ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
2 June 2014

Outline

Summary

Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

U.S. Seasonal Precipitation and Temperature Outlooks

Summary

Summary

ENSO Alert System Status: El Niño Watch

ENSO-neutral conditions continue.*

Sea surface temperatures (SST) are above-average across the equatorial Pacific Ocean.

Tropical rainfall is near-average across Indonesia and the tropical Pacific.

Chance of El Niño increases during the remainder of the year, exceeding 65% by summer.*

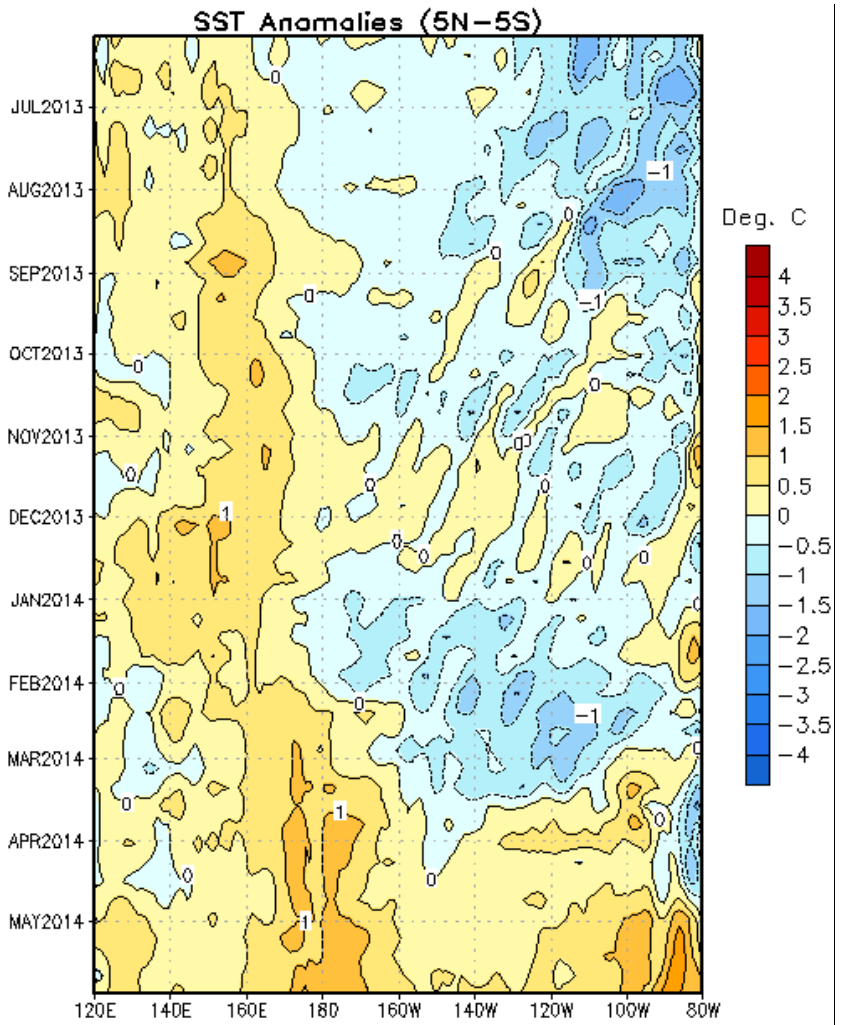
* Note: These statements are updated once a month in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

Recent Evolution of Equatorial Pacific SST Departures (°C)

During May-September 2013, well below-average SSTs were observed over the eastern half of the Pacific.

From January- February 2014, SSTs were mostly below average across the eastern equatorial Pacific.

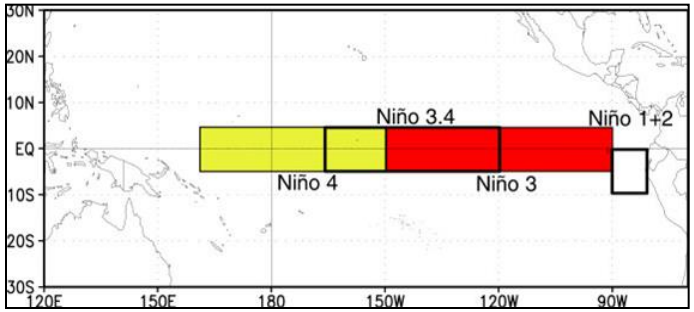
Since March, SST anomalies have been above average across the Pacific Ocean, especially in the eastern Pacific and near the Date Line.

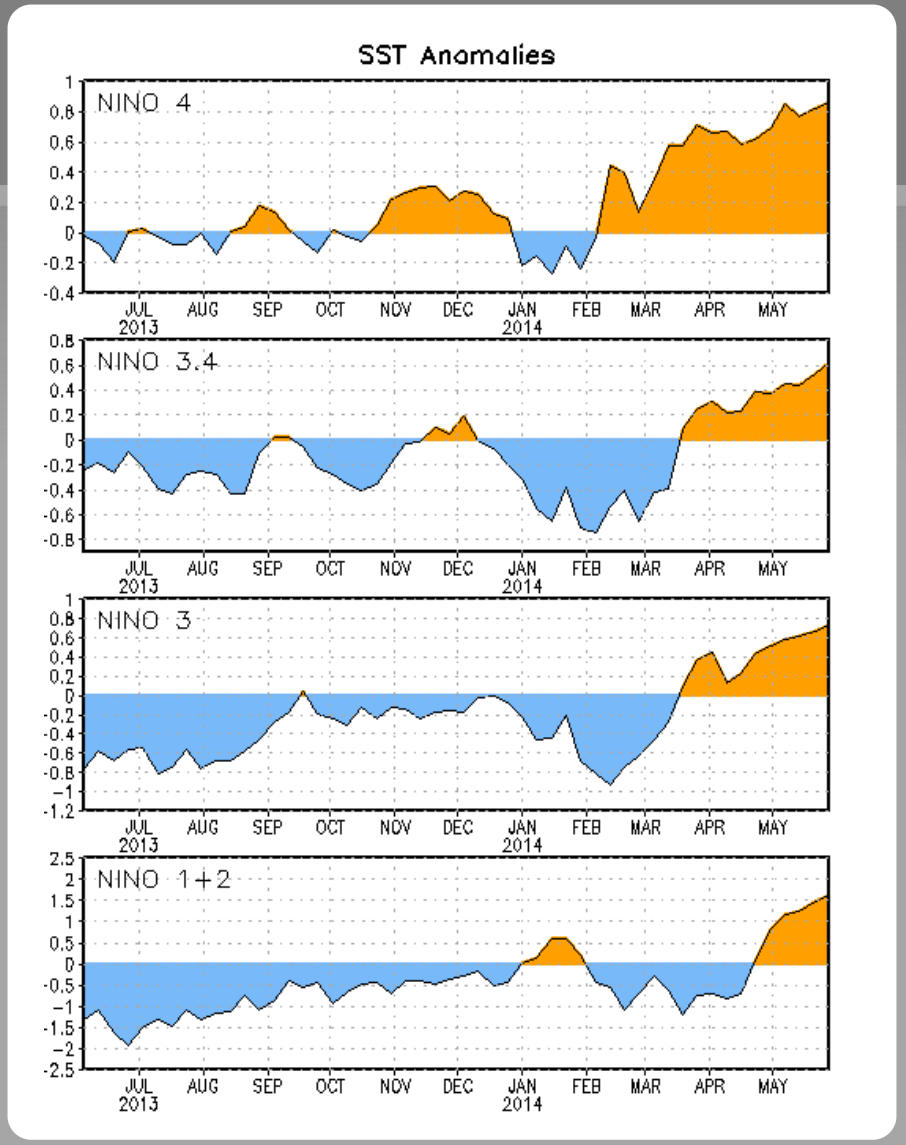


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

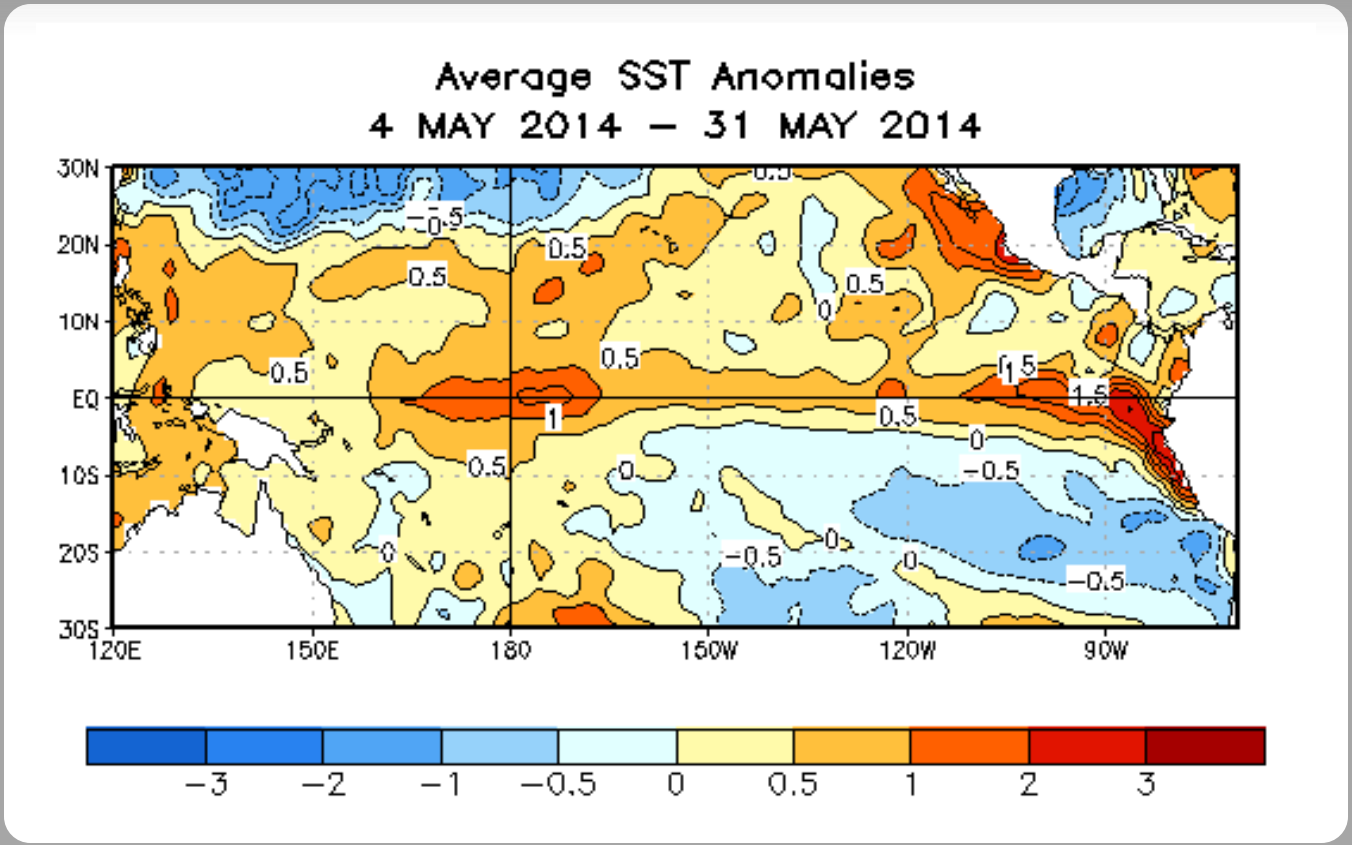
Niño 4	0.9ºC
Niño 3.4	0.6ºC
Niño 3	0.7ºC
Niño 1+2	1.6ºC





