



Australian Government
Bureau of Meteorology



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

Monthly Climate Bulletin

April 2015



Summary

Issued on 5 April 2015

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- The Bureau's ENSO Tracker is at ALERT status. This indicates that there is triple the normal chance of El Niño in 2015.
- ENSO indicators in the tropical Pacific are approaching or exceeding El Niño levels. Sea Surface Temperatures (SSTs) now exceed El Niño thresholds and trade winds have remained weaker than average for several weeks. If these patterns persist or strengthen, El Niño will become established.
- All international climate models surveyed by the Bureau indicate that ocean temperatures are likely to remain above El Niño thresholds until at least the southern hemisphere spring. However, the accuracy of model outlooks at this time of year is lower than at other times.
- There has been less weather activity than usual, except for the central Pacific, during the last three weeks, due in part to the weak Madden-Julian Oscillation (MJO) over the same period. The MJO is forecast to remain indiscernible over the coming week.
- The Intertropical Convergence Zone (ITCZ) in April was enhanced across most of the tropical north Pacific except north of New Guinea and the Solomon Islands. The South Pacific Convergence Zone (SPCZ) was located close to its average April position, but largely suppressed especially near the Date Line.
- Below normal rainfall is favoured for most of the Papua New Guinea mainland, central and southern Solomon Islands and Fiji and above normal rainfall for most Nauru, western Kiribati and northern Tuvalu according to the SCOPIC and POAMA outlooks for June to August 2015.
- Seven tropical cyclones passed through or developed in the southwest Pacific in the 2014/15 season. The long-term average is ten cyclones for the region east of the tip of Cape York, Queensland. Near average cyclone numbers were predicted for the 2014/15 season.

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El Niño–Southern Oscillation

Recent warming of Pacific Ocean could be an early indication of El Niño

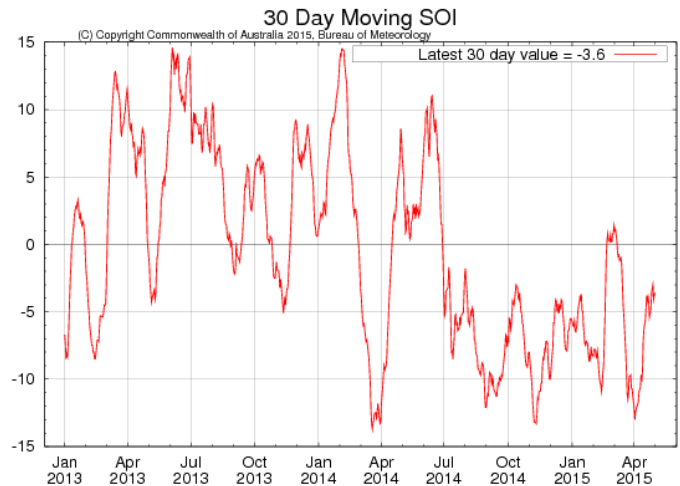
Bureau ENSO Wrap-Up issued on Tuesday 28 April 2015

ENSO indicators in the tropical Pacific are approaching El Niño levels. Sea surface temperatures now exceed El Niño thresholds and trade winds have remained weaker than average for several weeks. This suggests some coupling between the ocean and atmosphere may be occurring. If these patterns persist or strengthen, El Niño will become established.

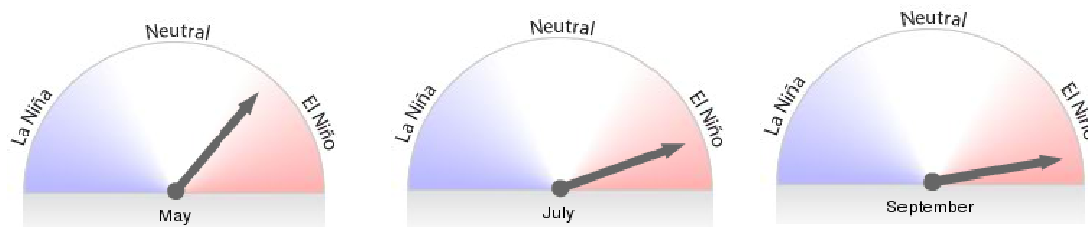
All international climate models surveyed by the Bureau indicate that ocean temperatures are likely to remain above El Niño thresholds until at least the southern hemisphere spring. However, the accuracy of model outlooks at this time of year, the traditional El Niño Southern Oscillation (ENSO) transition period, is lower than at other times.

Based upon model outlooks and current observations, the Bureau's ENSO Tracker is at ALERT status, approximately a 70% chance of El Niño developing. This indicates that there is triple the normal chance (20-25%) of El Niño in 2015. The 30-day and 90-day Southern-Oscillation Index (SOI) values to 2 May were -3.4 and -5.0 respectively.

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

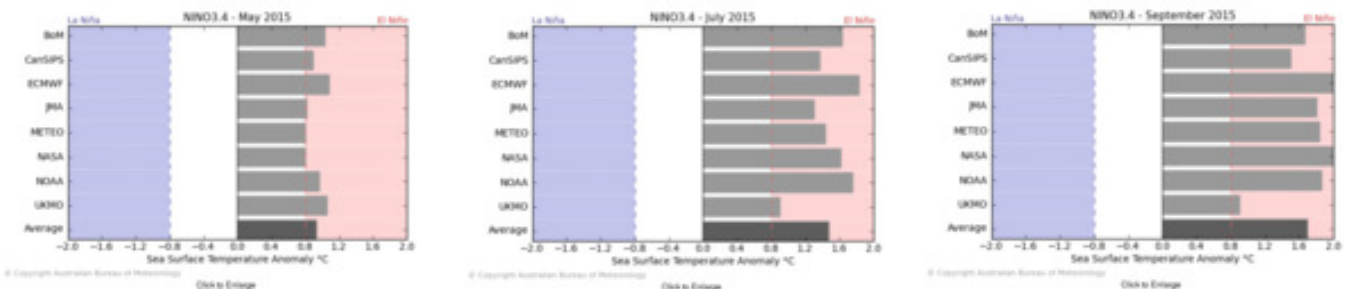


Bureau of Meteorology ENSO Model Outlooks for NINO3.4



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 Tuesday 28 April 2015

The Madden-Julian Oscillation (MJO) has been weak or indiscernible for most of the last three weeks and is expected to remain so for at least another week. Recent tropical weather has been active over the central Pacific and the western Indian Ocean due to the warmer than usual waters in these regions.

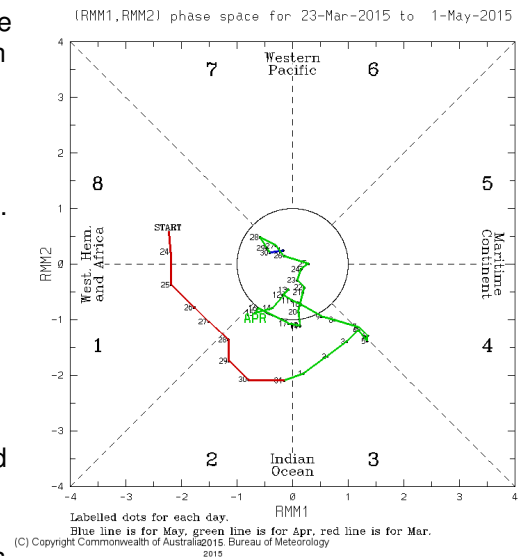
Wind Summary

The wind plots show weaker than average equatorial trade winds over much of the tropical Pacific for the last 30- and 7-days to 1 May. The trade winds have been consistently weaker than average, and on occasion reversed in direction (i.e. westerly), since the start of 2015. This has caused warming of the sub-surface of the tropical Pacific Ocean, as observed over recent months.

