



ENSO Cycle: Recent Evolution, Current Status and Predictions

**Update prepared by
Climate Prediction Center / NCEP
2 December 2013**



Outline

- Overview
- Recent Evolution and Current Conditions
- Oceanic Niño Index (ONI) – **Revised March 2012**
- Pacific SST Outlook
- U.S. Seasonal Precipitation and Temperature Outlooks
- Summary



Summary

ENSO Alert System Status: Not Active

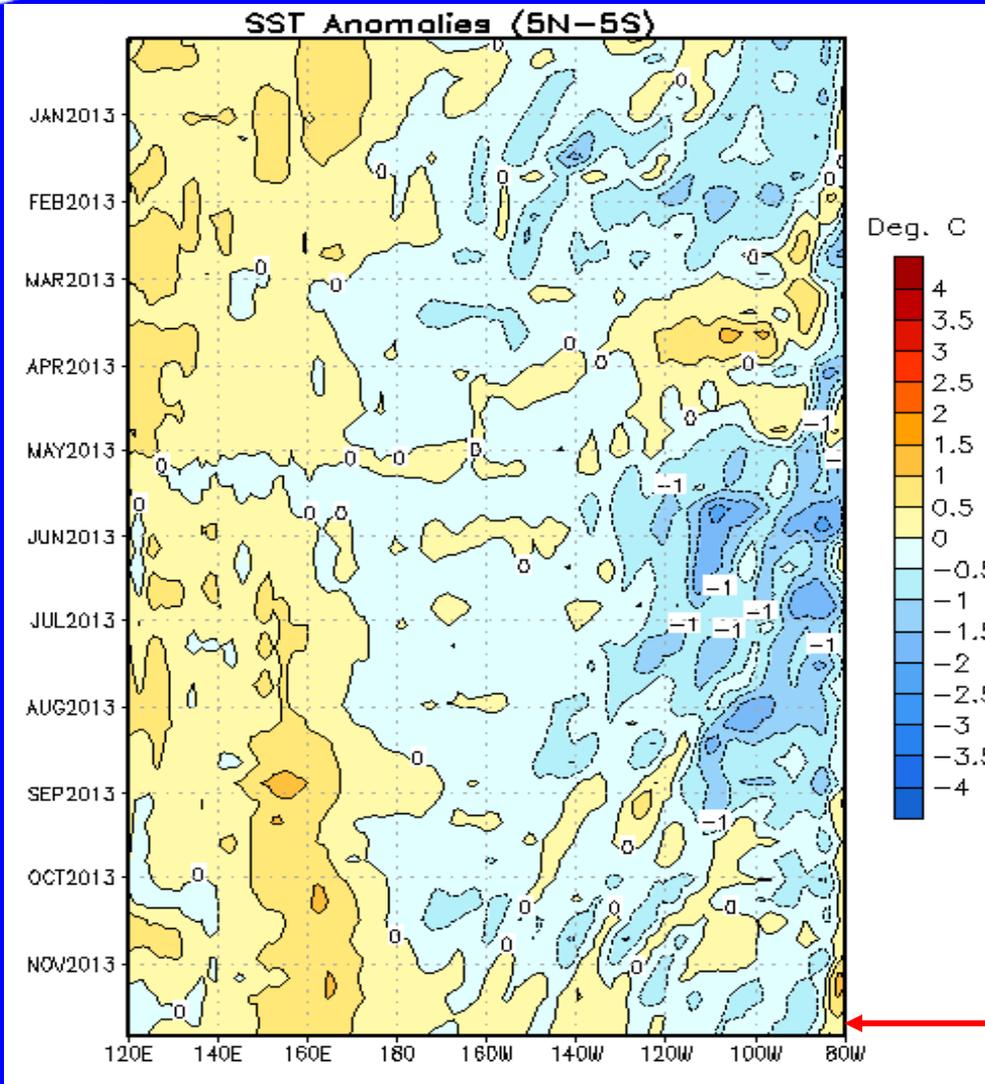
- **ENSO-neutral conditions continue.***
- **Equatorial sea surface temperatures (SST) are near average across much of the Pacific Ocean.**
- **ENSO-neutral is expected into the Northern Hemisphere spring 2014.***

* Note: These statements are updated once a month in association with the ENSO Diagnostics Discussion:
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory



Recent Evolution of Equatorial Pacific SST Departures (°C)

Time



Longitude

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

Recently, SSTs have been near-average across much of the equatorial Pacific.