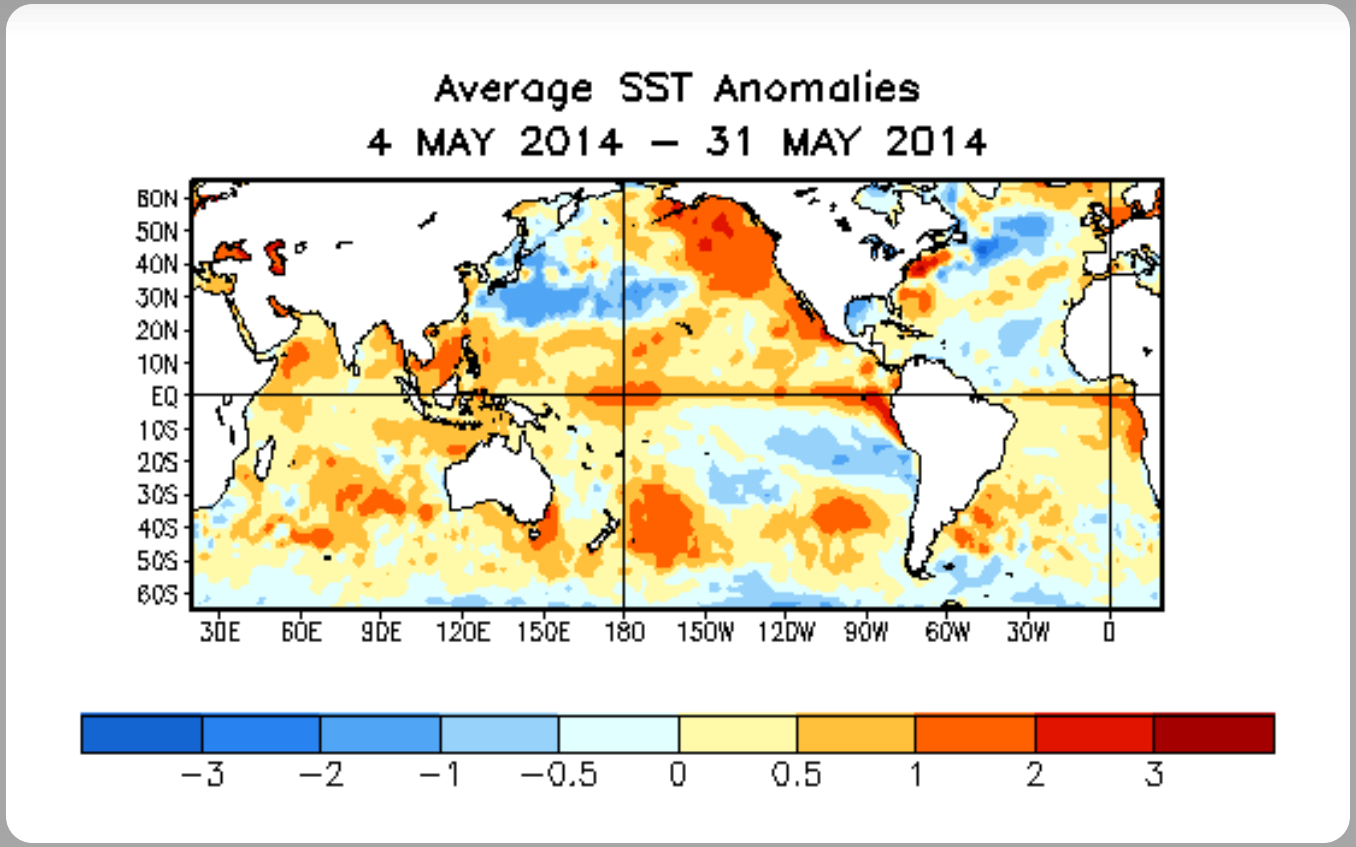
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across the Pacific Ocean, especially near the Date Line and in the eastern Pacific.



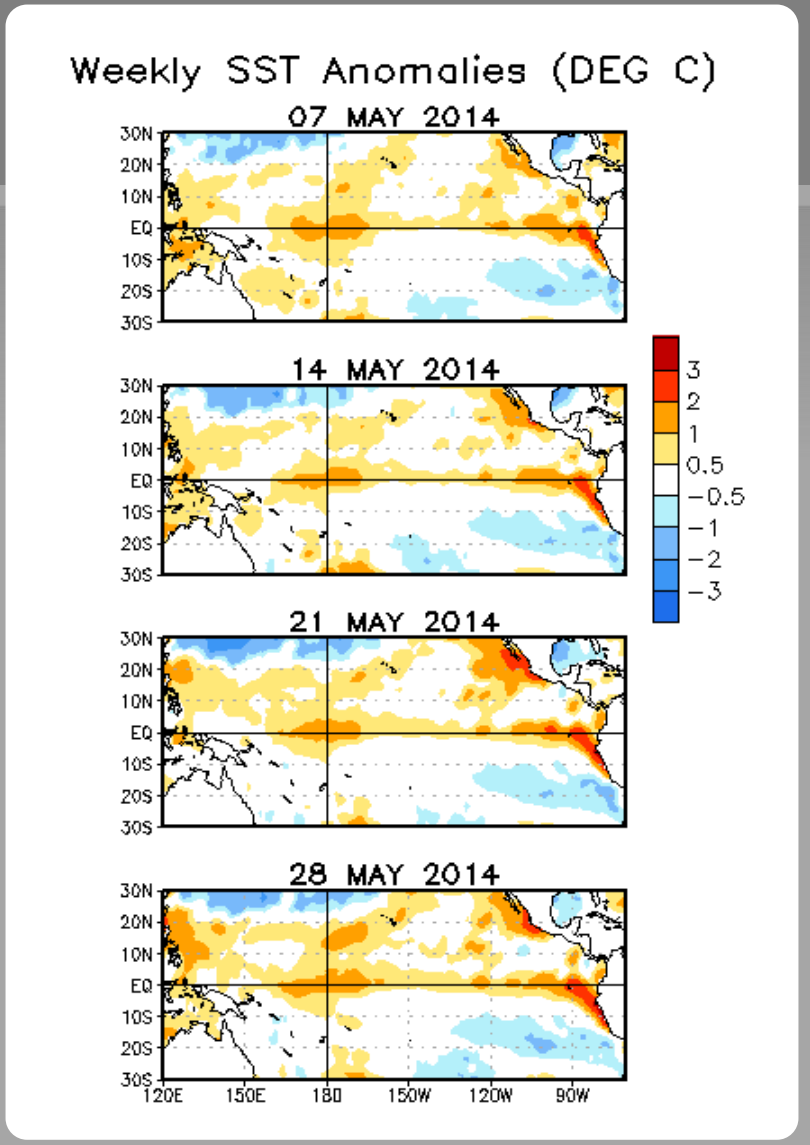
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, above-average equatorial SSTs were observed across the Pacific, near Indonesia, in the western Indian Ocean, and in the eastern Atlantic Ocean.



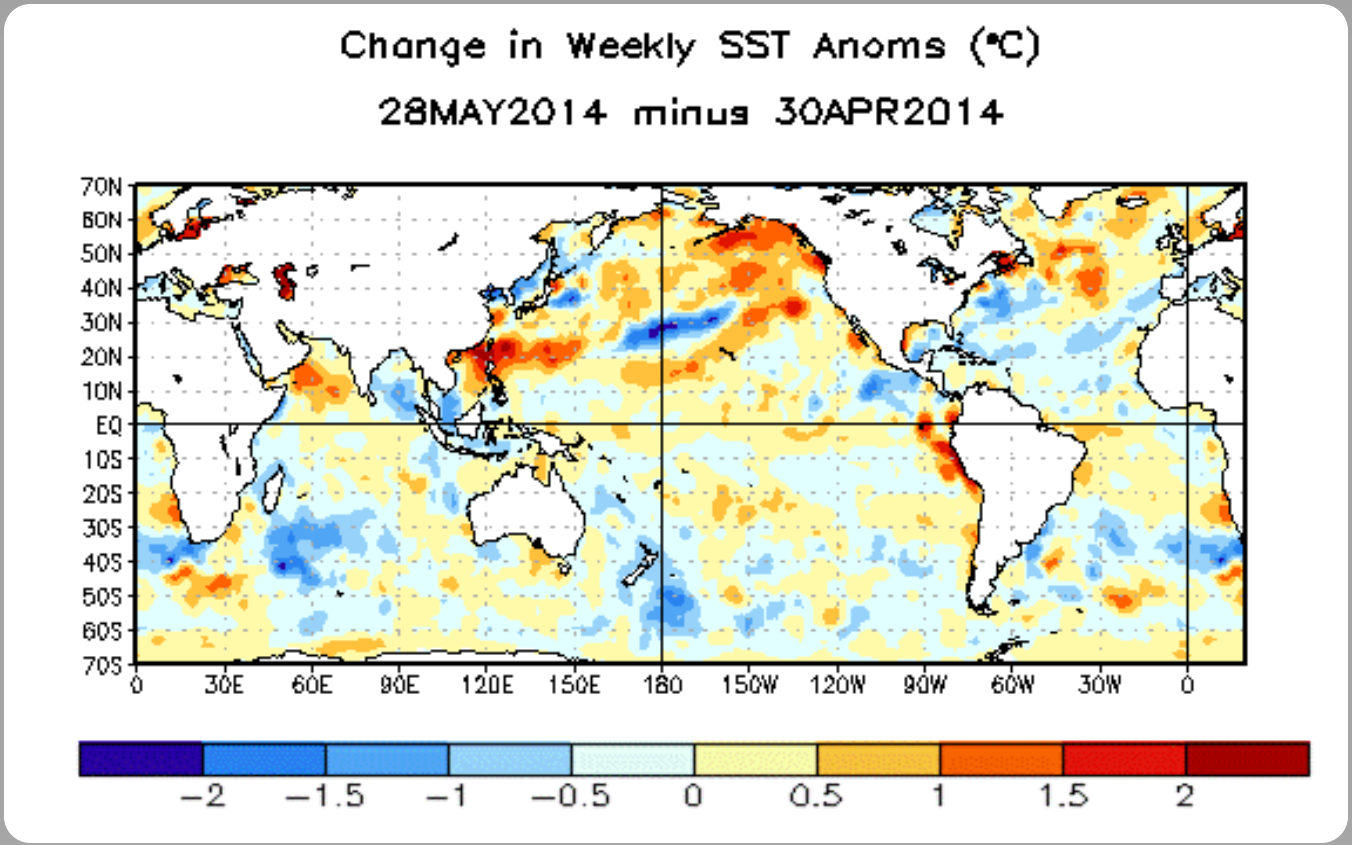
Weekly SST Departures during the Last Four Weeks

During the last four weeks, the SST anomalies remained positive near the International Date Line and increased across the eastern Pacific.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, changes in equatorial SST anomalies were positive near the coast of South America.