Bursts of westerly winds over the equatorial Pacific can induce warming of the ocean below by driving downwelling Kelvin waves, which travel eastward as a 'pulse' of warmer-than-average water and warm the surface and sub-surface of the ocean.

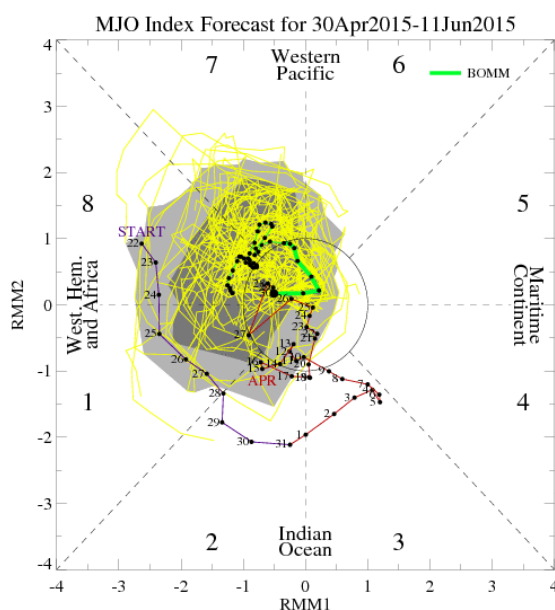
During La Niña, there is a sustained strengthening of the trade winds across much of the tropical Pacific, while during El Niño there is a sustained weakening of the trade winds.

40-Day MJO Phase Plot:

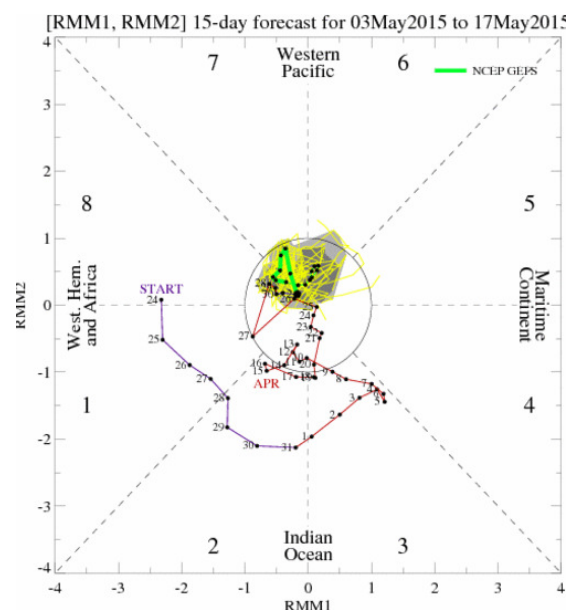


Link to the Bureau of Meteorology: Madden-Julian Oscillation for further information : <http://www.bom.gov.au/climate/mjo/>

MJO Phase Forecasts



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



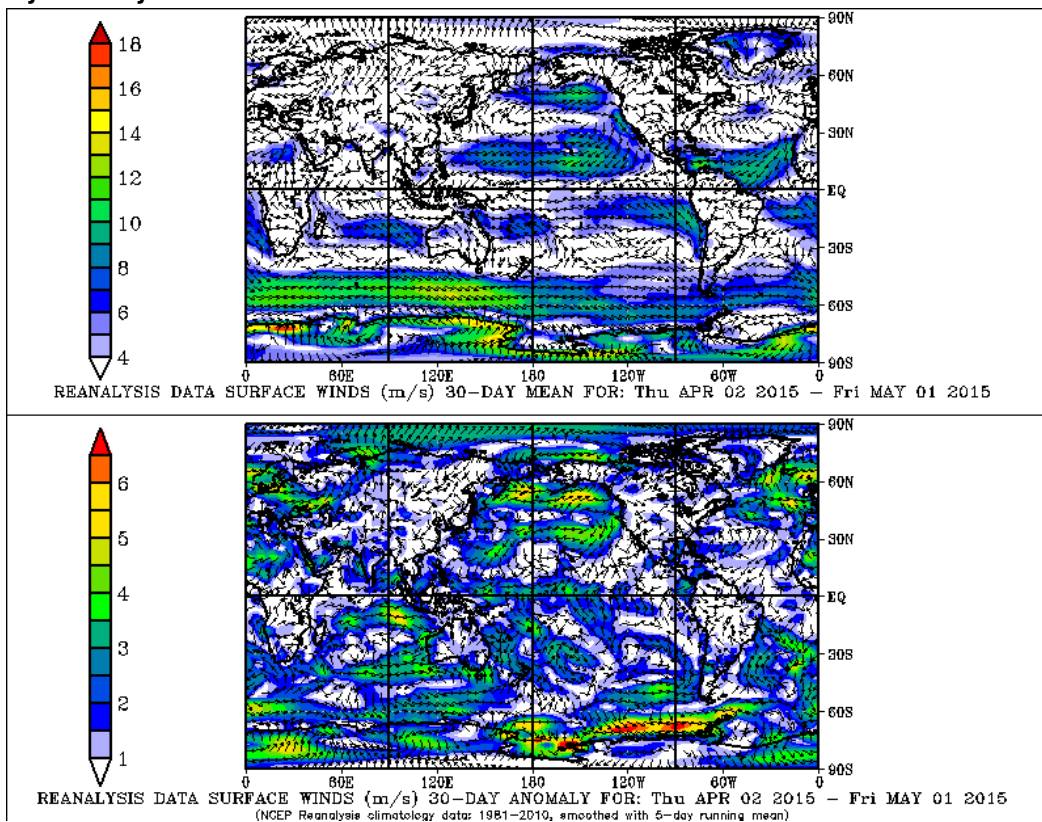
NOAA: MJO Model Forecasts Link: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar_wh.shtml