Niño Region SST Departures (°C) Recent Evolution

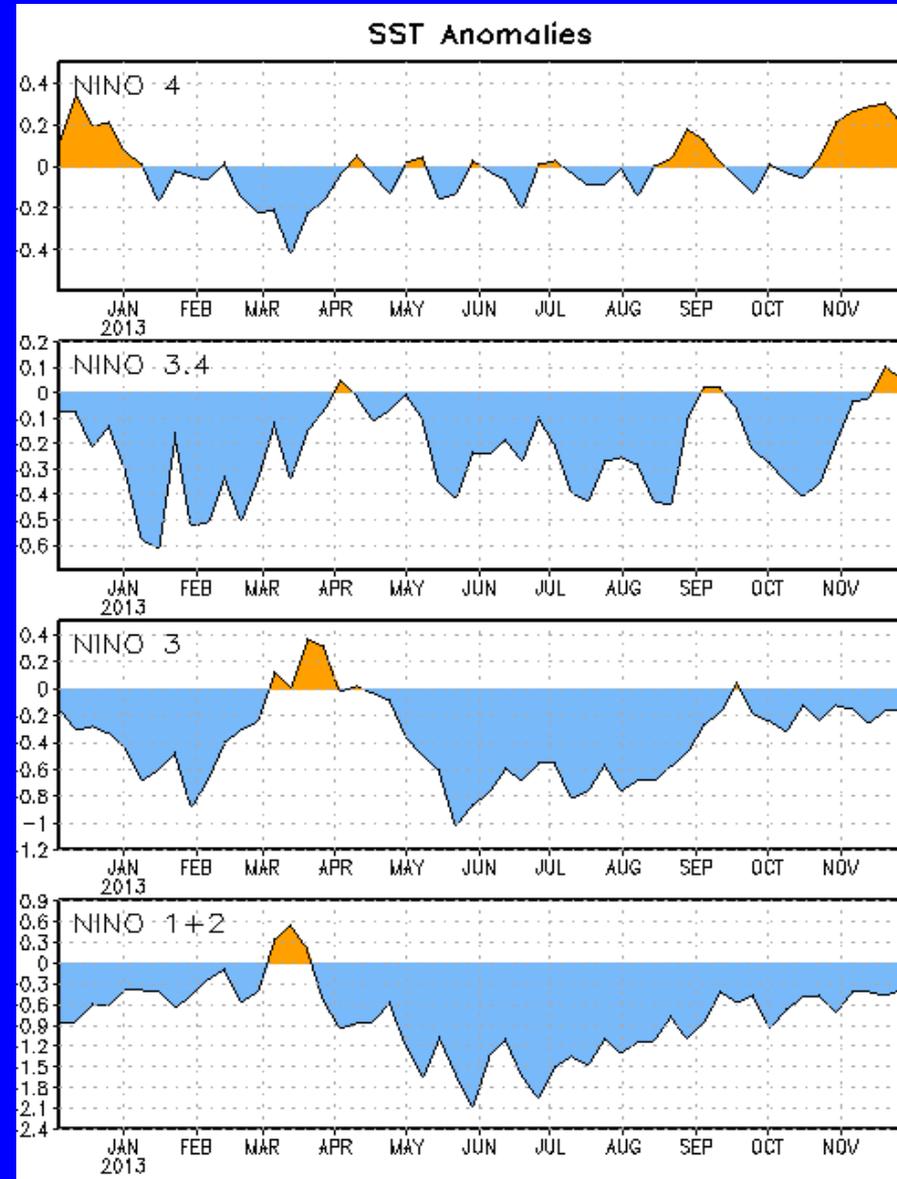
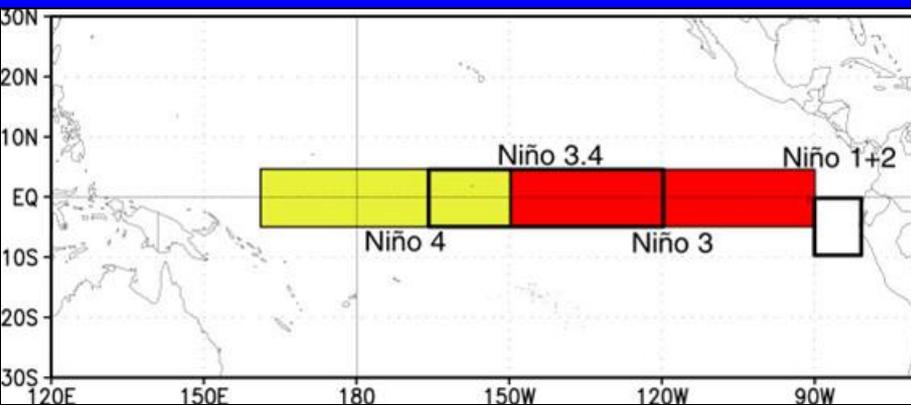
The latest weekly SST departures are:

Niño 4 0.2°C

Niño 3.4 0.1°C

Niño 3 -0.1°C

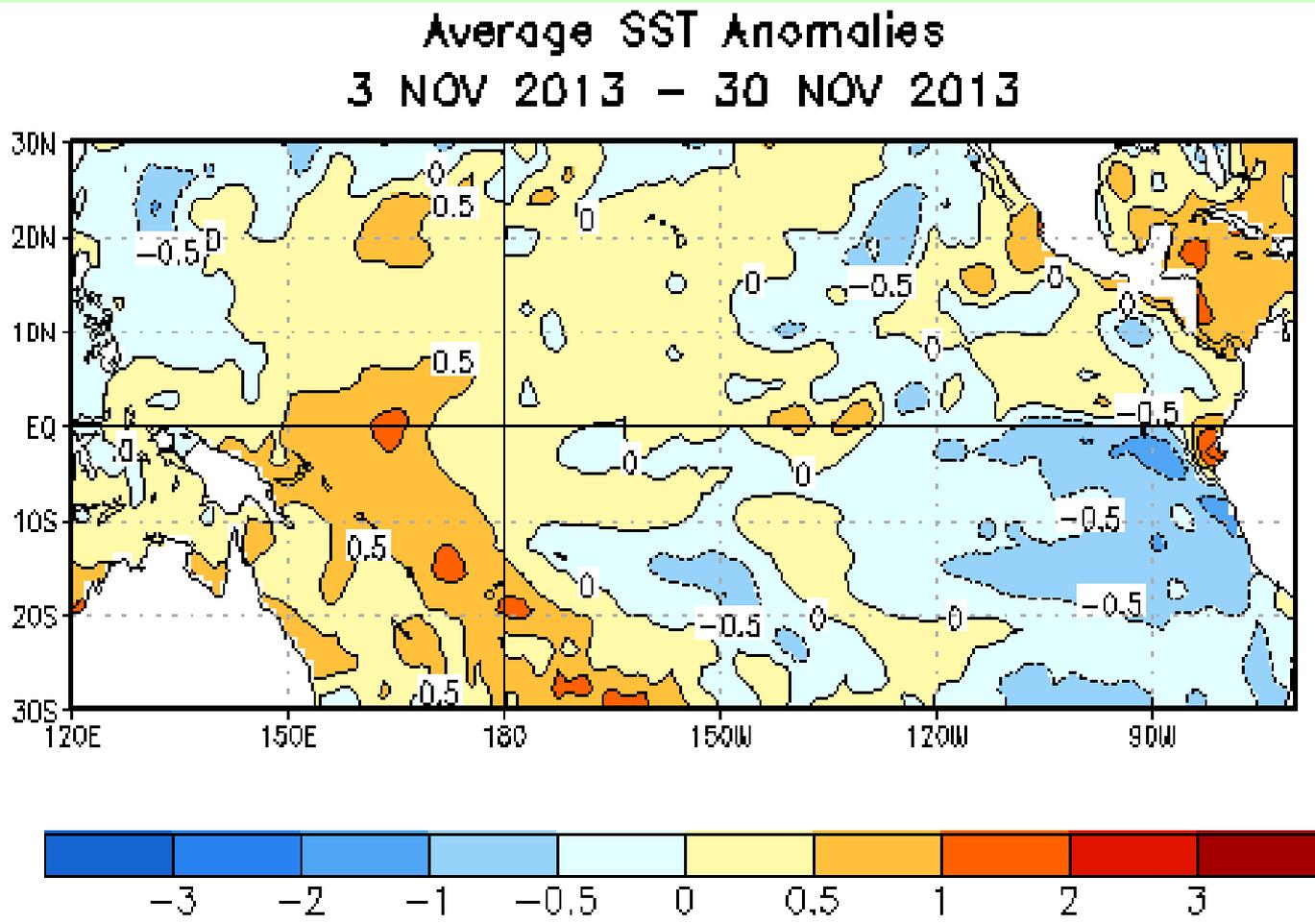
Niño 1+2 -0.4°C





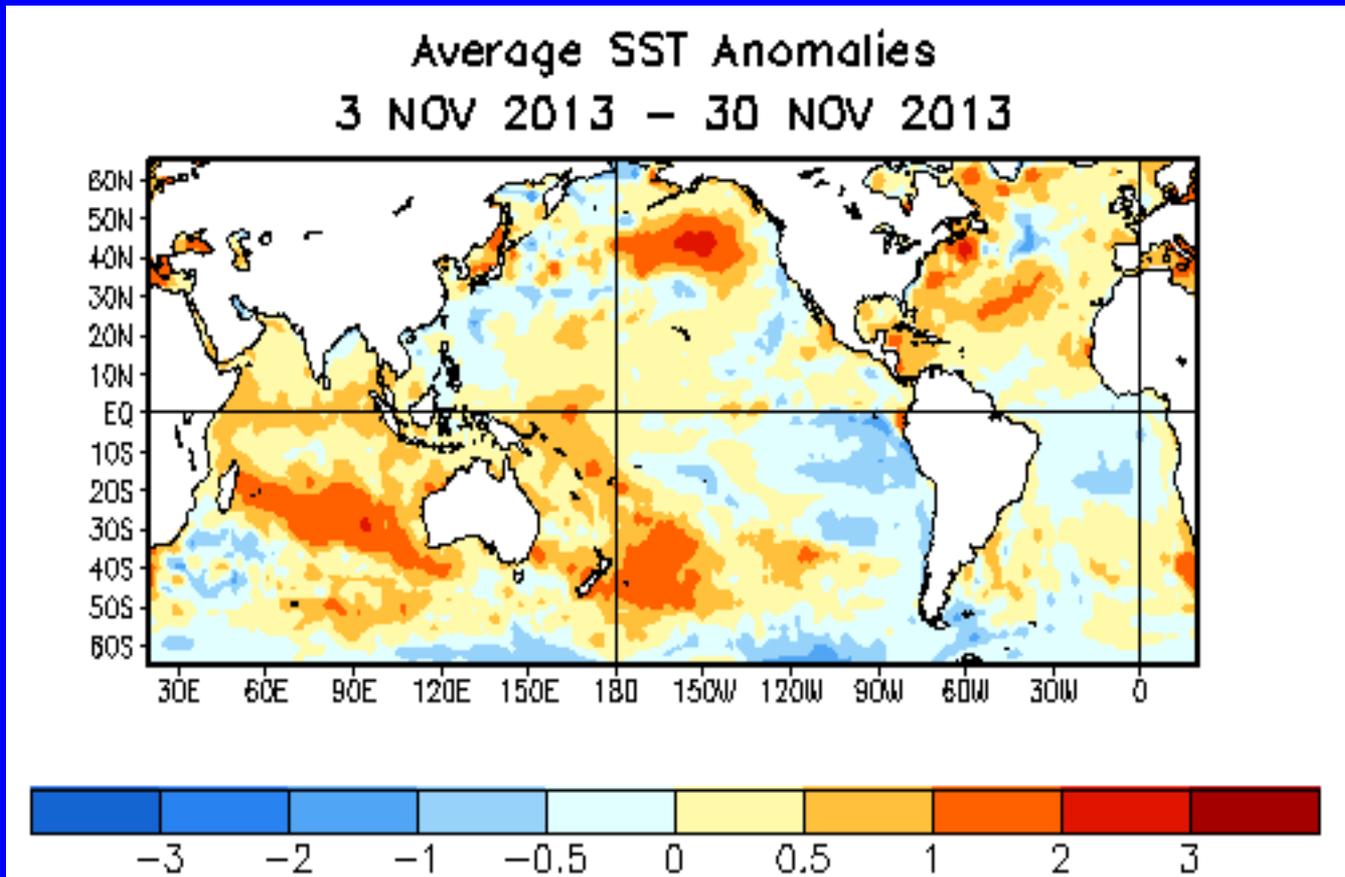
SST Departures (°C) in the Tropical Pacific During the Last 4 Weeks

During the last 4-weeks, equatorial SSTs were above average in the western Pacific, and near average in the central and eastern Pacific Ocean.





Global SST Departures (°C)



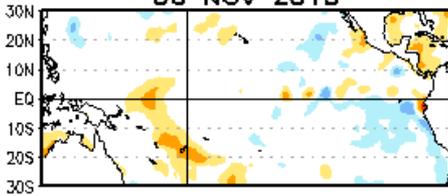
During the last four weeks, equatorial SSTs were above average in the western Pacific and Indian Oceans.



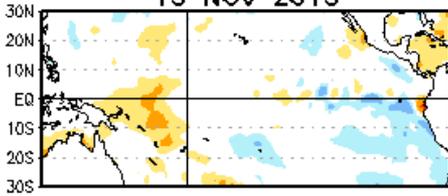
Weekly SST Departures (°C) for the Last Four Weeks

Weekly SST Anomalies (DEG C)

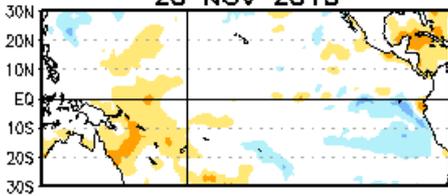
06 NOV 2013



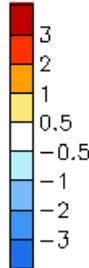
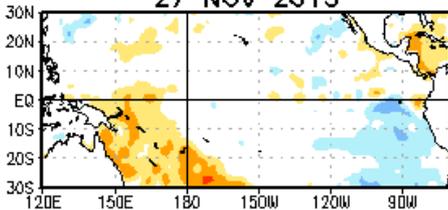
13 NOV 2013