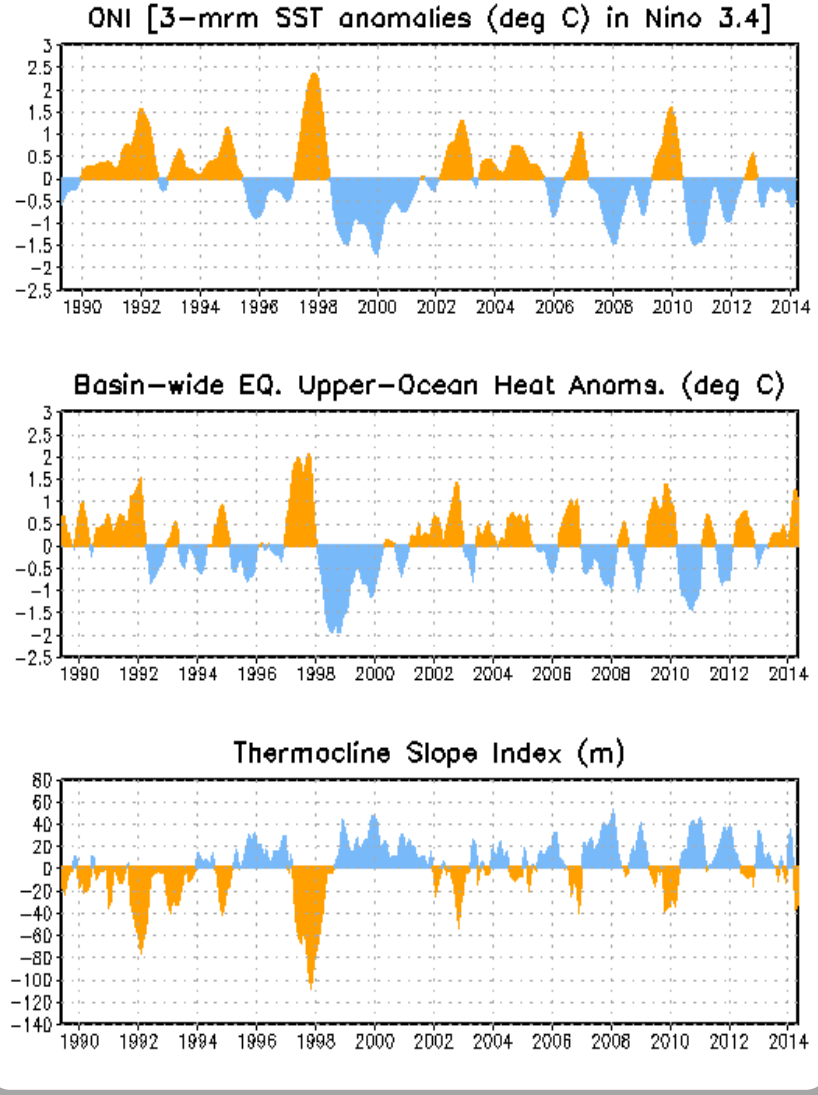
Upper-Ocean Conditions in the Equatorial Pacific

The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

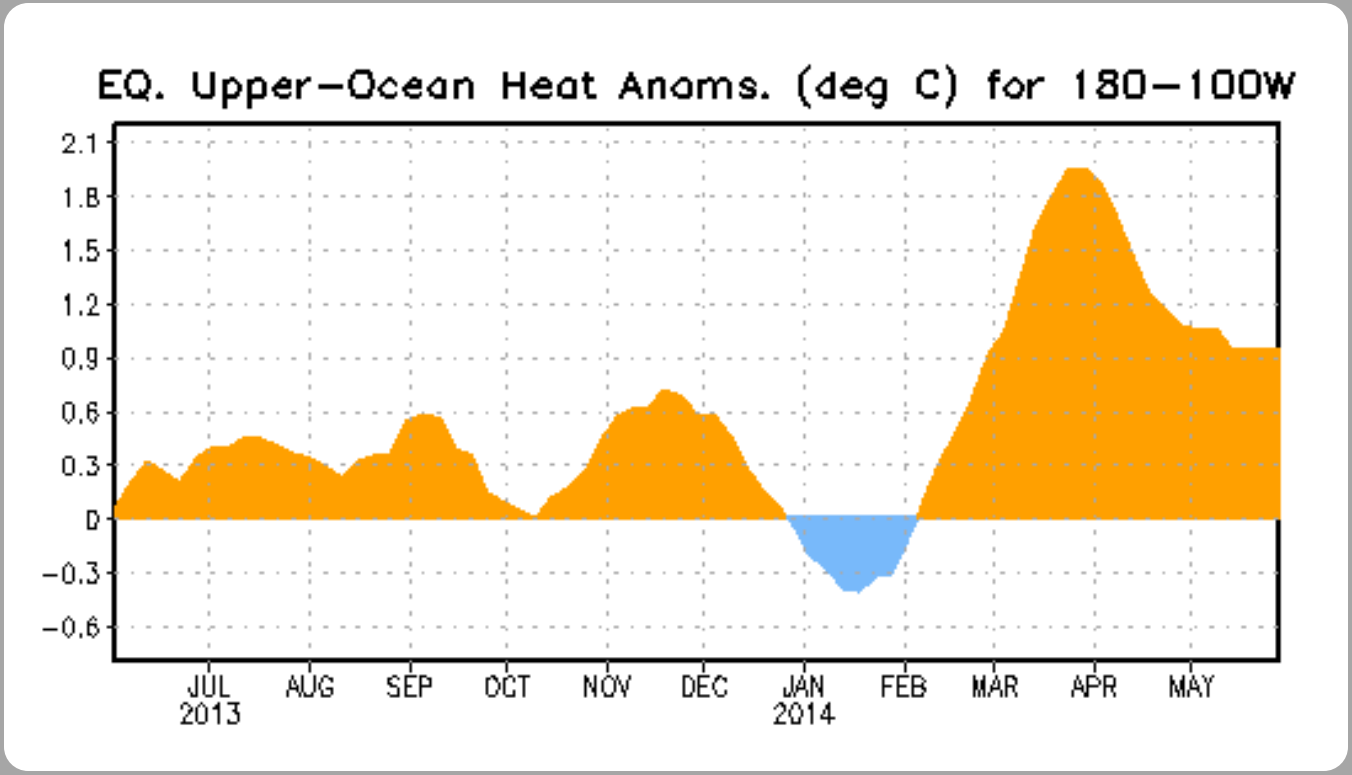
Recent values of the upper-ocean heat anomalies (positive) and thermocline slope index (negative) reflect a progression toward El Niño.

The monthly thermocline slope index represents the difference in anomalous depth of the 20°C isotherm between the western Pacific (160°E-150°W) and the eastern Pacific (90°-140°W).



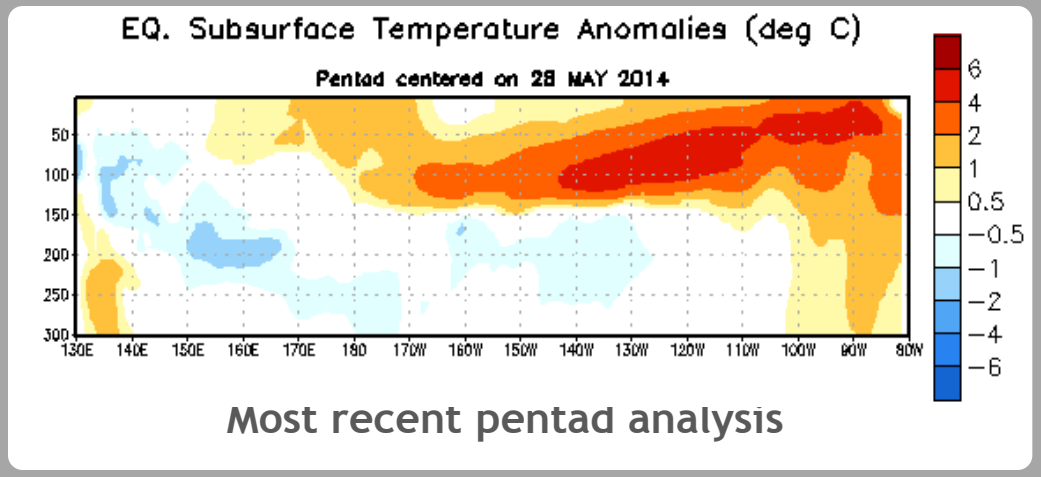
Weekly Central & Eastern Pacific Upper-Ocean (0-300 m) Average Temperature Anomalies

Subsurface temperature anomalies increased during June, August, and in October 2013. From January - March 2014, temperature anomalies strongly increased. Since April 2014, the positive anomalies have weakened.



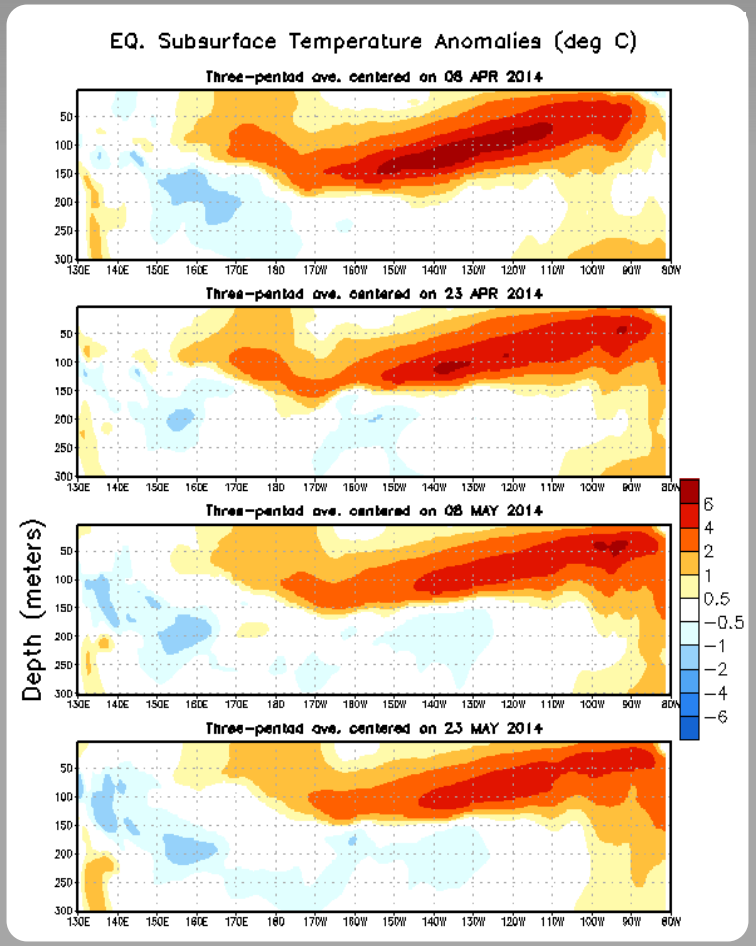
Sub-Surface Temperature Departures in the Equatorial Pacific

Positive subsurface anomalies remain widespread across most of the Pacific basin.



Most recent pentad analysis

The weakening of the positive temperature anomalies during April represented the effects of the upwelling phase of the Kelvin wave.