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

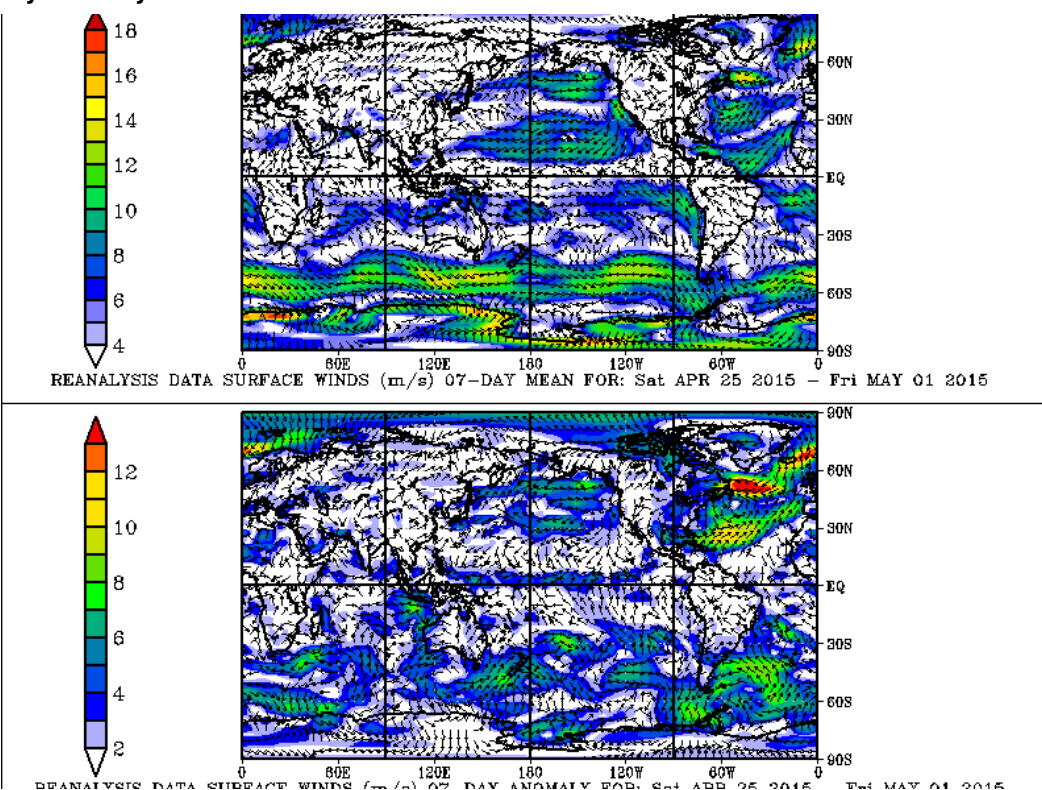


Madden–Julian Oscillation and Wind

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

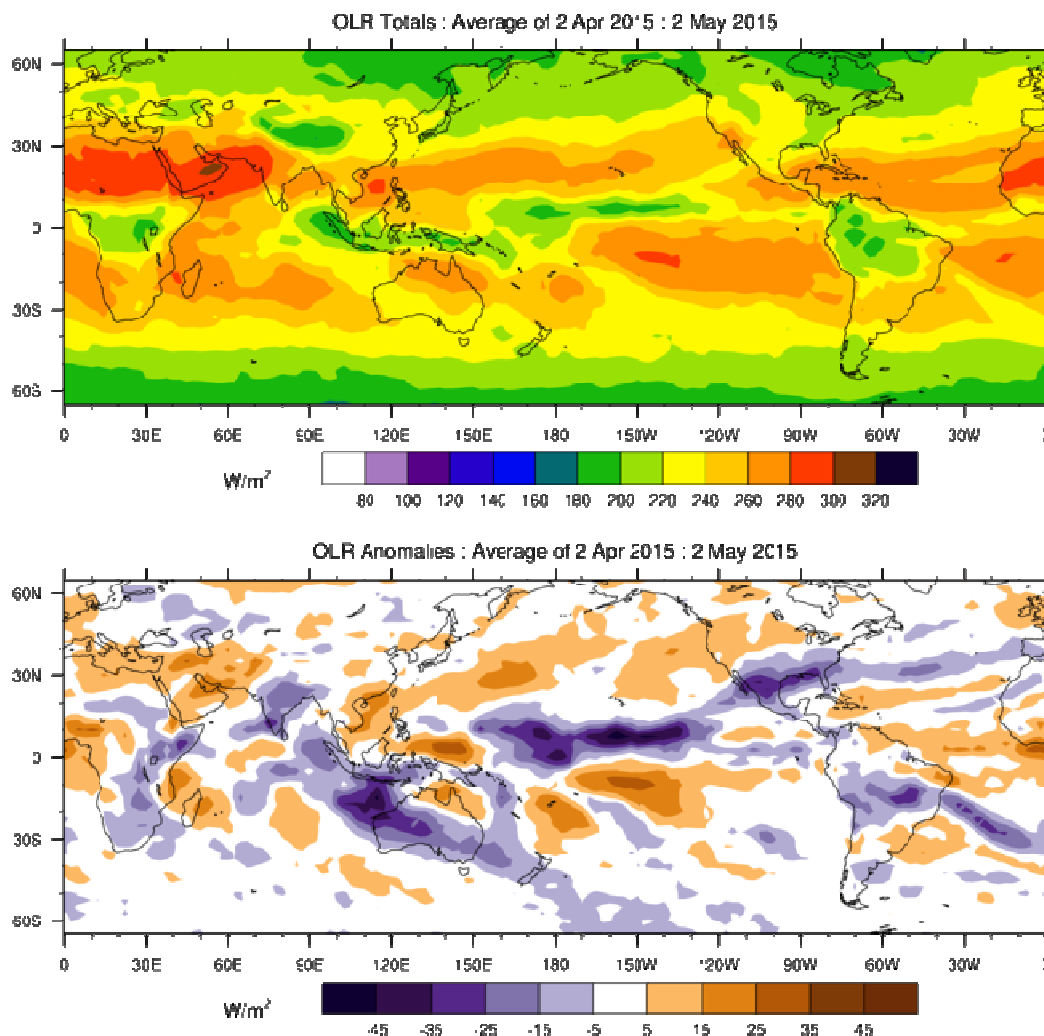
The 30-day OLR and TRMM rainfall anomaly maps to 3 May 2015 show an enhanced ITCZ across most of the tropical north Pacific except to the north of New Guinea and the Solomon Islands. Notable positive rainfall anomalies were present around the equator and centred on the Date Line, associated with warm SST anomalies in the same region.

In the south Pacific, the SPCZ was suppressed near the Date Line (esp. over Fiji and Tonga) and northeast of Samoa. Enhanced rainfall was present over the southern New Guinea islands, southern Solomon Islands, northern Vanuatu, southern Cook Islands and southernmost French Polynesian islands.

The TRMM 7-day rainfall map shows an active ITCZ across most of the north Pacific and active SPCZ over the Solomon Islands and southern Cook Islands.