20 NOV 2013

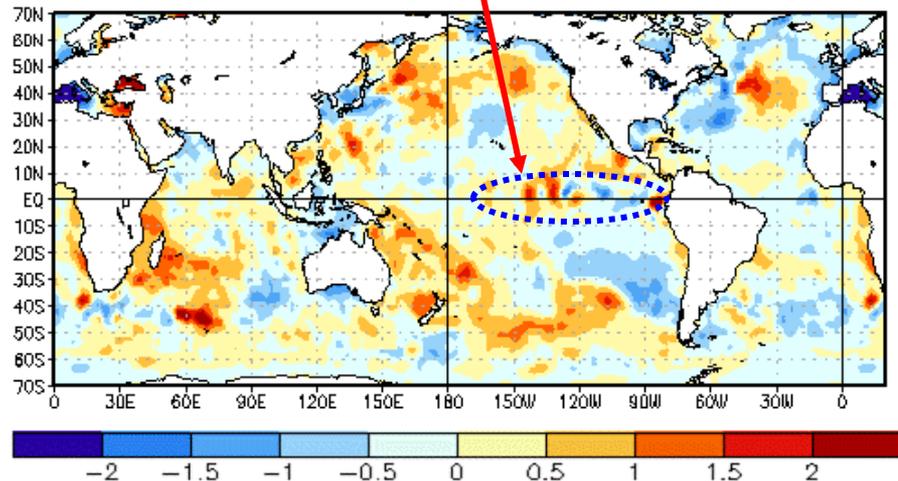


27 NOV 2013



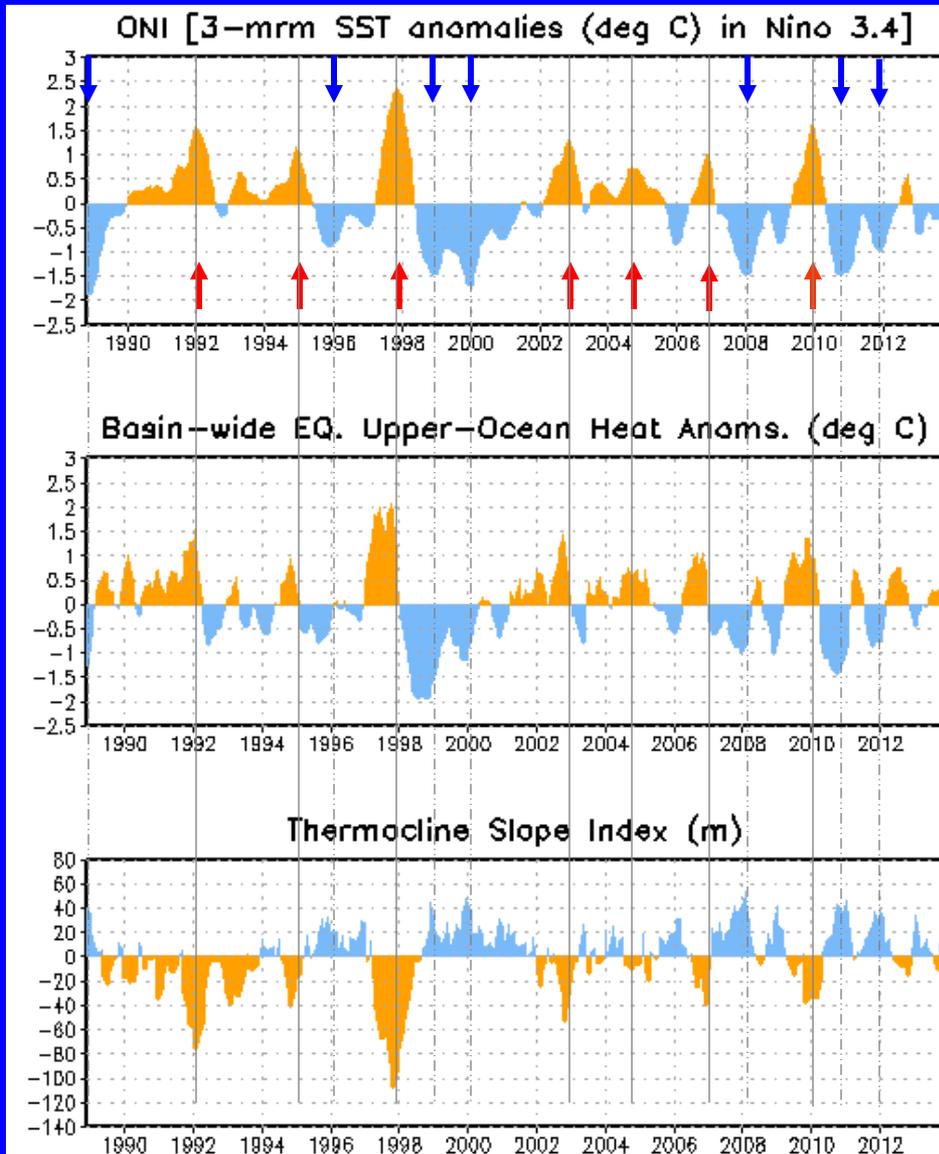
- During the last month, negative SST anomalies persisted in a small area of the eastern equatorial Pacific, while positive SST anomalies continued in the western Pacific.
- Over the last month, positive changes in SST anomalies were observed in the east-central Pacific, while negative changes were evident in the far eastern Pacific.

Change in Weekly SST Anoma (°C)
27NOV2013 minus 30OCT2013





Upper-Ocean Conditions in the Eq. Pacific



Cold Episodes ↓
Warm Episodes ↑

- 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.