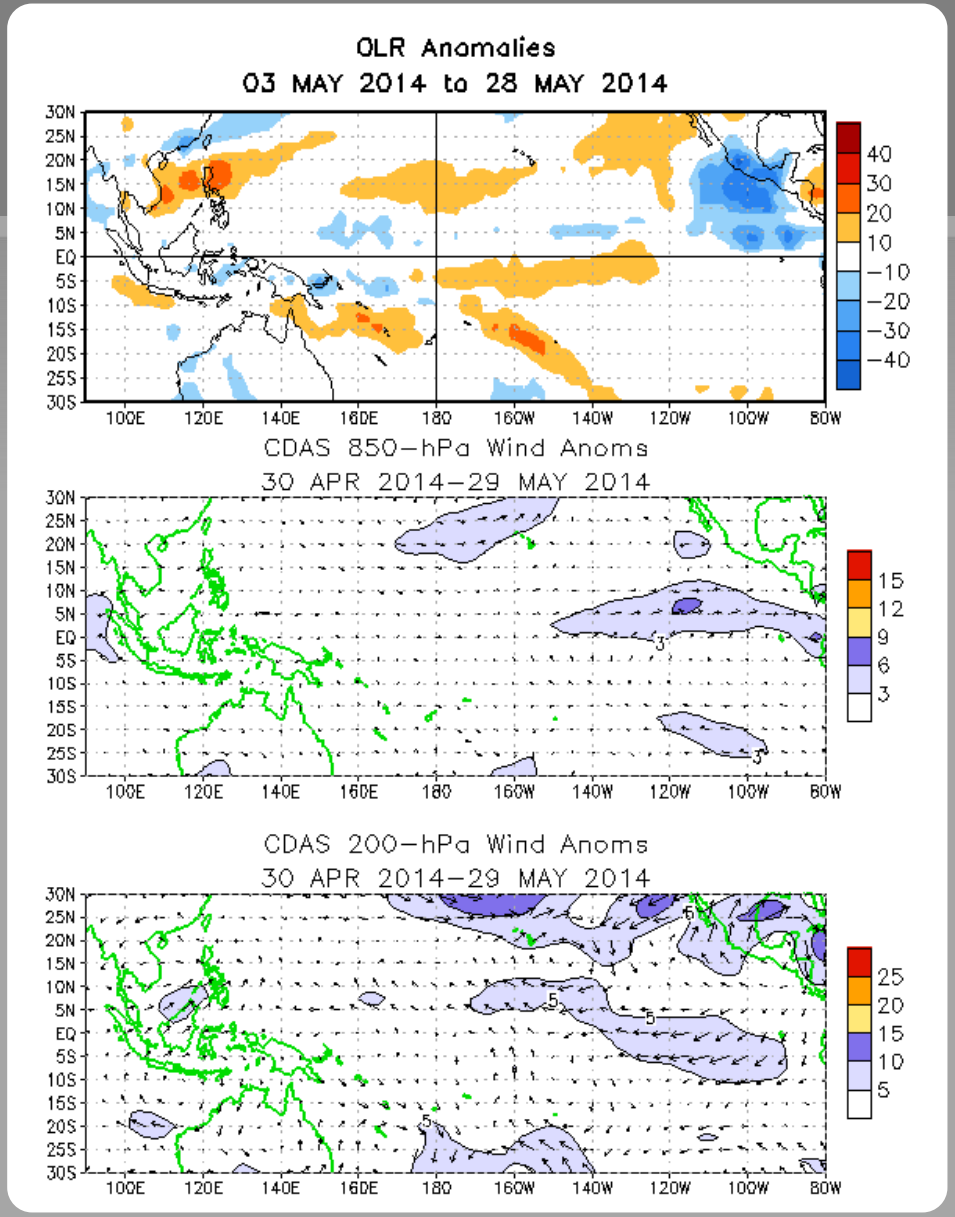


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation, red shading) were observed south of the Equator near and east of the Date Line.

Anomalous low-level (850-hPa) westerly winds were observed across the east-central and eastern equatorial Pacific.

Predominantly easterly wind anomalies are evident in the upper-level (200-hPa) winds in the east-central and eastern equatorial Pacific Ocean.



Intraseasonal Variability

Intraseasonal variability in the atmosphere (wind and pressure), which is often related to the Madden-Julian Oscillation (MJO), can significantly impact surface and subsurface conditions across the Pacific Ocean.

Related to this activity:

Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

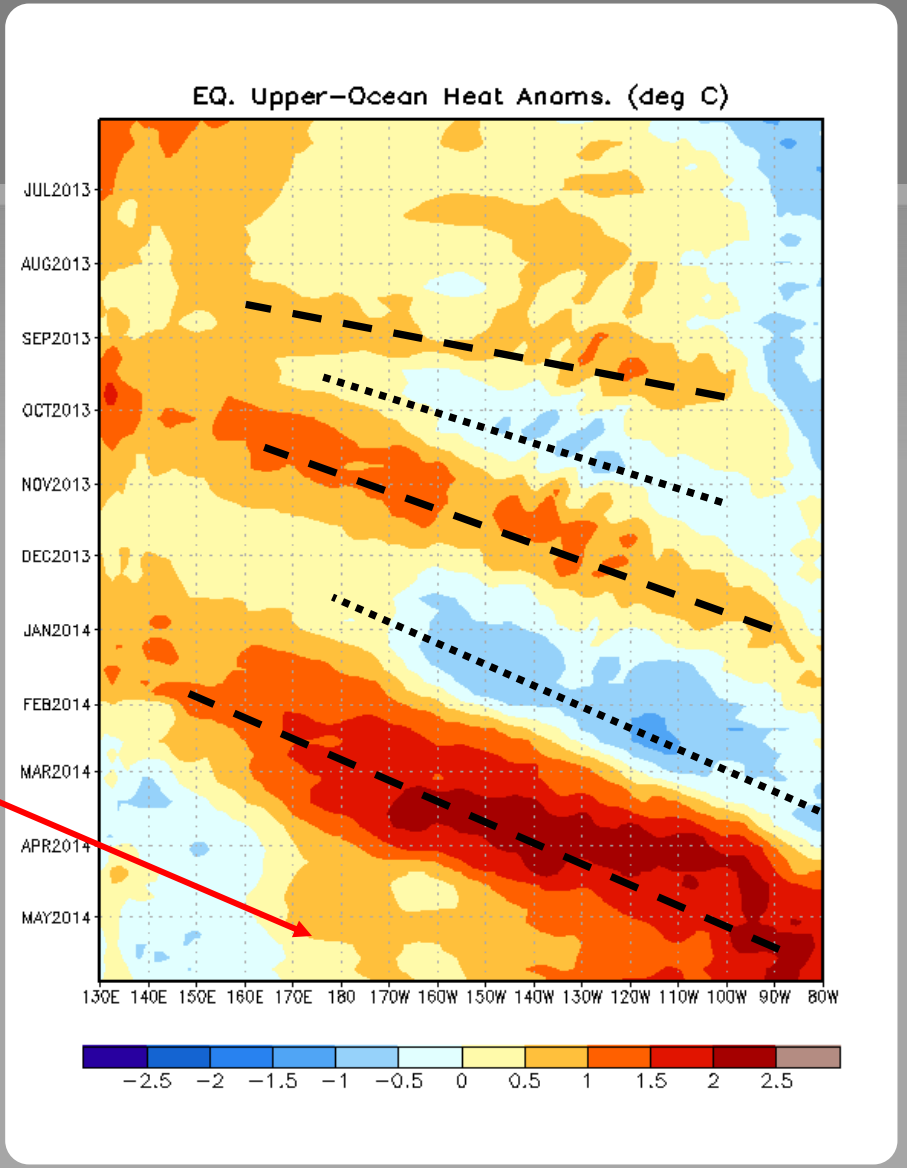
Above-average heat content persisted from June- September 2013 across the equatorial Pacific (except in the far eastern basin).

Enhanced oceanic Kelvin wave activity has been observed since early August 2013.

During January - April 2014, the downwelling phase of a strong Kelvin wave crossed the Pacific.

Since April, the positive anomalies have persisted in the eastern Pacific, and weakened across the western and central Pacific.

Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

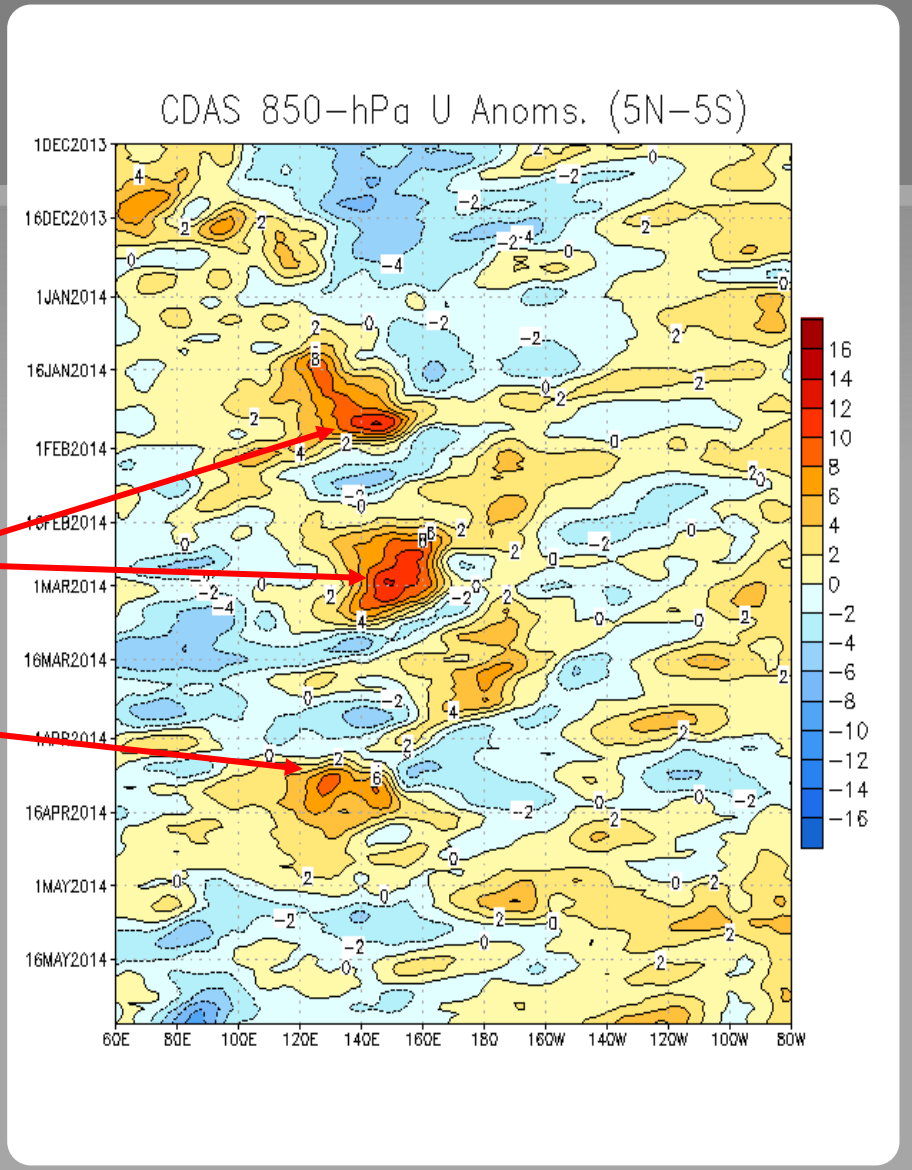


Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

During the last halves of January and February 2014, strong westerly wind bursts occurred over the western equatorial Pacific.

A weaker westerly wind burst occurred in early April 2014.