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

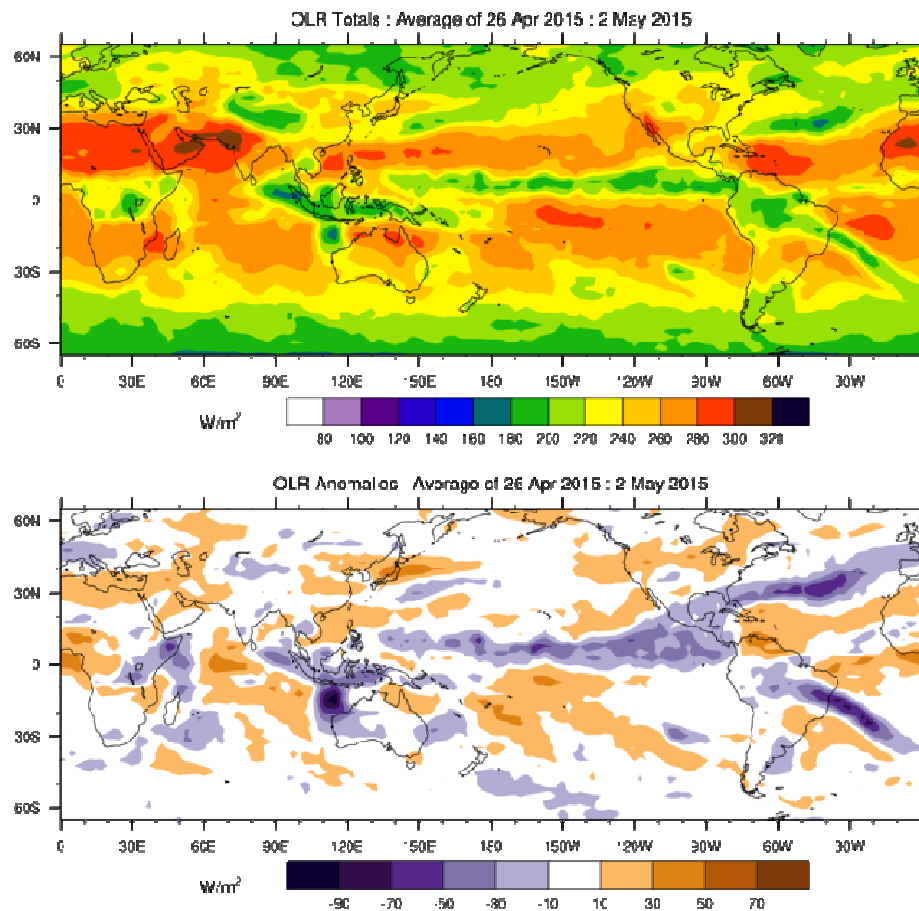


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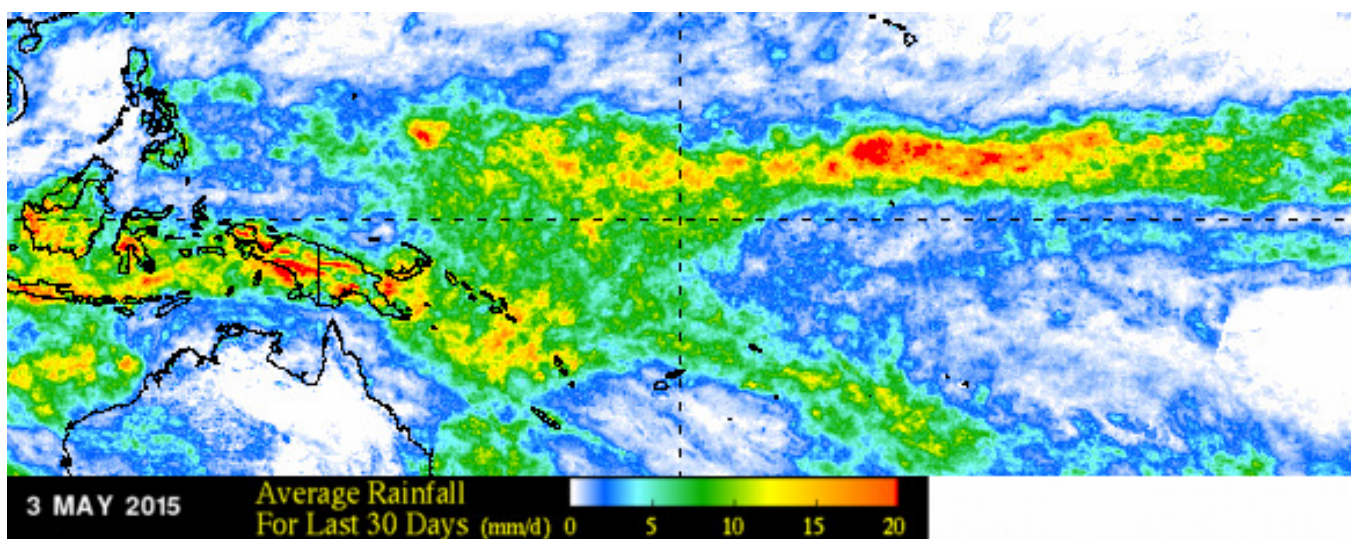
Cloud and Rainfall continued