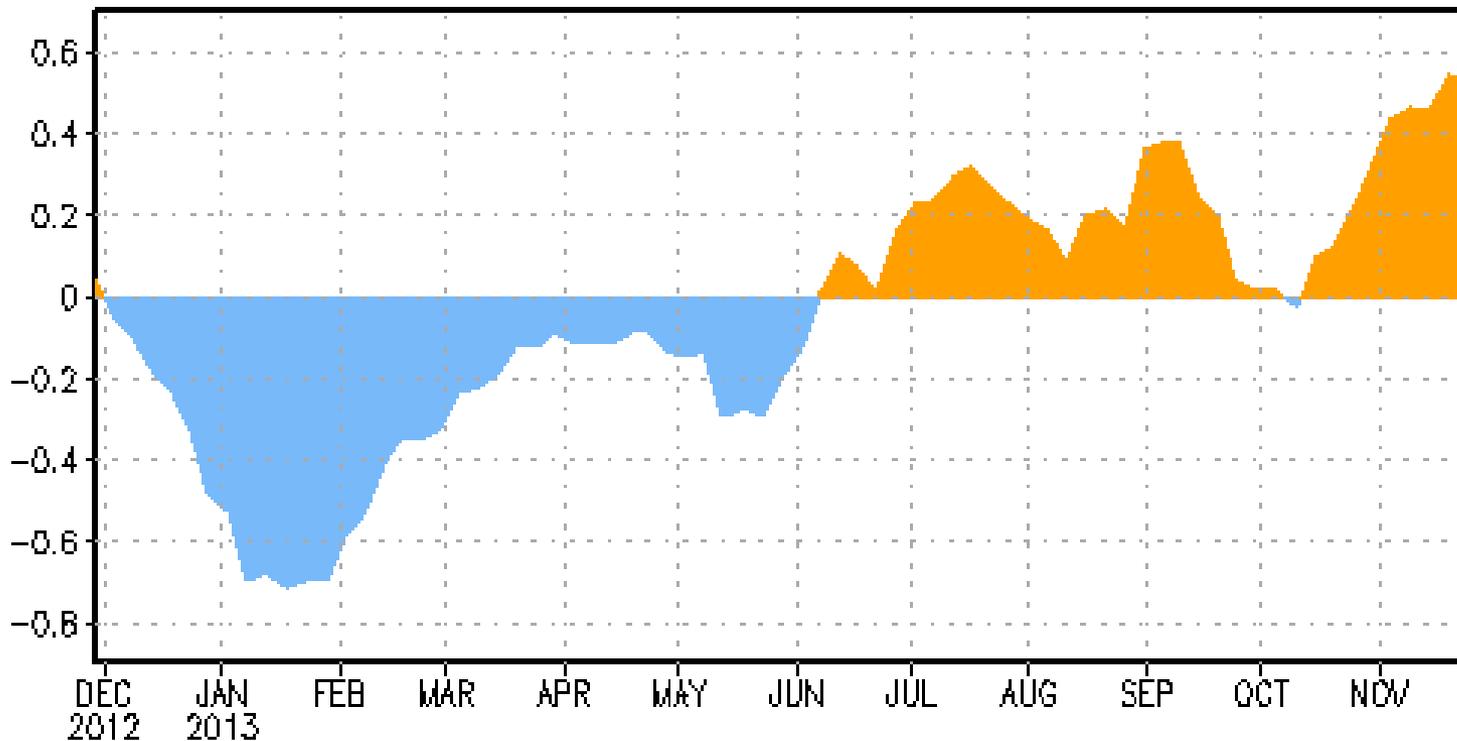
- Recent values of the upper-ocean heat anomalies (near zero) and thermocline slope index (near zero) reflect ENSO-neutral conditions.

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

EQ. Upper-Ocean Heat Anoms. (deg C) for 180-100W



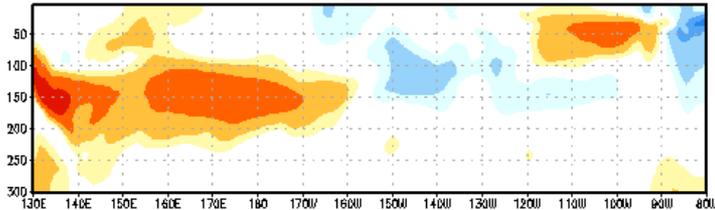
Subsurface temperatures were below average from December 2012 to May 2013, and above average from June 2013 to the present. Since mid-October, the subsurface temperature anomalies have increased.



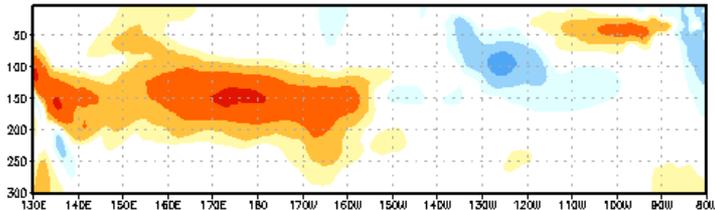
Sub-Surface Temperature Departures (°C) in the Equatorial Pacific

EQ. Subsurface Temperature Anomalies (deg C)

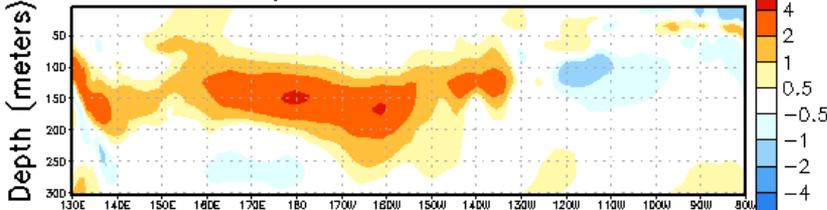
Three-pentad ave. centered on 05 OCT 2013



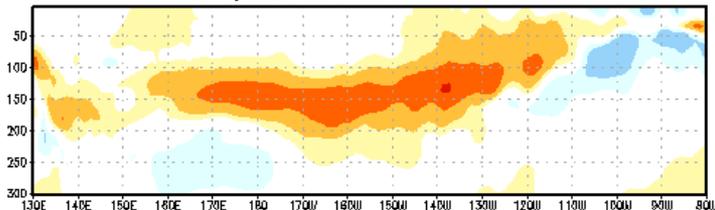
Three-pentad ave. centered on 20 OCT 2013



Three-pentad ave. centered on 04 NOV 2013



Three-pentad ave. centered on 19 NOV 2013



Time



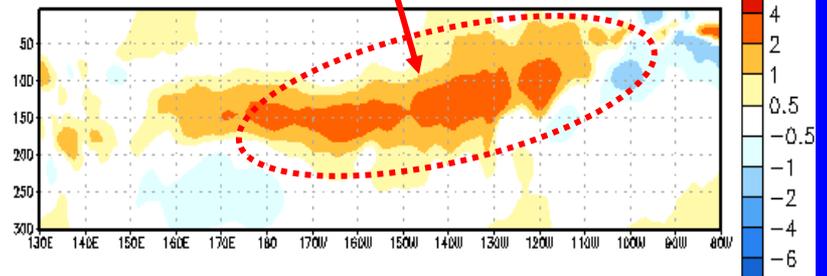
Longitude

• During the last two months, below-average subsurface temperatures weakened in the far eastern Pacific, and above-average temperatures in the western Pacific shifted eastward in association with a downwelling oceanic Kelvin wave.

