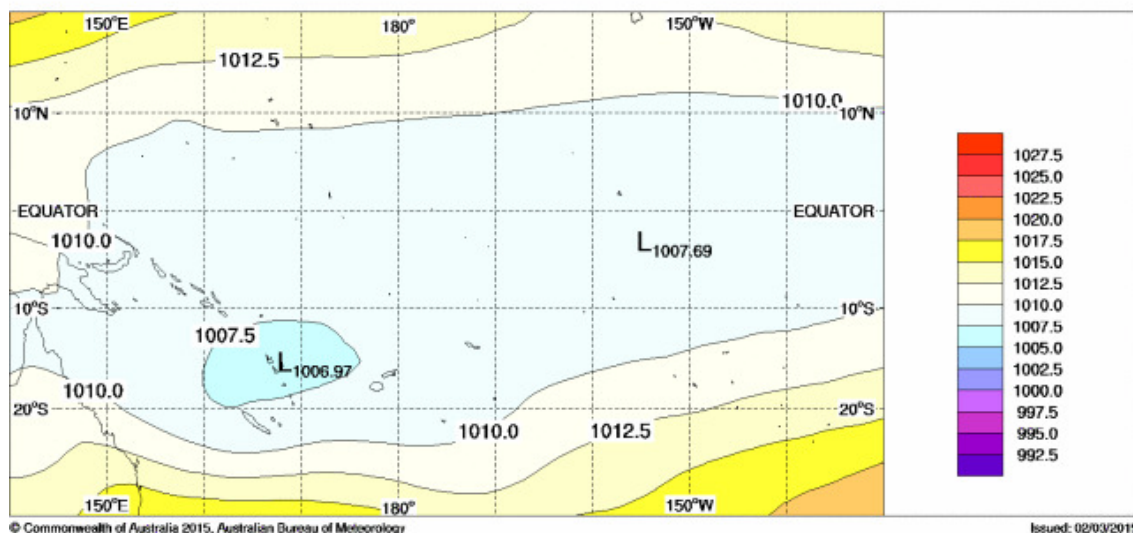
Mean Sea Level Pressure (MSLP)

The mean sea level pressure (MSLP) anomaly map for February shows anomalies greater than +1 hPa over parts of the far west tropical Pacific both north and south of the equator and in the subtropical south Pacific. Anomalies greater than +2 hPa lie over Australia and the northwest Pacific. Negative anomalies below -1 hPa extend eastwards from about 160°E at the equator and down to 10°S. At about 20°N, the negative anomalies were present to about 165°E.

Areas of above/below average MSLP usually coincide with areas of suppressed/enhanced convection and rain.

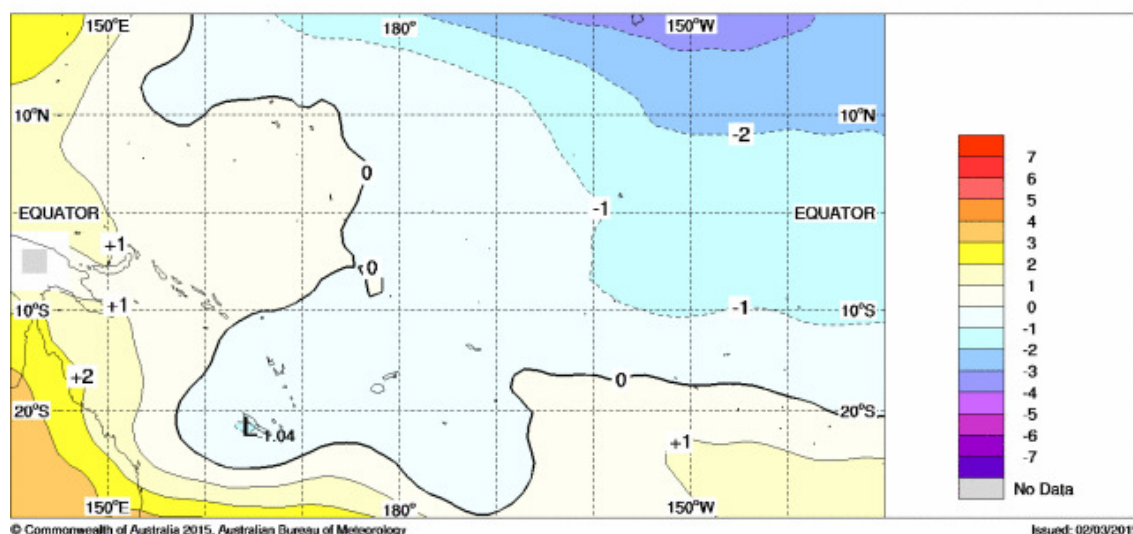
Monthly Mean

MSLP 2.5X2.5 ACCESS OP. ANAL. (hPa) 20150201 0000 20150228 0000



Monthly Anomalous [with respect to a 1979-2000 mean]