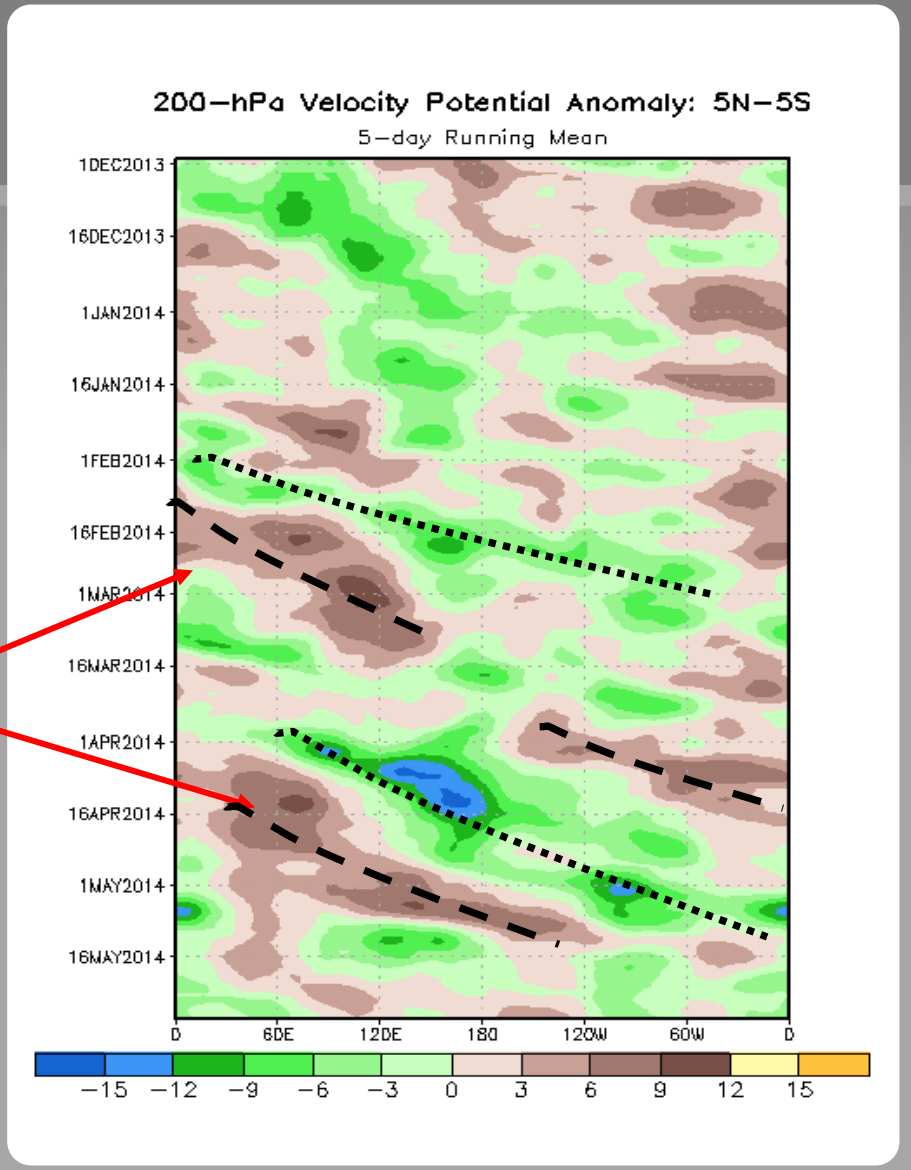
Recently, low-level westerly wind anomalies have been observed across the eastern half of the Pacific.



Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

During late February and April-May 2014, eastward propagation occurred in the pattern of velocity potential anomalies.



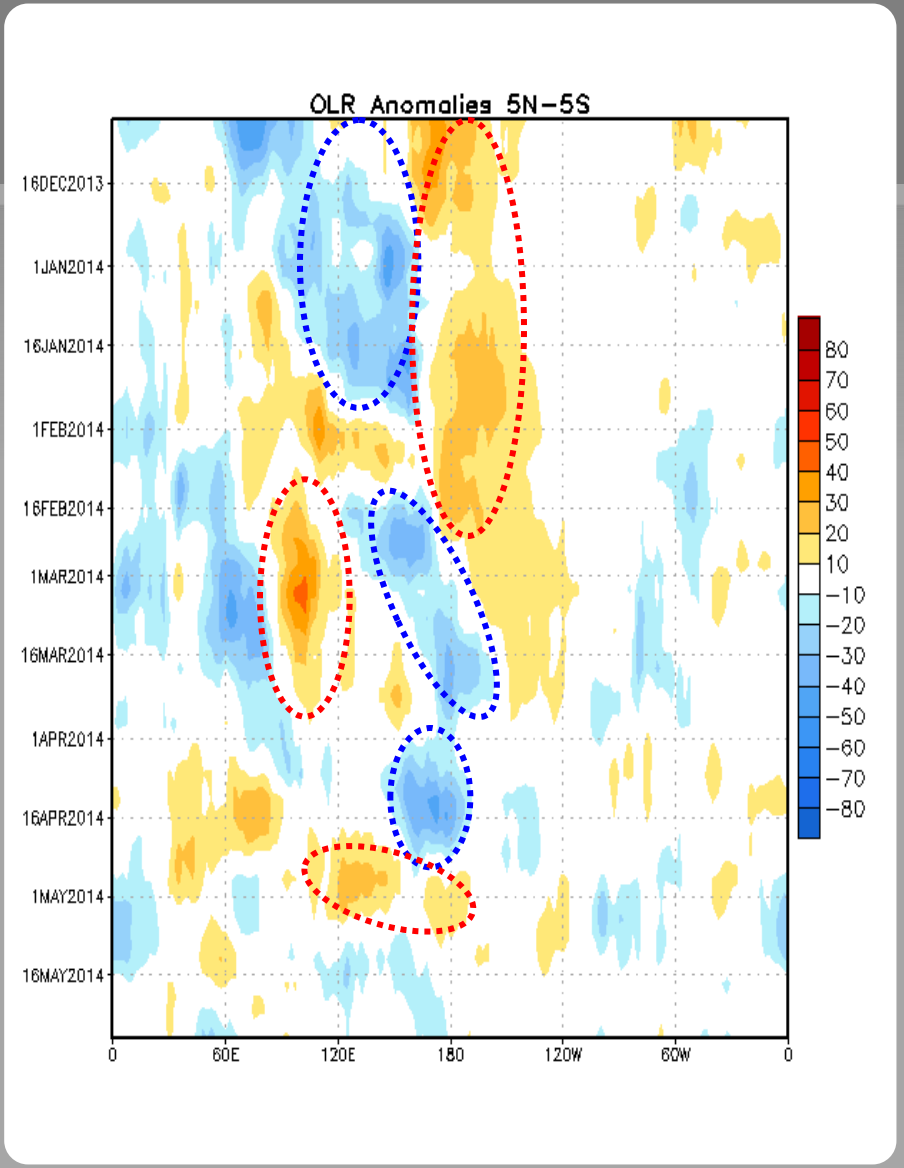
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)

Outgoing Longwave Radiation (OLR) Anomalies

Until January/February 2014, below-average OLR was generally evident over the western Pacific and above-average OLR persisted near the Date Line.

During February and March 2014, above-average OLR persisted near western Indonesia, while below-average OLR was observed over the western or central equatorial Pacific.

Recently, OLR has been near average across Indonesia and the Pacific.



Drier-than-average Conditions (orange/red shading)
Wetter-than-average Conditions (blue shading)

Oceanic Niño Index (ONI)

The ONI is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.

Defined as the three-month running-mean SST departures in the Niño 3.4 region. Departures are based on a set of improved homogeneous historical SST analyses (Extended Reconstructed SST – ERSST.v3b). The SST reconstruction methodology is described in Smith et al., 2008, J. Climate, vol. 21, 2283-2296.)

Used to place current events into a historical perspective

NOAA's operational definitions of El Niño and La Niña are keyed to the ONI index.

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a positive ONI greater than or equal to +0.5°C.

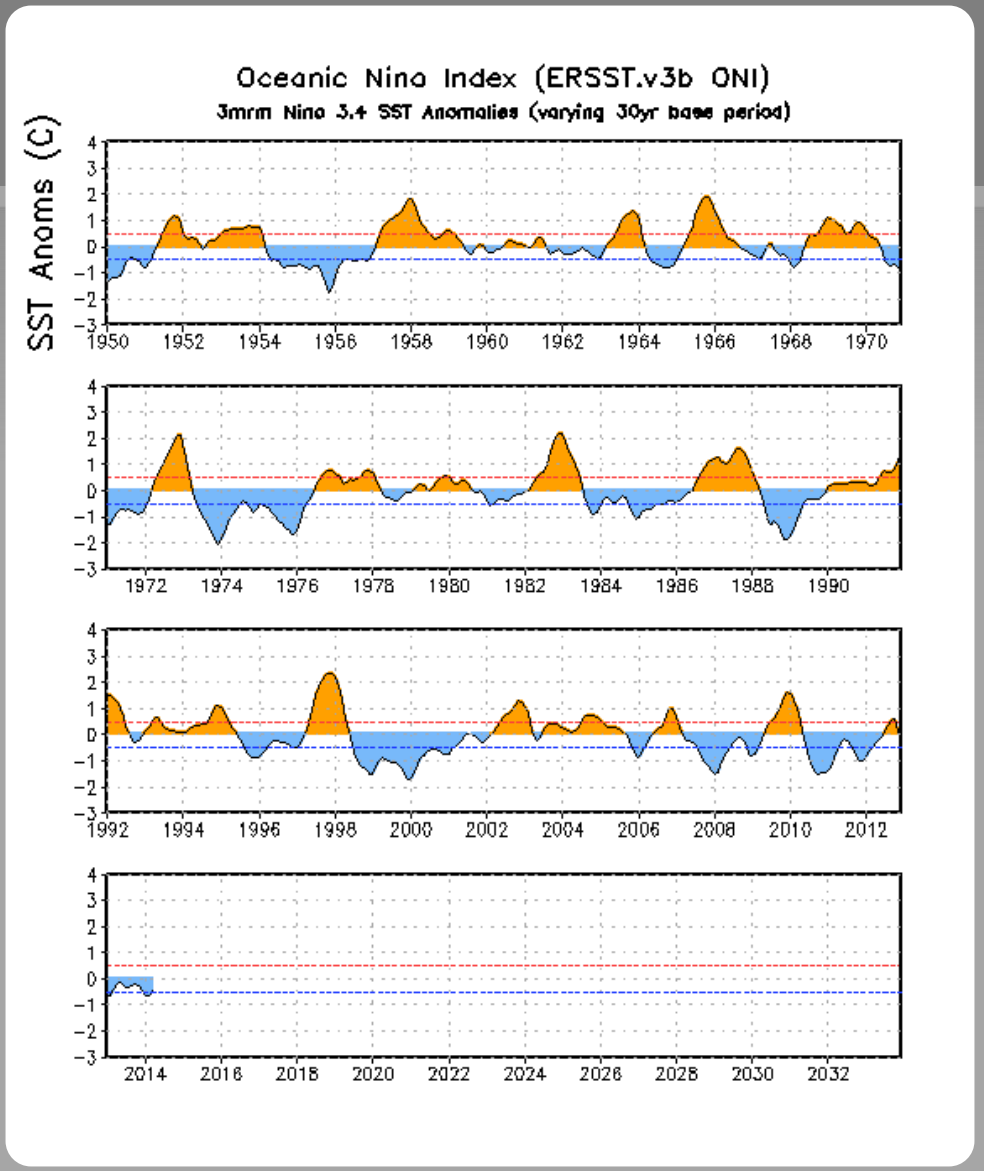
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5° C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

ONI (°C): Evolution since 1950

The most recent ONI value (February - April 2014) is -0.5°C.