OLR Totals and Anomalies, 7 Day OLR



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

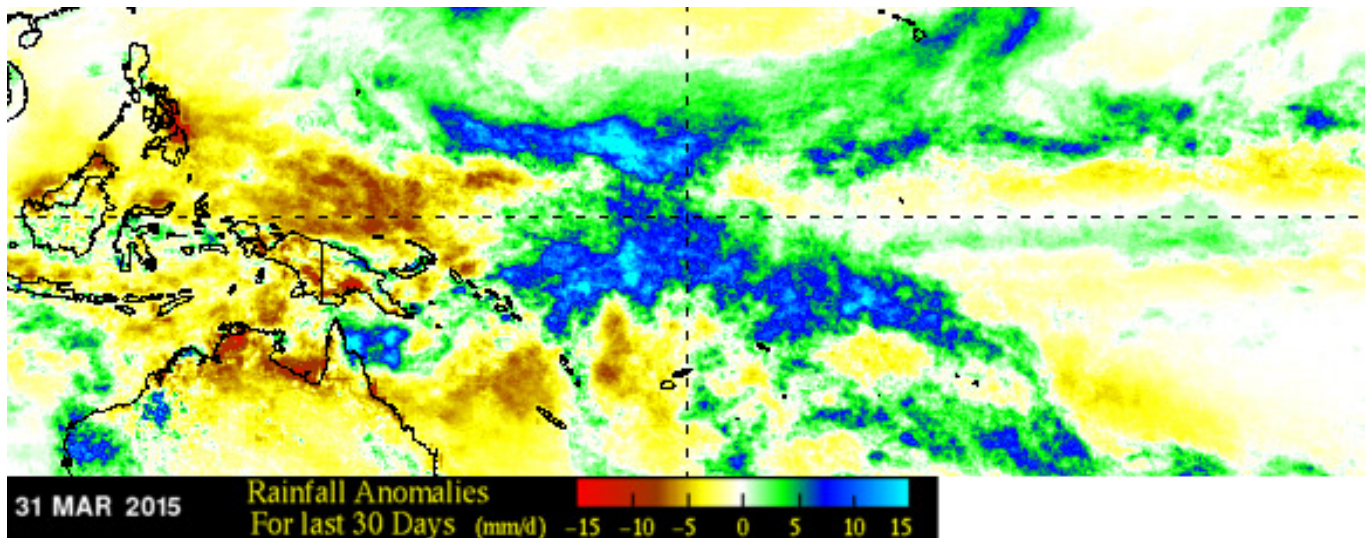
TRMM 30-Day Rainfall Averages



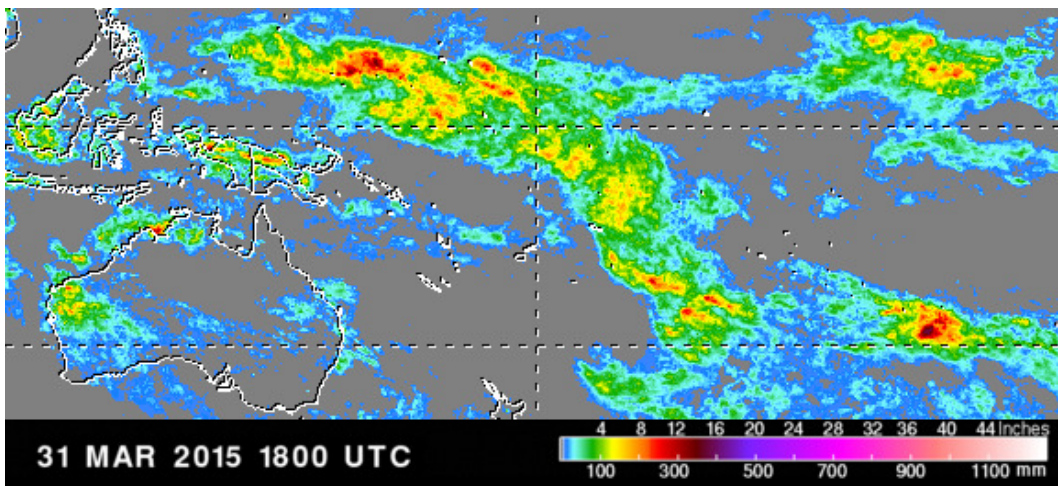


Cloud and Rainfall continued

30-Day Rainfall Anomalies

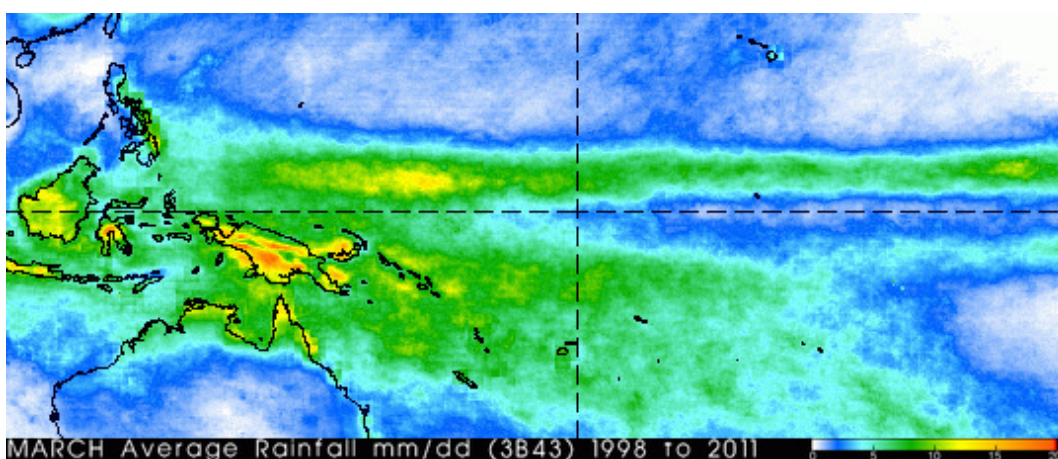


7-Day Rainfall Accumulation



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

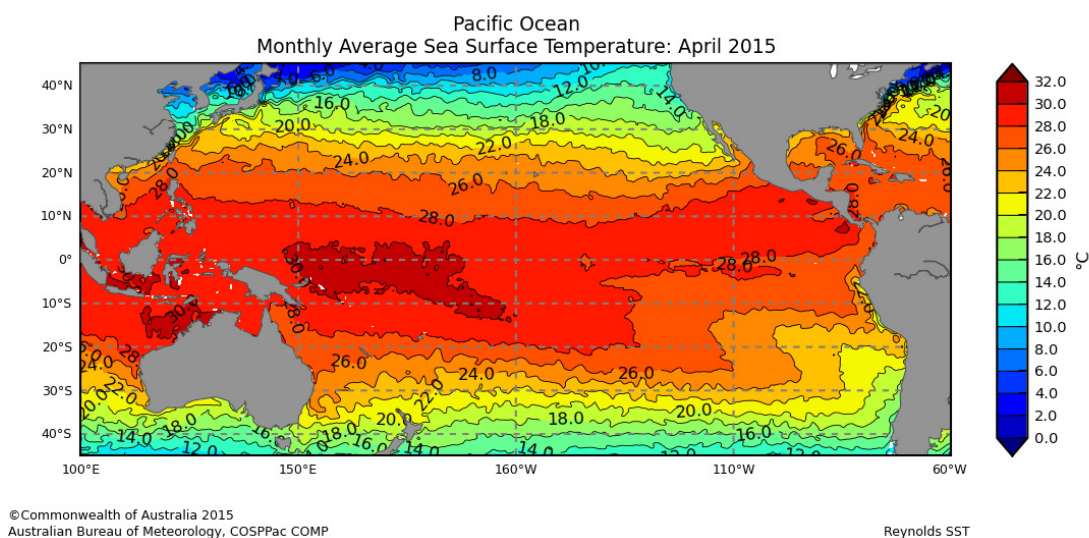
The SST anomaly map for April shows significant warm anomalies across the western and central equatorial Pacific Ocean. At the Date Line warm anomalies exceed $+1.5^{\circ}\text{C}$ while anomalies in the Nino regions all exceed $+1.0^{\circ}\text{C}$ on the weekly timescale, with the latest weekly Nino3.4 value at $+1.1^{\circ}\text{C}$, an increase of $+0.2$ over the last fortnight. Weak cool anomalies remain in the Coral Sea and around parts of New Guinea, in the south Pacific subtropics east of New Zealand and in the eastern Pacific Ocean. Warm anomalies remained across a large part of the northeast Pacific Basin, in the south Pacific on both sides of the Date Line and in the Tasman Sea between Australia and New Zealand.

The April decile map shows SSTs in the above average to highest-on-record range (deciles 8-10) across most of the northeast, tropical north and parts of the southwest Pacific and the Tasman Sea. Sea surface temperatures in the below average to lowest-on-record range (deciles 1-3) were present in the central north Pacific and parts of the eastern Pacific.

The Bureau of Meteorology's four-month sequence of equatorial sub-surface water temperature anomalies plot to the end of April shows cool anomalies in the western Pacific have strengthened to the west of the Date Line. Concurrently, warm sub-surface anomalies to the east of the Date Line have strengthened and expanded further easterwards during April eradicating the cool anomalies that have been present in the far eastern Pacific during 2015.

The TAO/TRITON 5-day sub-surface water temperature anomalies plot to 2 May shows warm anomalies across most of the sub-surface of the equatorial Pacific, with warm anomalies in the far eastern Pacific exceed 5°C . Cool anomalies remain present in the far western Pacific between 100 m and 200 m depth. The last fortnight has seen warming in central and eastern equatorial Pacific sub-surface waters.