MSLP 2.5X2.5 ACCESS OP. ANAL.-NCEP2 (hPa) 20150201 0000 20150228 0000

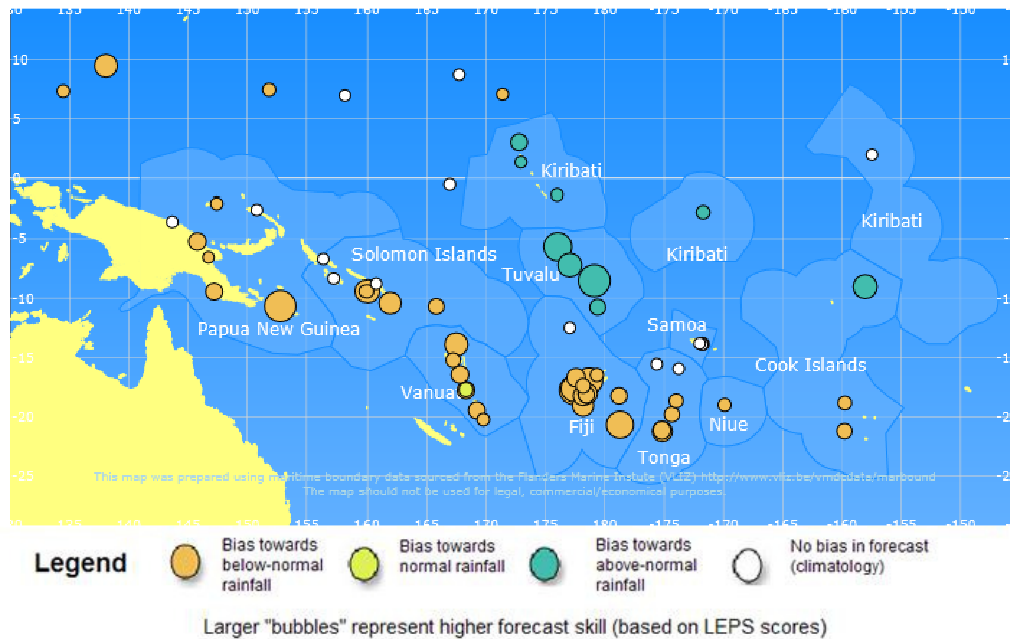


Bureau of Meteorology: South Pacific Circulation Patterns Link: <http://www.bom.gov.au/cgi-bin/climate/cmb.cgi?page=indexa&area=spac>



Model Outlooks

SCOPIC Seasonal Climate Outlook—**Preliminary** Spatial Summary for April to June 2015

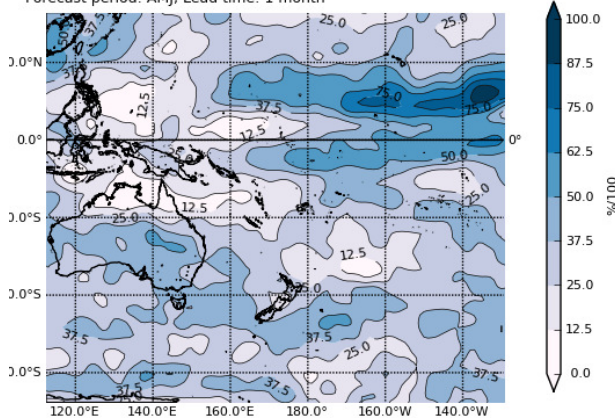


Link to COSPPac Online Climate Outlook Forum for further information: <http://www.bom.gov.au/cosppac/comp/ocof/index.shtml>