El Niño

Neutral

La Niña

Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v3b

El Niño	Highest ONI Value
JJA 1951 - DJF 1951/52	1.2
DJF 1952/53 - JFM 1954	0.8
MAM 1957 - JJA 1958	1.8
OND 1958 - FMA 1959	0.6
MJJ 1963 - JFM 1964	1.4
AMJ 1965 - MAM 1966	1.9
JAS 1968 - DJF 1969/70	1.1
AMJ 1972 - FMA 1973	2.1
ASO 1976 - JFM 1977	0.8
ASO 1977 - JFM 1978	0.8
AMJ 1982 - MJJ 1983	2.2
JAS 1986 - JFM 1988	1.6
AMJ 1991 - MJJ 1992	1.6
ASO 1994 - FMA 1995	1.2
AMJ 1997 - MAM 1998	2.4
AMJ 2002 - JFM 2003	1.3
JJA 2004 - DJF 2004/05	0.7
ASO 2006 - DJF 2006/07	1.0
JJA 2009 - MAM 2010	1.6

La Niña	Lowest ONI Value
ASO 1949 - JAS 1950	-1.4
SON 1950 - JFM 1951	-0.8
AMJ 1954 – NDJ 1956/57	-1.7
AMJ 1964 - DJF 1964/65	-0.8
JJA 1970 - DJF 1971/72	-1.3
AMJ 1973 - JJA 1974	-2.0
SON 1974 - MAM 1976	-1.7
ASO 1983 - DJF 1983/84	-0.9
SON 1984 - ASO 1985	-1.1
AMJ 1988 - AMJ 1989	-1.9
ASO 1995 - FMA 1996	-0.9
JJA 1998 - FMA 2001	-1.7
OND 2005 - FMA 2006	-0.9
JAS 2007 - MJJ 2008	-1.5
OND 2008 - FMA 2009	-0.8
JJA 2010 - MAM 2011	-1.5
ASO 2011 - FMA 2012	-1.0

NOTE (Mar. 2012): The historical values of the ONI have slightly changed due to an update in the climatology. Please click here for more details on the methodology.

Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v3b

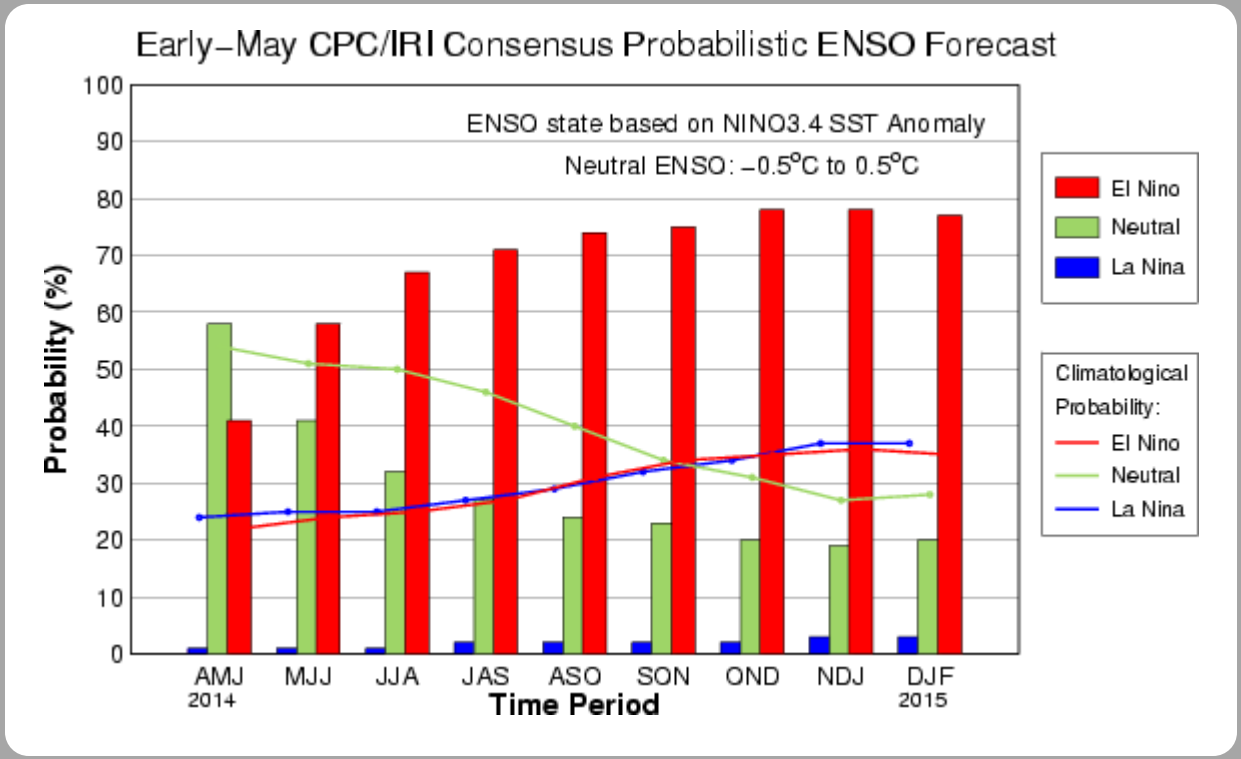
Recent Pacific warm (red) and cold (blue) episodes based on a threshold of +/- 0.5 °C for the Oceanic Nino Index (ONI) [3 month running mean of ERSST.v3b SST anomalies in the Nino 3.4 region (5N-5S, 120-170W)]. For historical purposes El Niño and La Niña episodes are defined when the threshold is met for a minimum of 5 consecutive over-lapping seasons. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2002	-0.2	0.0	0.1	0.3	0.5	0.7	0.8	0.8	0.9	1.2	1.3	1.3
2003	1.1	0.8	0.4	0.0	-0.2	-0.1	0.2	0.4	0.4	0.4	0.4	0.3
2004	0.3	0.2	0.1	0.1	0.2	0.3	0.5	0.7	0.8	0.7	0.7	0.7
2005	0.6	0.4	0.3	0.3	0.3	0.3	0.2	0.1	0.0	-0.2	-0.5	-0.8
2006	-0.9	-0.7	-0.5	-0.3	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.0
2007	0.7	0.3	-0.1	-0.2	-0.3	-0.3	-0.4	-0.6	-0.8	-1.1	-1.2	-1.4
2008	-1.5	-1.5	-1.2	-0.9	-0.7	-0.5	-0.3	-0.2	-0.1	-0.2	-0.5	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.2	0.4	0.5	0.6	0.8	1.1	1.4	1.6
2010	1.6	1.3	1.0	0.6	0.1	-0.4	-0.9	-1.2	-1.4	-1.5	-1.5	-1.5
2011	-1.4	-1.2	-0.9	-0.6	-0.3	-0.2	-0.2	-0.4	-0.6	-0.8	-1.0	-1.0
2012	-0.9	-0.6	-0.5	-0.3	-0.2	0.0	0.1	0.4	0.5	0.6	0.2	-0.3
2013	-0.6	-0.6	-0.4	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.4
2014	-0.6	-0.6	-0.5									

CPC/IRI Probabilistic ENSO Outlook

Updated: 8 May 2014

The chance of El Niño increases during the remainder of 2014, exceeding 65% by summer (JJA) and peaking near 80% during the late fall/early winter.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

Most models predict either ENSO-neutral (-0.5°C to +0.5°C) or El Niño (greater or equal to +0.5°C) during the rest of 2014.

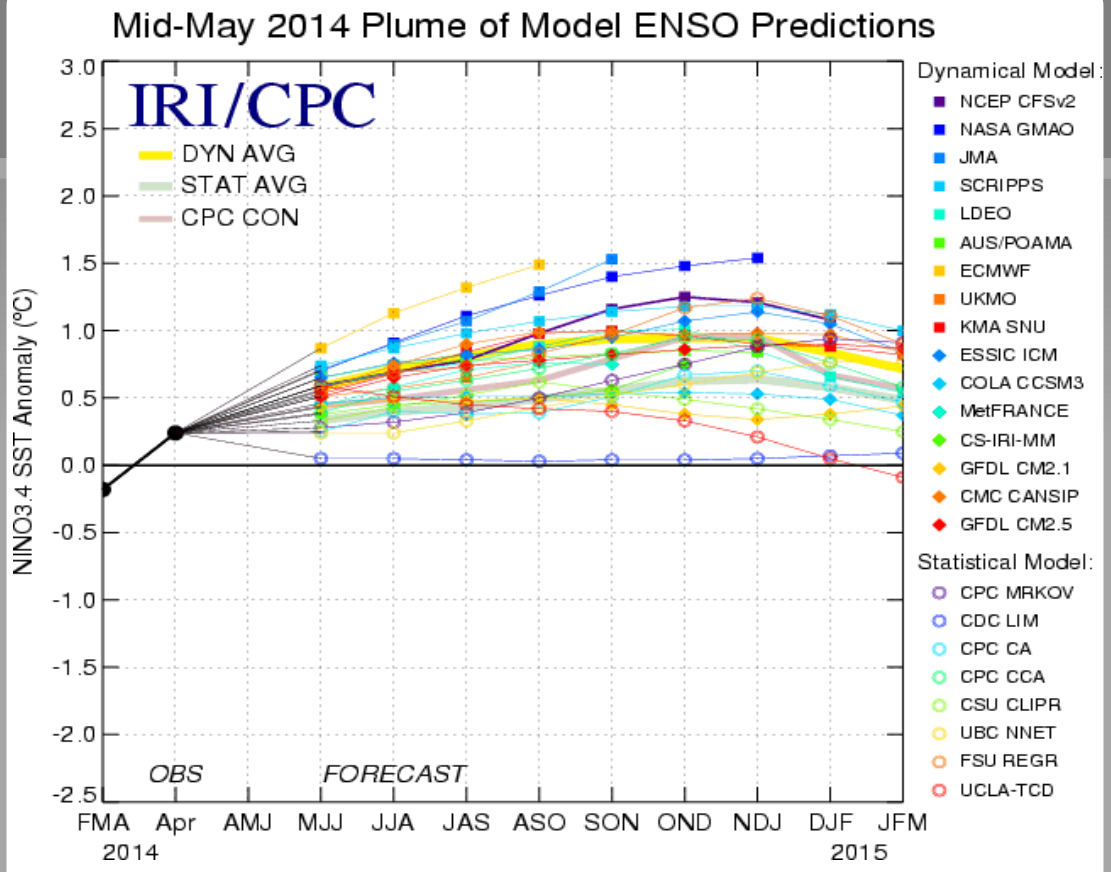
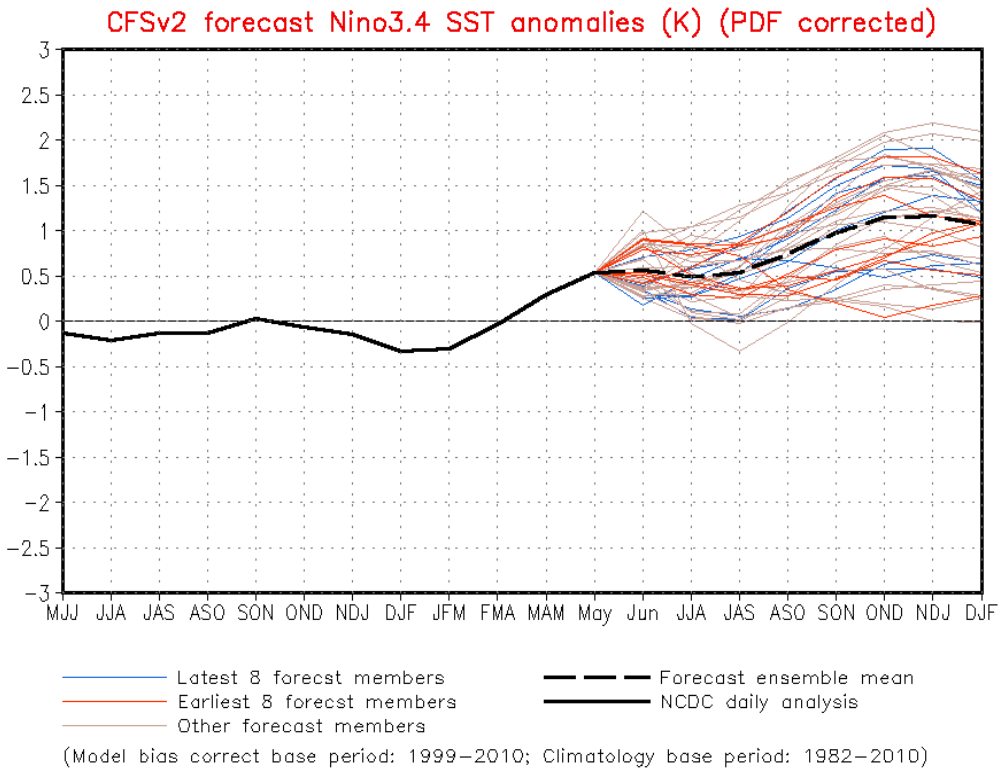