• Recently, above-average temperatures have shifted farther east into the eastern Pacific.

EQ. Subsurface Temperature Anomalies (deg C)

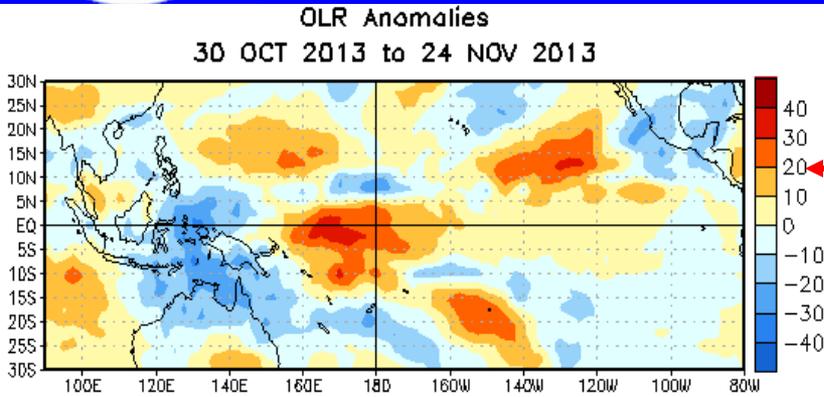
Pentad centered on 24 NOV 2013



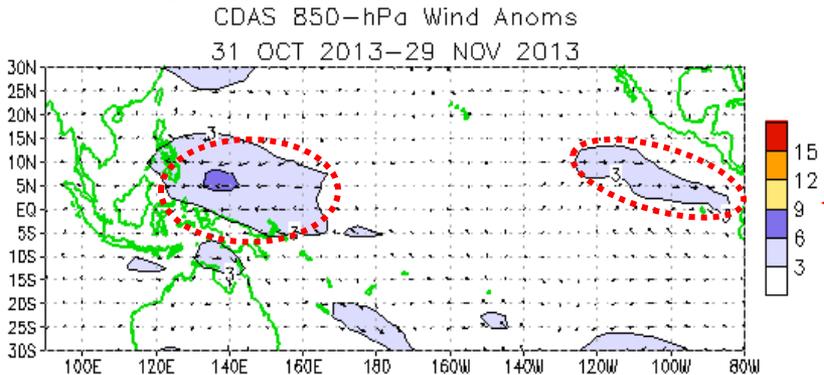
Most recent pentad analysis



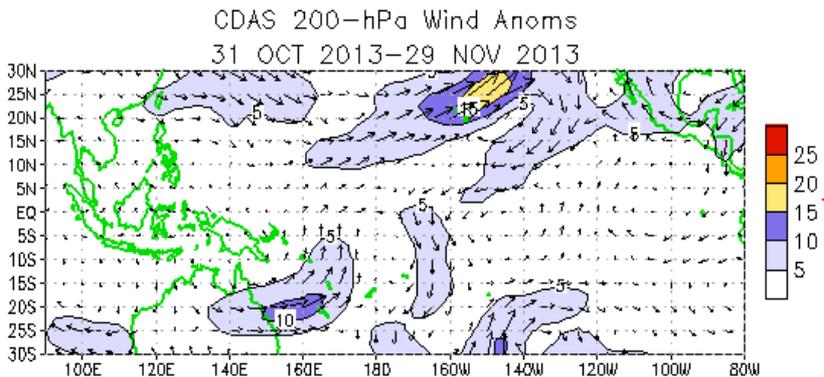
Tropical OLR and Wind Anomalies During the Last 30 Days



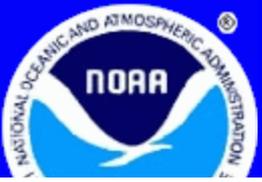
Negative OLR anomalies (enhanced convection and precipitation, blue shading) were observed over Indonesia, Papua New Guinea, and northern Australia. Positive OLR anomalies (suppressed convection and precipitation, red shading) were evident over the central equatorial Pacific Ocean.



Weak low-level (850-hPa) easterly wind anomalies were apparent over the western Pacific, while anomalous westerly winds continued mostly north of the equator in the eastern Pacific Ocean.

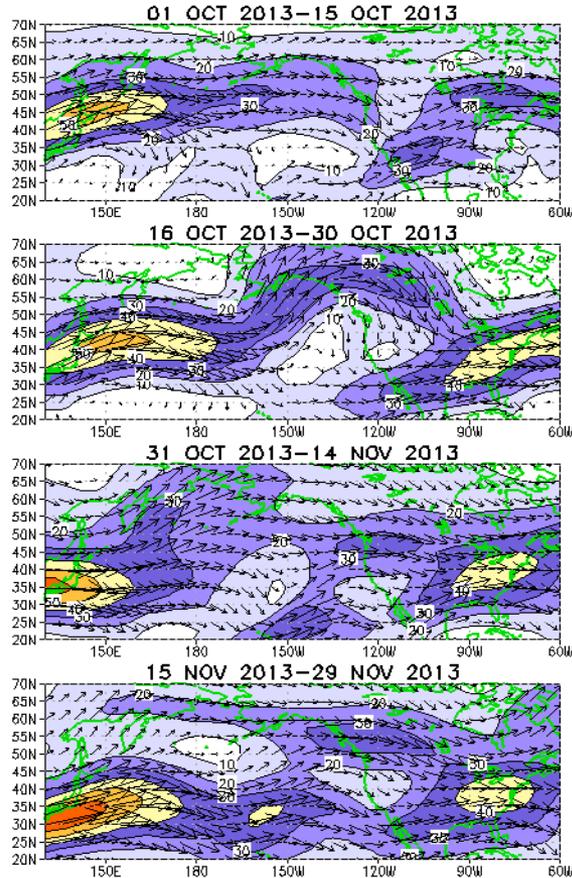


Upper-level (200-hPa) winds were near normal across most of the equatorial Pacific.