Monthly Mean SST

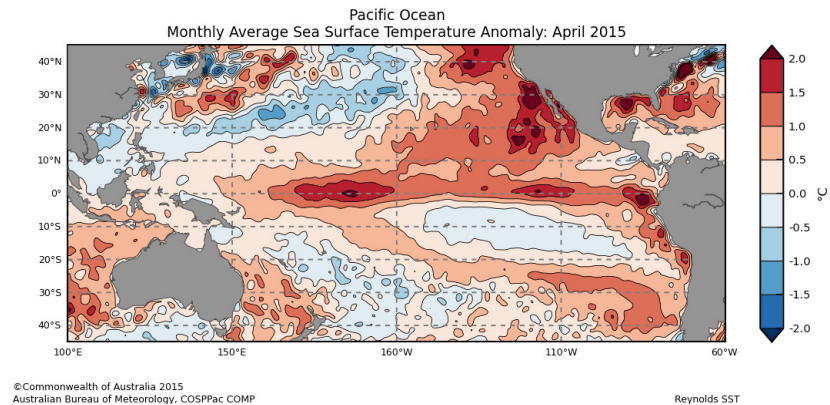


Reynolds Data 'About' file Link: http://www.bom.gov.au/cosppac/comp/ocean-portal/about_reynolds.pdf

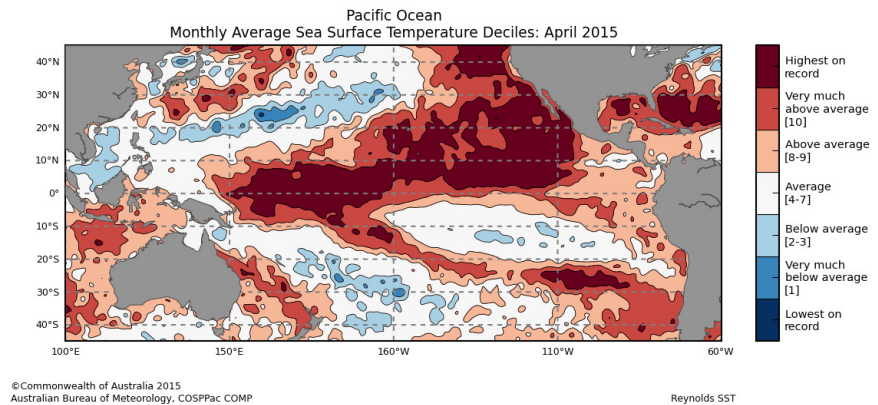


Oceanic Conditions Continued

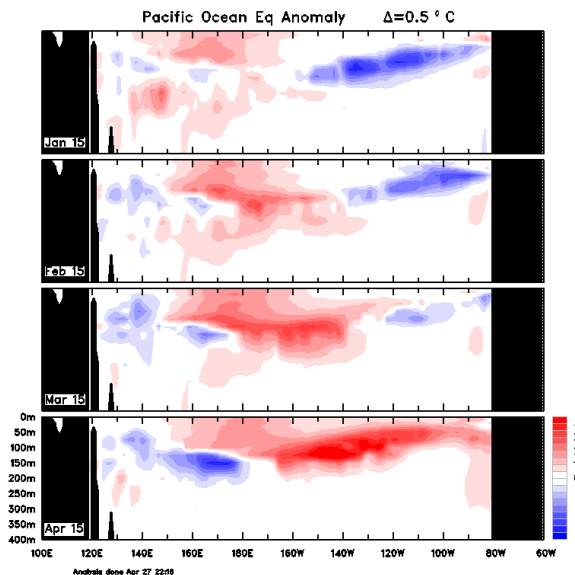
Monthly Average SST Anomaly



Monthly Average SST Deciles



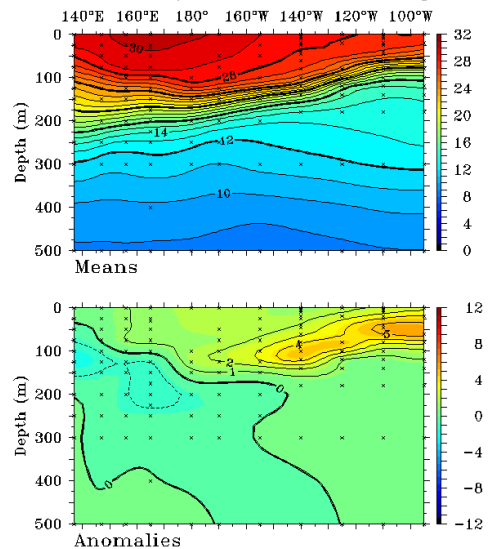
Ocean Sub-surface temperatures



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: May 2 2015 2°S to 2°N Average



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/>



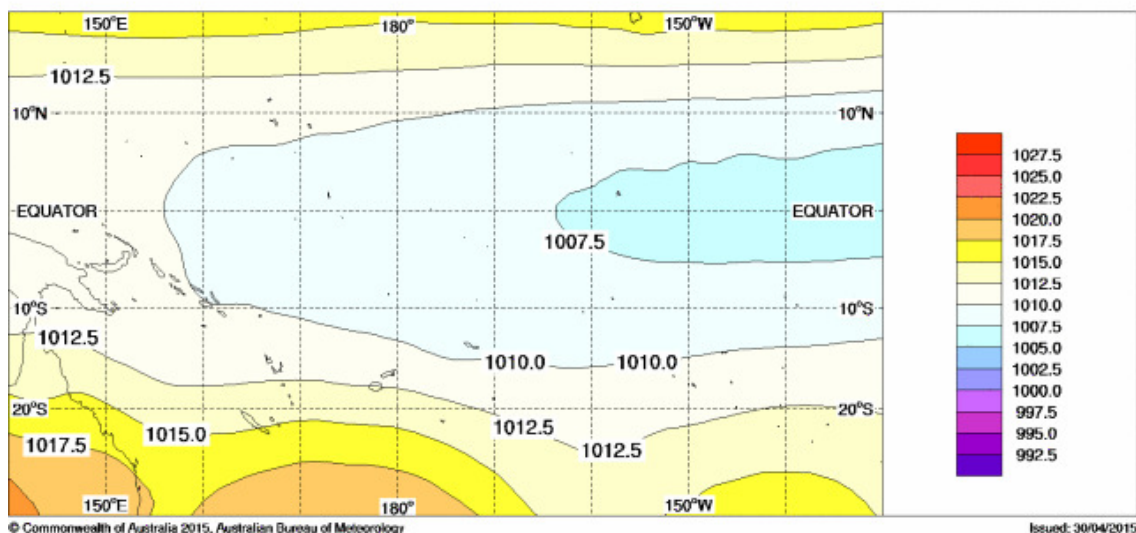
Mean Sea Level Pressure (MSLP)

The Mean Sea Level Pressure (MSLP) anomaly map for April shows anomalies greater than +1 hPa over parts of the far western Pacific. Anomalies greater than +2 hPa stretch to the south of Vanuatu and Fiji and to the east of New Caledonia. Negative anomalies below -1 hPa extended eastwards from 170°W deepening to below -2 hPa by 160°W close to the equator.