POAMA Pacific Seasonal Rainfall Outlook

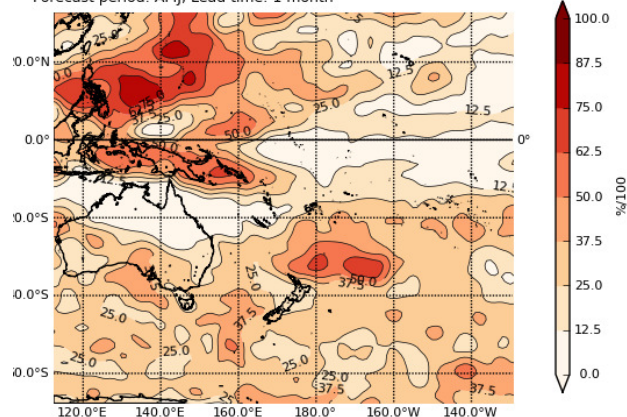
Spatial Map of POAMA Probabilities for Wetter than Normal Season

PACCSAP: Dynamical Seasonal Outlooks for the Pacific.
Outlook based on POAMA 2 CGCM adjusted for historical skill.
Experimental outlook for demonstration and research only.
Variable: hr24_prpc_pt3(%/100)
Model initialised: 20150301
Forecast period: AMJ, Lead time: 1 month



Spatial Map of POAMA Probabilities for Drier than Normal Season

PACCSAP: Dynamical Seasonal Outlooks for the Pacific.
Outlook based on POAMA 2 CGCM adjusted for historical skill.
Experimental outlook for demonstration and research only.
Variable: hr24_prpc_pt1(%/100)
Model initialised: 20150301
Forecast period: AMJ, Lead time: 1 month



Other Model Outlook Links:

European Centre for Medium-Range Weather Forecasts (ECMWF) Link: <http://www.ecmwf.int/en/forecasts/charts/seasonal/rain-public-charts-long-range-forecast>

United Kingdom Meteorological Office Global Long-Range Probability Maps Link: <http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/glob-seas-prob>

National Centers for Environmental Prediction (NCEP) Coupled Model Seasonal Outlook Link: <http://www.cpc.ncep.noaa.gov/pacdir/COU1.html>

The International Research Institute for Climate and Society (IRI) Pacific Islands Precipitation Probability Forecast Link: <http://portal.iri.columbia.edu/portal/server.pt?open=512&objID=944&PageID=7868&mode=2&cached=false>



Model Outlooks Continued

Table of POAMA2.4 Rainfall % Outlooks for April to June 2015

Station	Country	Lower Tercile	Middle Tercile	Upper Tercile
Aitutaki	Cook Islands	33%	34%	33%
Rarotonga	Cook Islands	43%	24%	33%
Penrhyn	Cook Islands	9%	51%	39%
Chuuk	Federated States of Micronesia	30%	40%	30%
Pohnpei	Federated States of Micronesia	42%	46%	12%
Yap	Federated States of Micronesia	61%	27%	12%
Nadi Airport	Fiji	18%	57%	24%
Rotuma	Fiji	18%	63%	18%
Suva	Fiji	18%	58%	24%
Udu Point	Fiji	27%	43%	30%
Lakeba	Fiji	24%	55%	21%
Nabouwalu	Fiji	27%	49%	24%
Vunisea	Fiji	18%	59%	24%
Arorae	Kiribati	5%	40%	55%
Butaritari	Kiribati	33%	52%	15%
Tabuaeran	Kiribati	21%	33%	46%
Tarawa	Kiribati	9%	75%	15%
Kanton	Kiribati	9%	36%	55%
Kiritimati	Kiribati	15%	30%	55%
Nauru	Nauru	5%	56%	39%
Hanan Airport	Niue	30%	45%	21%
Koror	Palau	42%	53%	5%
Daru	Papua New Guinea	24%	61%	15%
Port Moresby	Papua New Guinea	58%	18%	24%
Madang	Papua New Guinea	61%	5%	34%
Misima	Papua New Guinea	55%	27%	18%
Momote	Papua New Guinea	40%	36%	24%
Kavieng	Papua New Guinea	49%	27%	24%
Wewak W.O	Papua New Guinea	55%	18%	27%
Nadzab	Papua New Guinea	67%	15%	18%

Link to POAMA Pacific Seasonal Prediction Portal for further information: <http://poama.bom.gov.au/experimental/pasap/index.shtml>