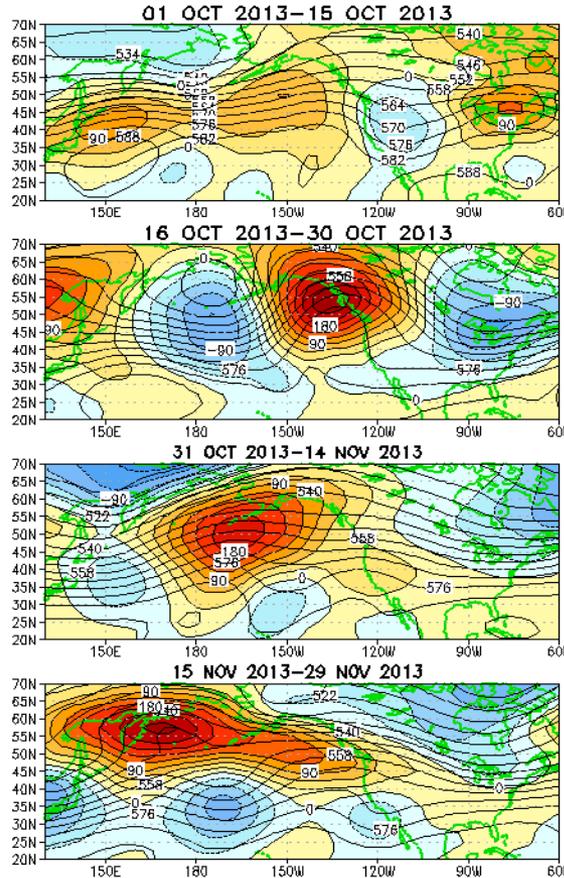


Atmospheric Circulation over the North Pacific & North America During the Last 60 Days

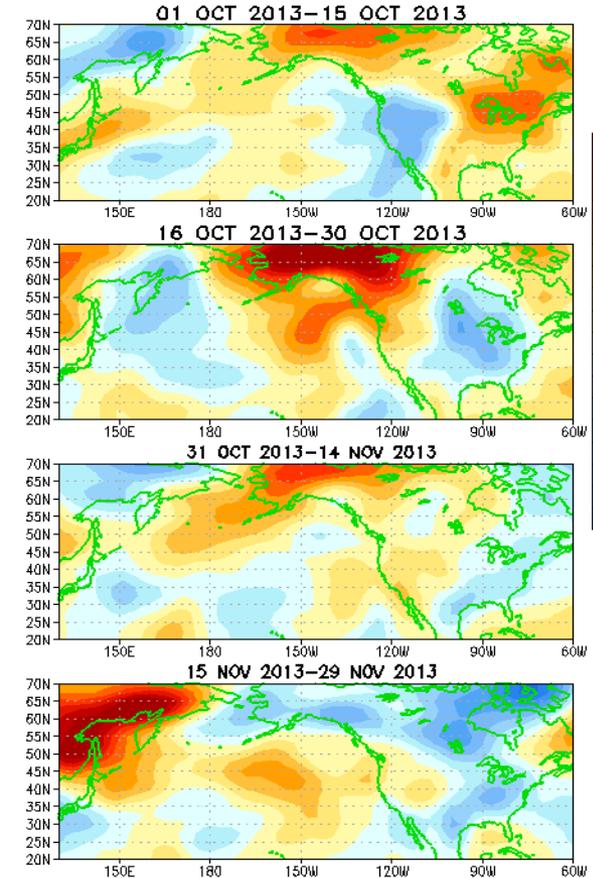
200-hPa Wind



500-hPa Height & Anoms.



925-hPa Temp. Anoms. (°C)



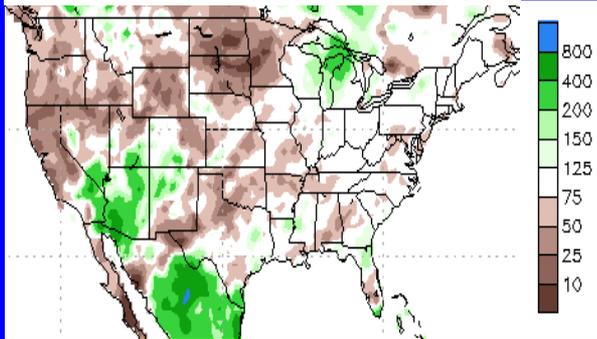
Through the first half of October, an anomalous ridge and above-average temperatures dominated eastern North America, while an anomalous trough and below-average temperatures affected portions of the western U.S. During late October through November, an anomalous trough and below-average temperatures affected central and eastern North America.



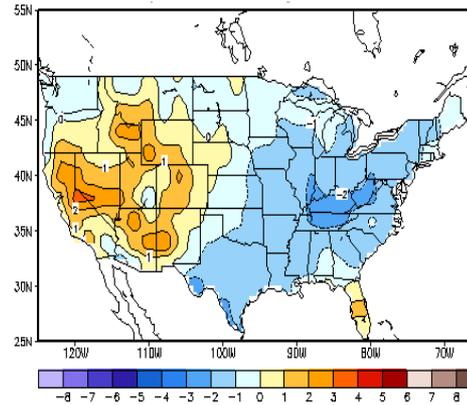
U.S. Temperature and Precipitation Departures During the Last 30 and 90 Days

Last 30 Days

30-day (ending 30 Nov 2013) % of average precipitation

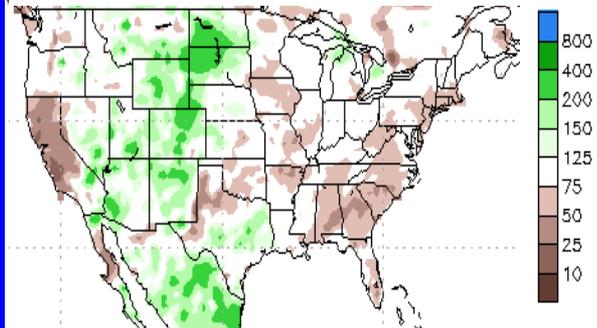


30-day (ending 30 Nov 2013) temperature departures (degree C)

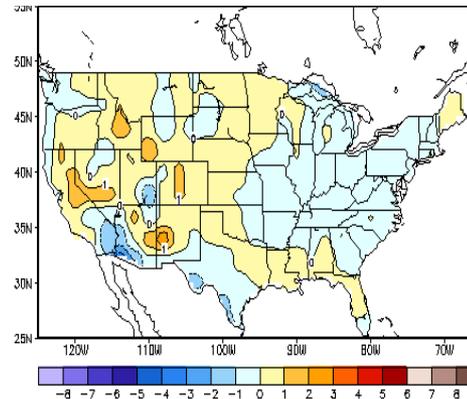


Last 90 Days

90-day (ending 30 Nov 2013) % of average precipitation



90-day (ending 30 Nov 2013) temperature departures (degree C)