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

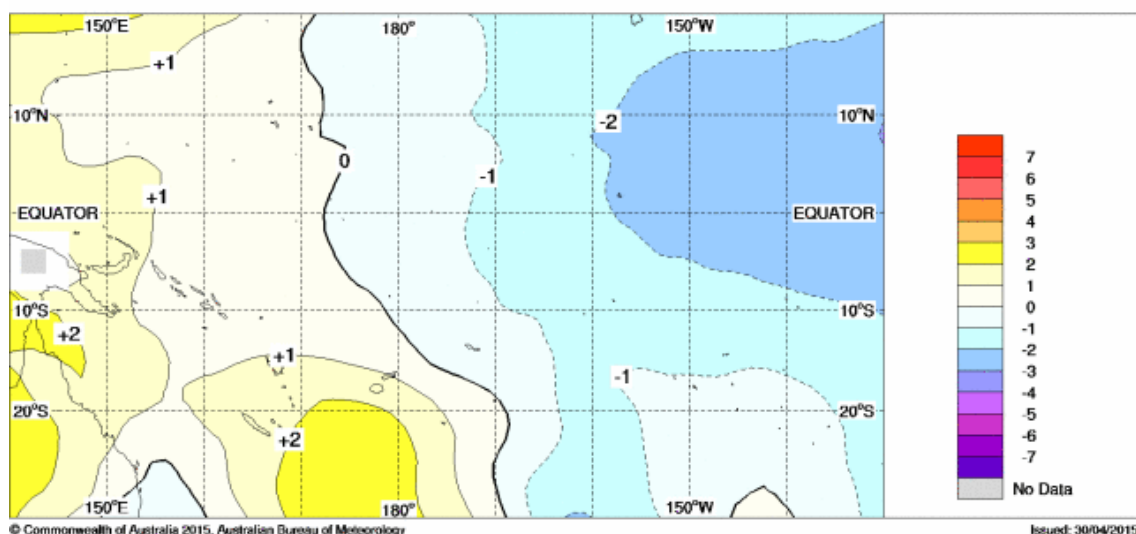
Monthly Mean

MSLP 2.5X2.5 ACCESS OP. ANAL. (hPa) 20150401 0000 20150428 0000



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

MSLP 2.5X2.5 ACCESS OP. ANAL.-NCEP2 (hPa) 20150401 0000 20150428 0000

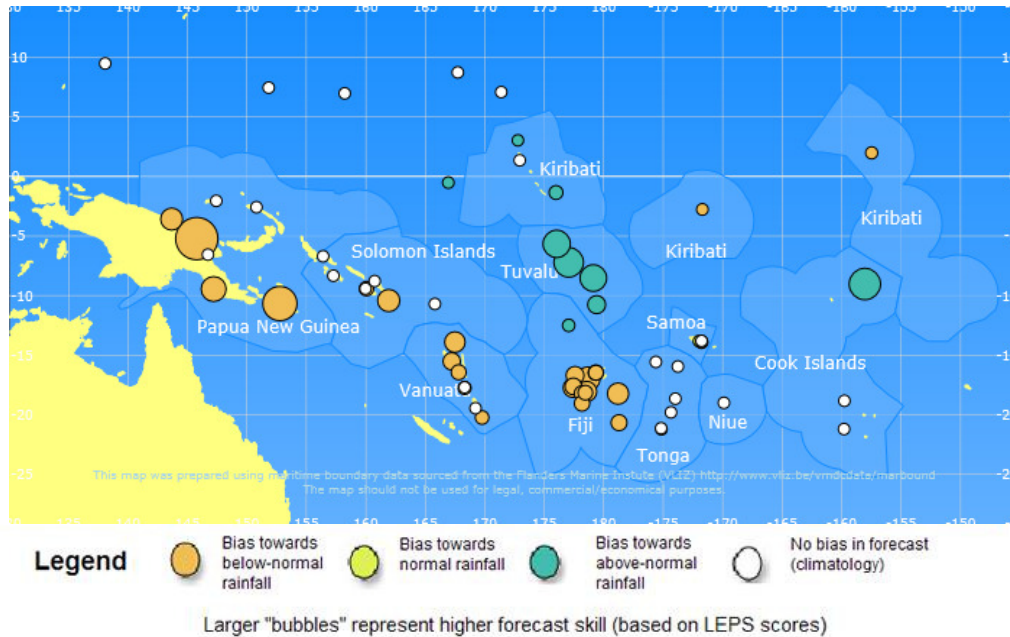


Bureau of Meteorology: South Pacific Circulation Patterns Link: <http://www.bom.gov.au/cgi-bin/climate/cmb.cgi?page=indexa&area=spac>



Model Outlooks

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

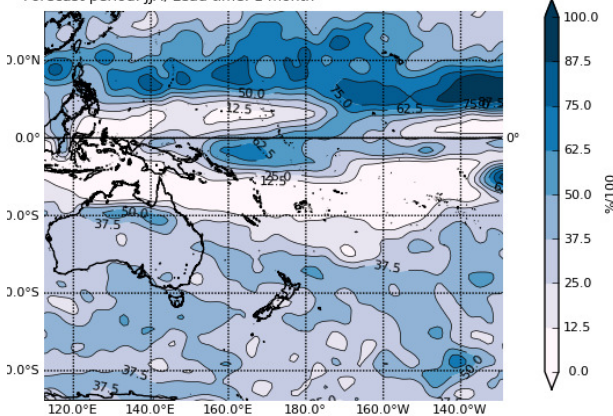


Link to COSPPac Online Climate Outlook Forum for further information: <http://www.bom.gov.au/cosppac/comp/ocof/index.shtml>

POAMA Pacific Seasonal Rainfall Outlook

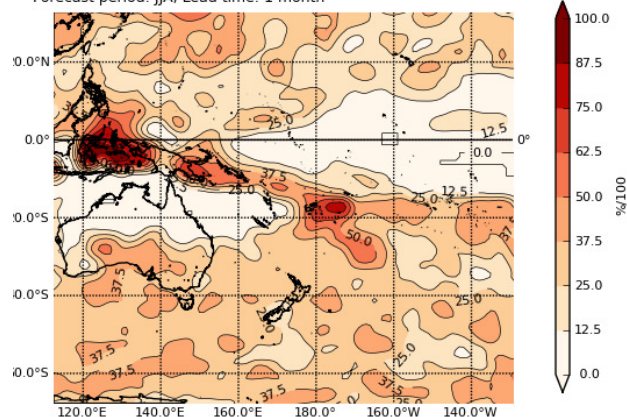
Spatial Map of POAMA Probabilities for Wetter than Normal Season

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_prct_pt3(%/100)
Model initialised: 20150501
Forecast period: JJA, 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_prct_pt1(%/100)
Model initialised: 20150501
Forecast period: JJA, 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 June to August 2015

Station	Country	Lower Tercile	Middle Tercile	Upper Tercile
Aitutaki	Cook Islands	55%	40%	5%
Rarotonga	Cook Islands	45%	50%	5%
Penrhyn	Cook Islands	5%	90%	5%
Chuuk	Federated States of Micronesia	30%	46%	24%
Pohnpei	Federated States of Micronesia	12%	83%	5%
Yap	Federated States of Micronesia	24%	49%	27%
Nadi Airport	Fiji	58%	33%	9%
Rotuma	Fiji	58%	37%	5%
Suva	Fiji	58%	33%	5%
Udu Point	Fiji	61%	34%	5%
Lakeba	Fiji	73%	22%	5%
Nabouwalu	Fiji	48%	47%	5%
Vunisea	Fiji	58%	33%	9%
Arorae	Kiribati	5%	40%	55%
Butaritari	Kiribati	15%	58%	27%
Tabuaeran	Kiribati	5%	50%	45%
Tarawa	Kiribati	9%	42%	49%
Kanton	Kiribati	5%	59%	36%
Kiritimati	Kiribati	5%	68%	27%
Nauru	Nauru	5%	34%	61%
Hanan Airport	Niue	48%	47%	5%
Koror	Palau	45%	46%	9%
Daru	Papua New Guinea	5%	83%	12%
Port Moresby	Papua New Guinea	73%	9%	18%
Madang	Papua New Guinea	64%	21%	15%
Misima	Papua New Guinea	61%	30%	9%
Momote	Papua New Guinea	33%	27%	40%
Kavieng	Papua New Guinea	43%	27%	30%
Wewak W.O	Papua New Guinea	24%	55%	21%
Nadzab	Papua New Guinea	76%	9%	15%