Model Outlooks Continued

Table of POAMA2.4 Rainfall % Outlooks for March to May 2015

Station	Country	Lower Tercile	Middle Tercile	Upper Tercile
Kwajalein	Republic of Marshall Islands	39%	21%	40%
Majuro	Republic of Marshall Islands	30%	52%	18%
Apia	Samoa	12%	39%	49%
Faleolo	Samoa	12%	39%	49%
Honiara	Solomon Islands	70%	5%	25%
Munda	Solomon Islands	70%	5%	25%
Santa Cruz	Solomon Islands	43%	36%	21%
Taro	Solomon Islands	58%	12%	30%
Kira kira	Solomon Islands	58%	24%	18%
Nuku'alofa	Tonga	46%	24%	30%
Keppel	Tonga	24%	30%	46%
Haapai	Tonga	40%	33%	27%
Lupepau'u	Tonga	40%	33%	27%
Niuafoou	Tonga	24%	30%	46%
Funafuti	Tuvalu	9%	55%	36%
Nanumea	Tuvalu	6%	42%	52%
Nui	Tuvalu	6%	33%	61%
Niulakita	Tuvalu	15%	58%	27%:
Aneityum	Vanuatu	12%	70%	18%
Bauerfield (Efate)	Vanuatu	6%	78%	15%
Lamap (Malekula)	Vanuatu	12%	72%	15%
Pekoa	Vanuatu	12%	72%	15%
Port Vila	Vanuatu	6%	79%	15%
Sola	Vanuatu	30%	52%	18%
White Grass	Vanuatu	12%	73%	15%

Link to POAMA Pacific Seasonal Prediction Portal for further information: <http://poama.bom.gov.au/experimental/pasap/index.shtml>



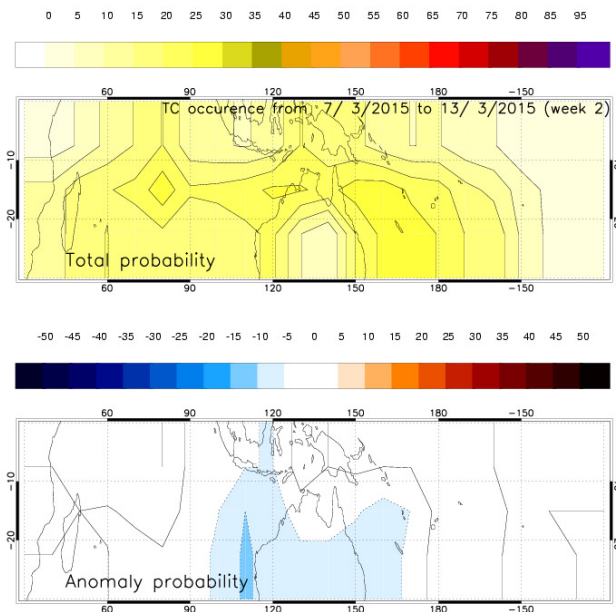
Cyclones and Other Information

Tropical Cyclone Information

The southern hemisphere tropical cyclone season runs between 1 November and 30 April. As of 5 March 2015, three tropical cyclones have developed in the southwest Pacific region. Namely, Marcia, Niko and Ola.

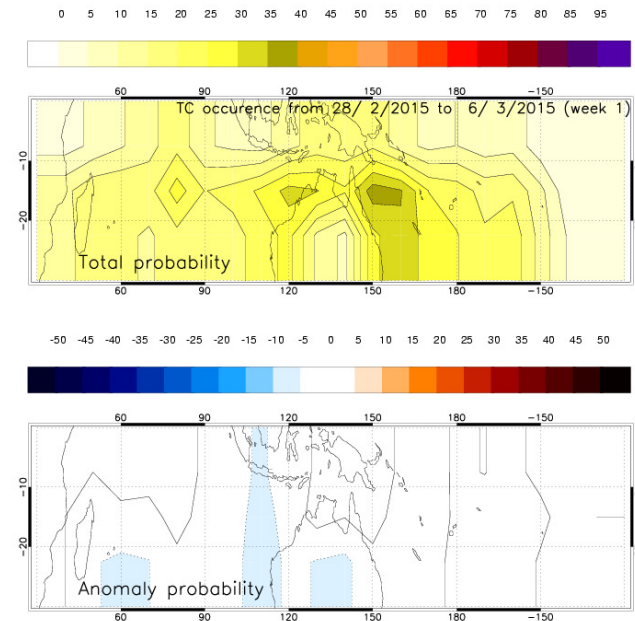
MeteoFrance Tropical Cyclone Outlook Link: <http://www.meteo.nc/cyclone/coin-des-experts>