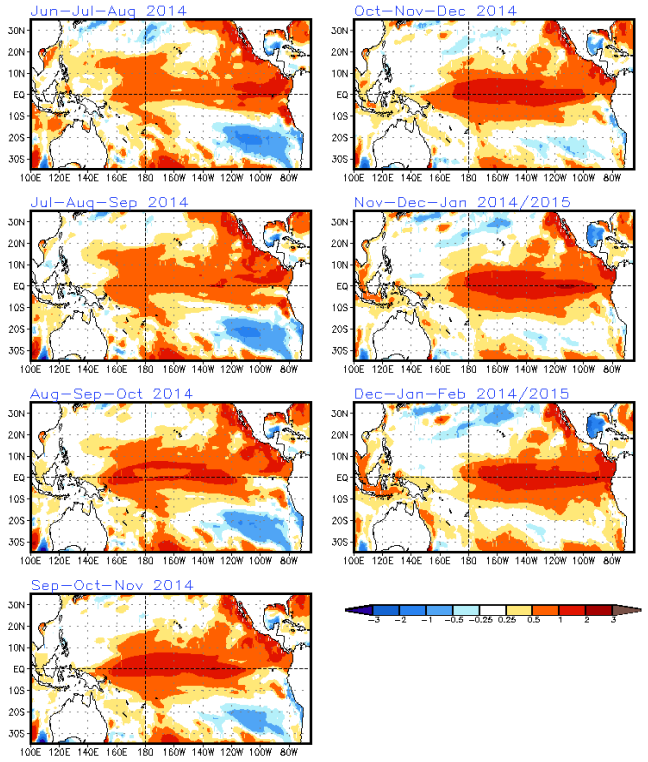
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 13 May 2014).

SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 2 June 2014

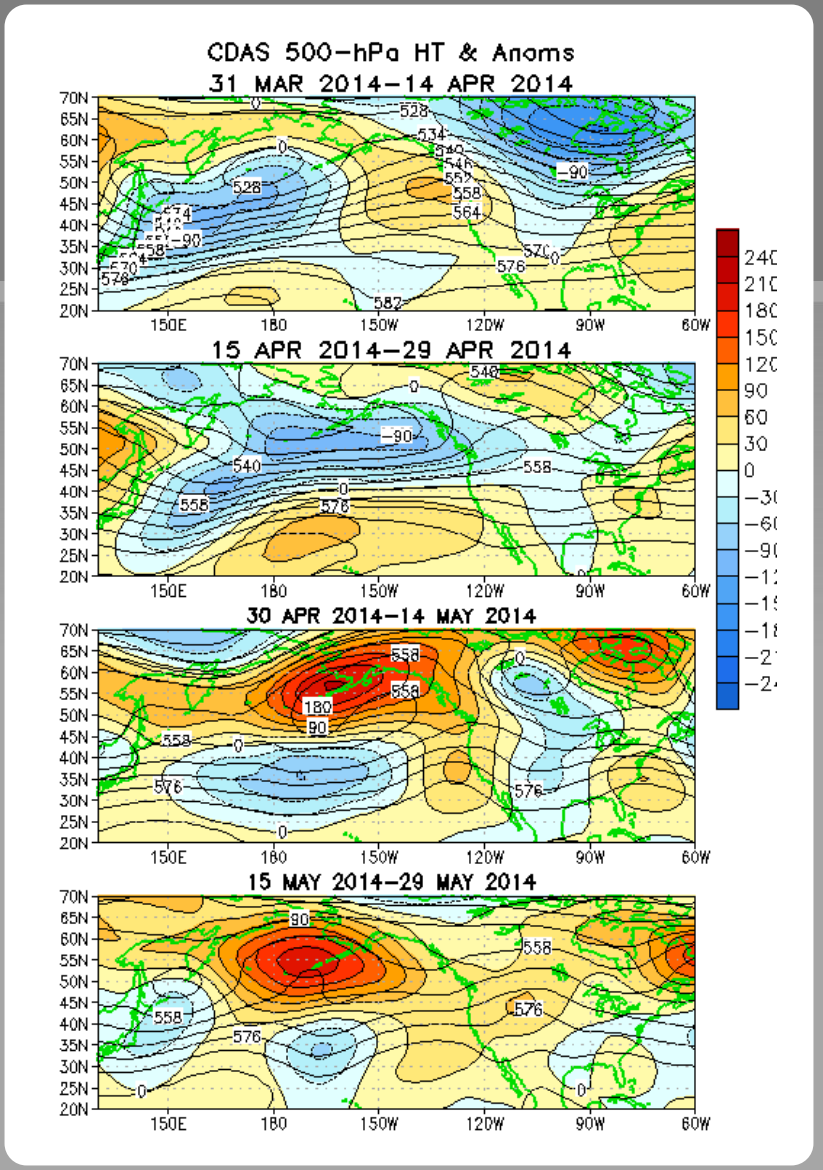
The CFS.v2 ensemble mean (black dashed line) predicts El Niño starting within the next 1-3 months.





Atmospheric anomalies over the North Pacific & North America During the Last 60 Days

During April through May, an anomalous trough and below-average temperatures affected portions of central or eastern North America. Upstream, anomalous ridging over western N. America contributed to above-average temperatures over that region.



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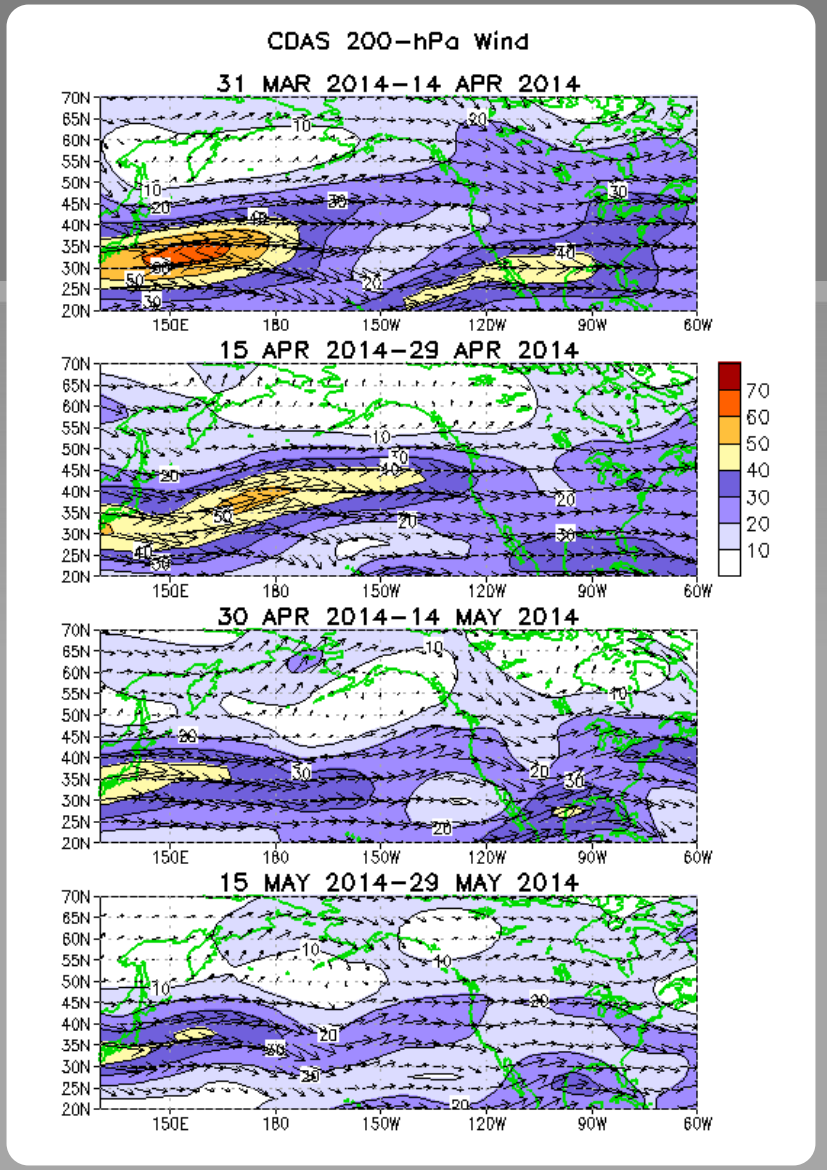