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 June to August 2015

Station	Country	Lower Tercile	Middle Tercile	Upper Tercile
Kwajalein	Republic of Marshall Islands	18%	61%	21%
Majuro	Republic of Marshall Islands	30%	64%	6%
Apia	Samoa	21%	74%	5%
Faleolo	Samoa	21%	74%	5%
Honiara	Solomon Islands	46%	30%	24%
Munda	Solomon Islands	61%	12%	27%
Santa Cruz	Solomon Islands	42%	53%	5%
Taro	Solomon Islands	33%	24%	43%
Kira kira	Solomon Islands	64%	30%	6%
Nuku'alofa	Tonga	58%	27%	15%
Keppel	Tonga	88%	7%	5%
Haapai	Tonga	79%	16%	5%
Lupepau'u	Tonga	79%	16%	5%
Niuafuou	Tonga	88%	7%	12%
Funafuti	Tuvalu	12%	55%	33%
Nanumea	Tuvalu	5%	34%	61%
Nui	Tuvalu	5%	37%	58%
Niulakita	Tuvalu	21%	67%	12%
Aneityum	Vanuatu	27%	49%	24%
Bauerfield (Efate)	Vanuatu	5%	89%	6%
Lamap (Malekula)	Vanuatu	5%	90%	5%
Pekoa	Vanuatu	5%	90%	5%
Port Vila	Vanuatu	5%	89%	6%
Sola	Vanuatu	36%	59%	5%
White Grass	Vanuatu	5%	90%	5%

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



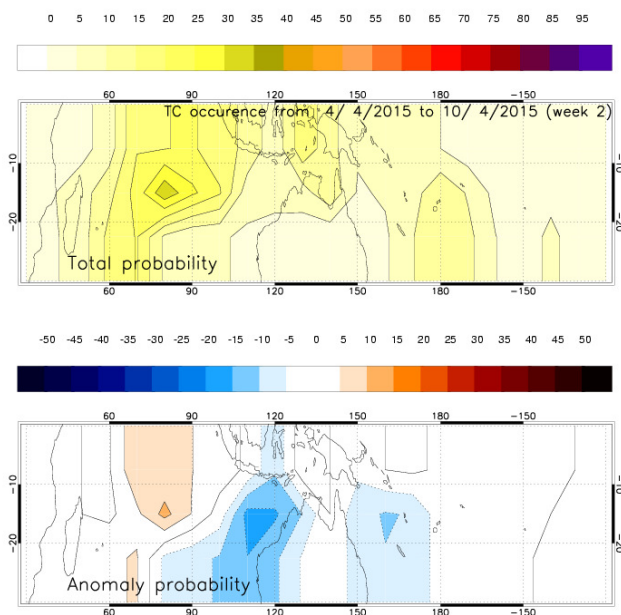
Cyclones and Other Information

Tropical Cyclone Information

The southern hemisphere tropical cyclone season runs between 1 November and 30 April. Seven cyclones passed through or developed in the southwest Pacific in the 2014/15 season. Namely, Marcia, Niko, Ola, Pam, Rebuen, Nathan and Solo. The long-term average is ten cyclones for the southwest Pacific region east of the tip of Cape York, Queensland (east of 142°E).

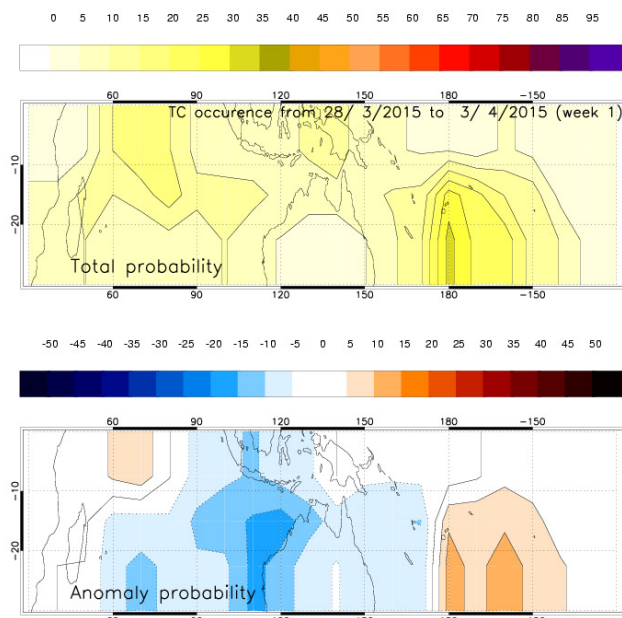
MeteoFrance Tropical Cyclone Outlook Link: <http://www.meteo.nc/cyclone/coin-des-experts>

Week 2

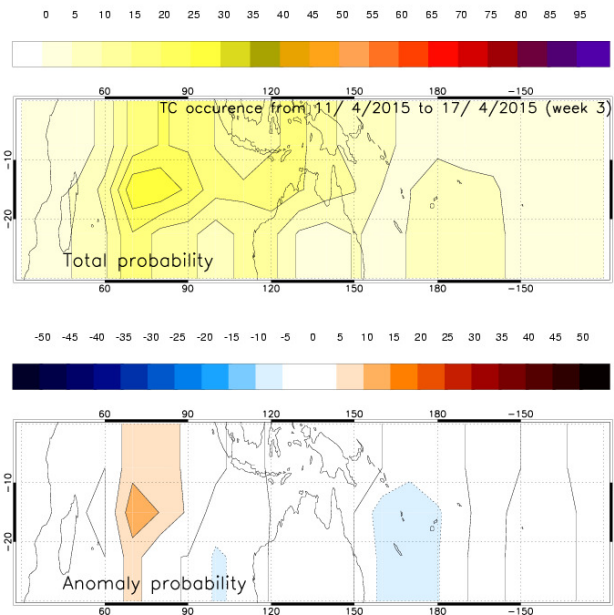


MeteoFrance Tropical Cyclone Weekly Forecasts

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

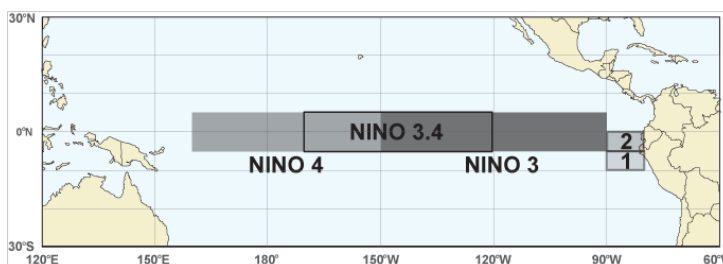
20 degrees Celsius Isotherm Depth

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



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