Week 2

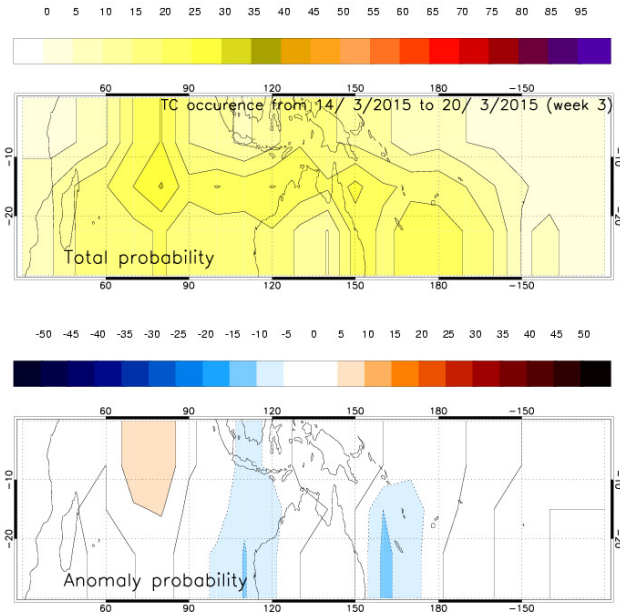


MeteoFrance Tropical Cyclone Weekly Forecasts

Week 1



Week 3



Bureau of Meteorology South Pacific Tropical Cyclone Outlook Link: <http://www.bom.gov.au/climate/ahead/south-pacific/tc.shtml>

Bureau of Meteorology Tropical Cyclone Climatologies Link: http://www.bom.gov.au/jsp/ncc/climate_averages/tropical-cyclones/index.jsp

PACCSAP Tropical Cyclone Data Portal Link: <http://www.bom.gov.au/cyclone/history/tracks/>

RSMC - Fiji Meteorological Service Tropical Cyclone Warnings Link: http://www.met.gov.fj/current_warnings.php

RSMC - Japan Meteorological Agency Tropical Cyclone Warnings Link: <http://www.jma.go.jp/en/typh/>

TCWC - Australian Bureau of Meteorology Tropical Cyclone Warnings Link: <http://www.wmo.int/pages/prog/www/tcp/RSMC-TCWC.html>

Tropical Cyclone warnings and information from the Joint Typhoon Warning Center Link: <http://www.usno.navy.mil/JTWC/>

New Zealand Meteorological Service Weather Warning Link: <http://www.metservice.com/warnings/home>



Other Information

Further 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 -8 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 $+8$ 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. <http://www.bom.gov.au/climate/glossary/soi.shtml>

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. http://www.cdc.noaa.gov/ENSO/enso.mei_index.html

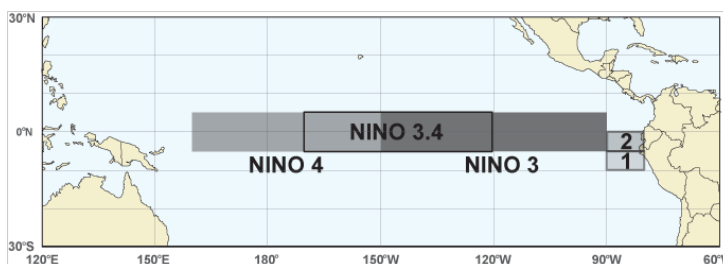
20 degrees Celsius Isotherm Depth

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 deeper than normal 20°C isotherm (positive anomaly) implies a greater heat content in the upper ocean, whilst a shallower 20°C isotherm (negative anomaly) implies a lower than normal heat content in the upper ocean. http://www.pbs.org/wgbh/nova/el_nino/anatomy/origins.html

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°N to 5°S	80°E to 15°W
NINO2	5°S to 25°S	80°E to 15°W
NINO3	5°N to 5°S	155°W to 90°W
NINO3.4	5°N to 5°S	120°W to 170°W
NINO4	5°N to 5°S	160°E to 150°W



NOTE: NINO1+2 is the combined areas 1 and 2