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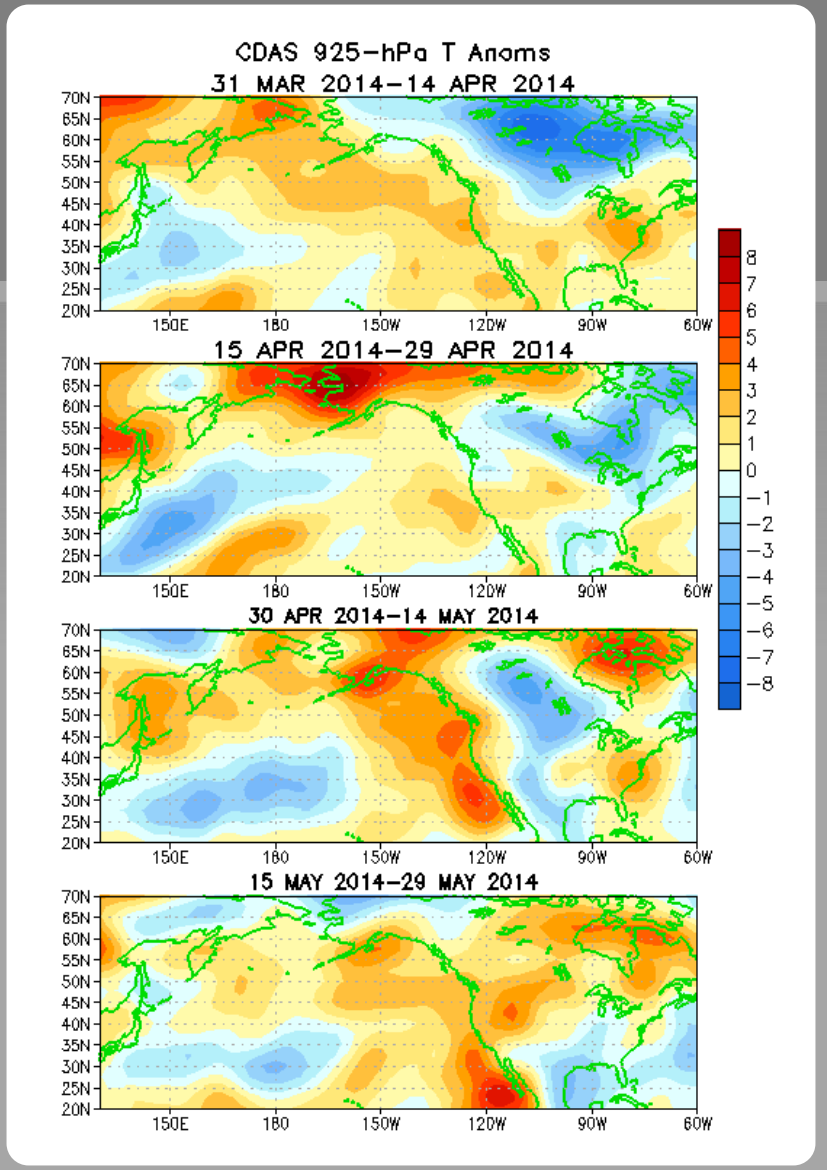
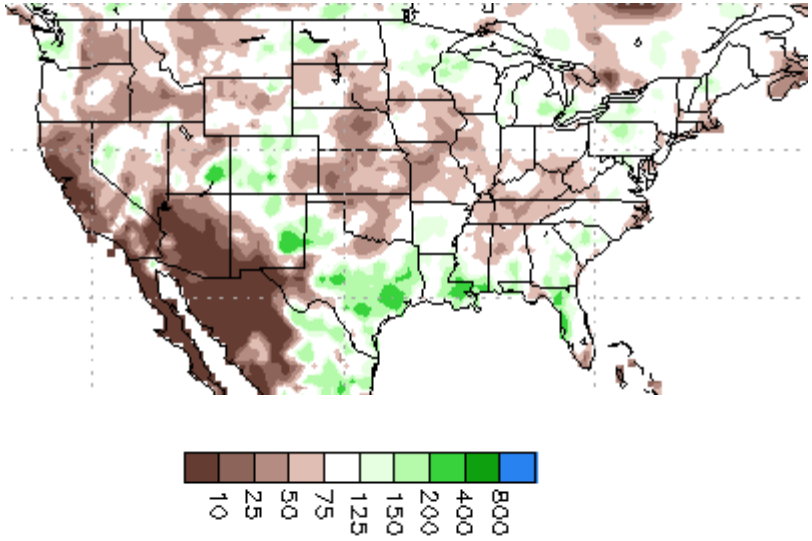


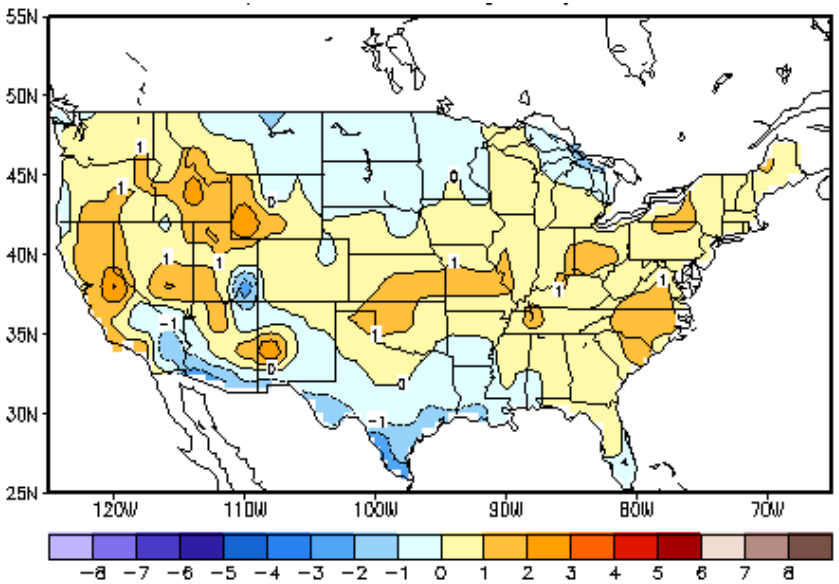
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 31 May 2014

Percent of Average Precipitation



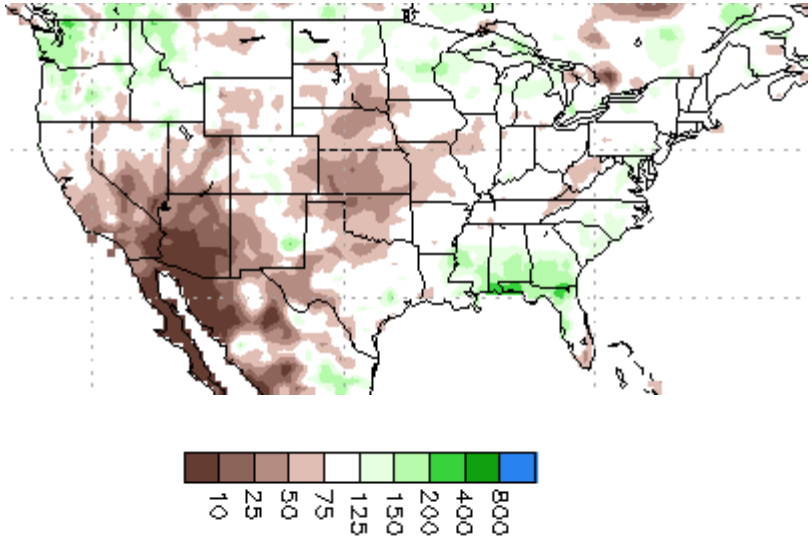
Temperature Departures (degree C)



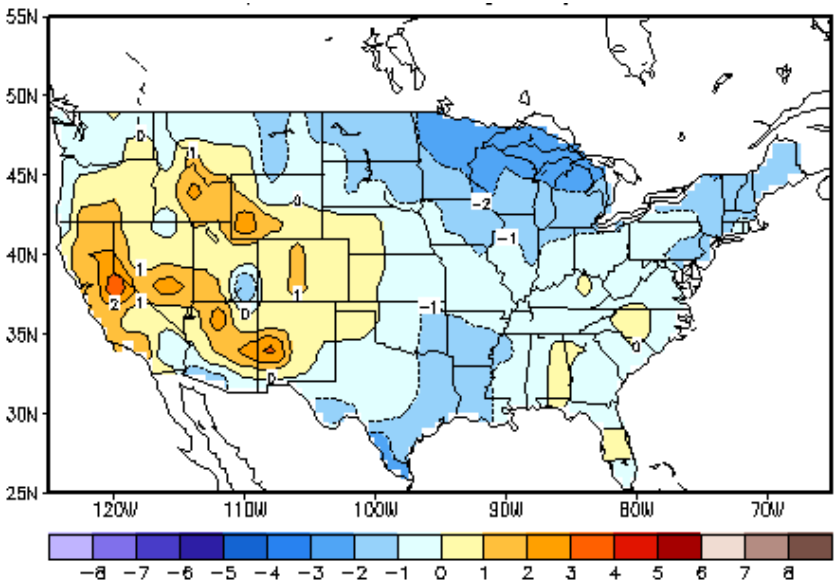
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 31 May 2014

Percent of Average Precipitation



Temperature Departures (degree C)

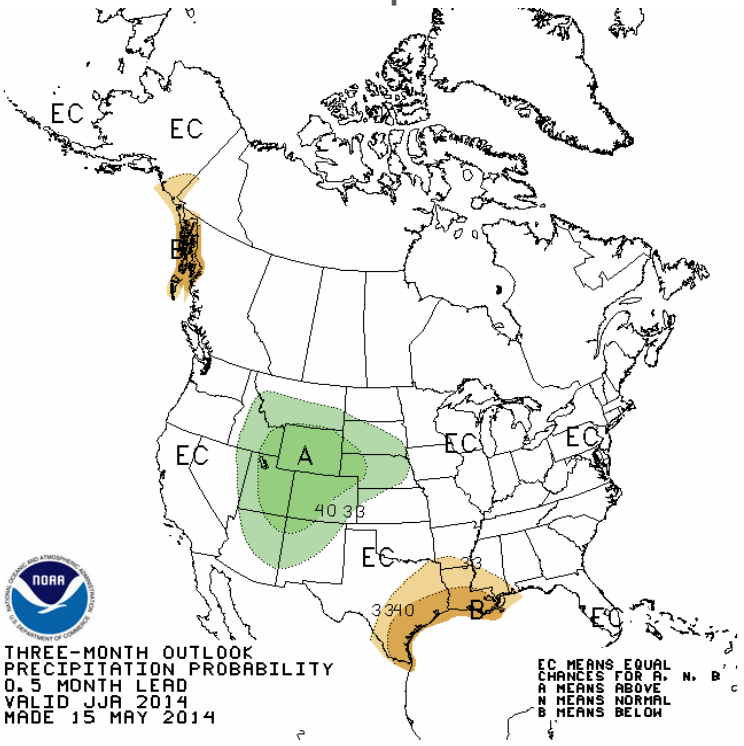


U. S. Seasonal Outlooks

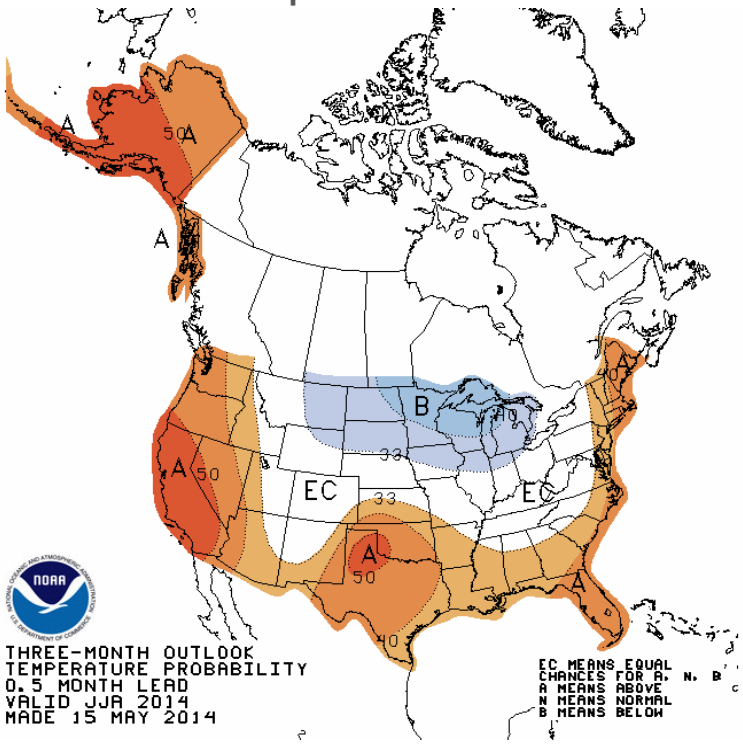
June - August 2014

The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.

Precipitation



Temperature



Summary

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Tropical rainfall is near-average across Indonesia and the tropical Pacific.

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