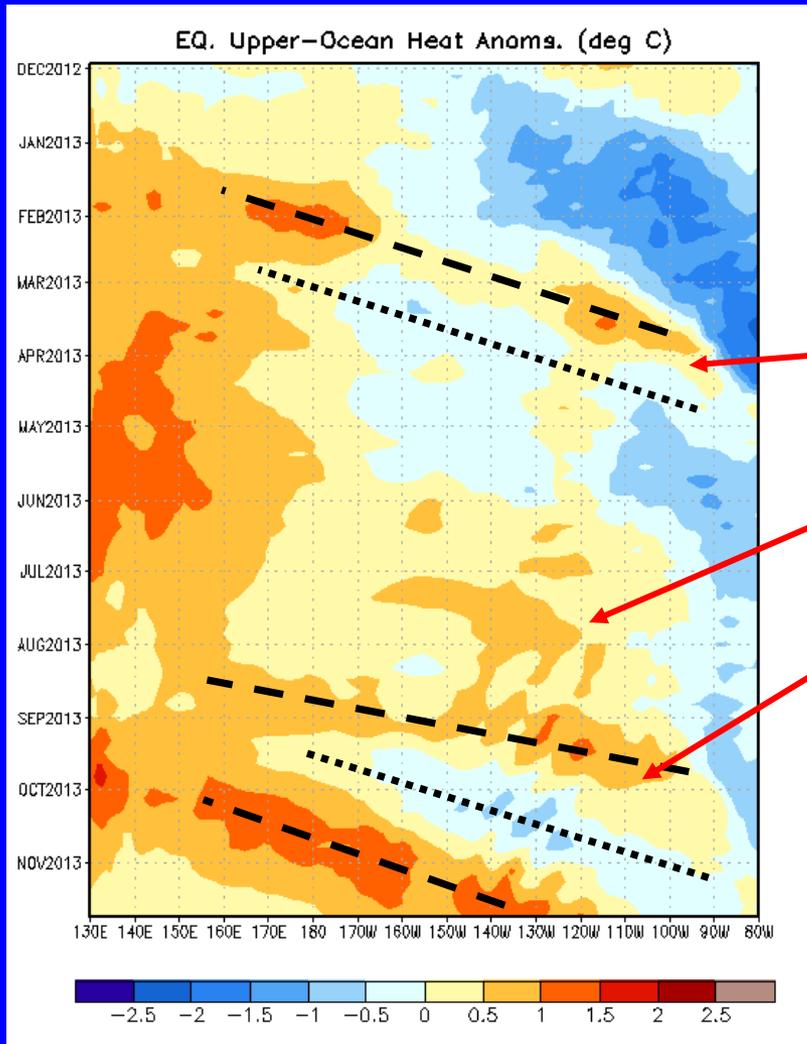


Intraseasonal Variability

- **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

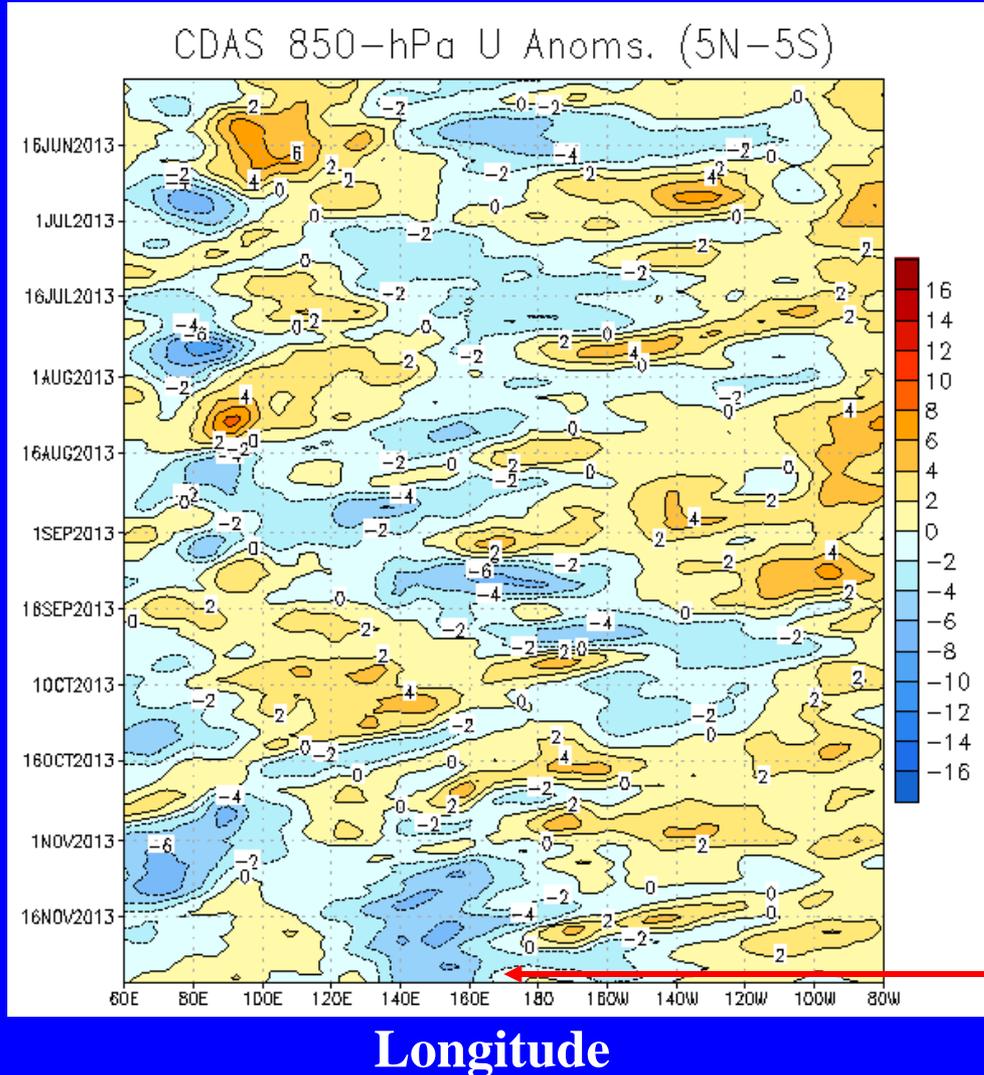


- In February through April 2013, oceanic Kelvin wave activity was evident.
- Above-average heat content persisted from June-September 2013 across the equatorial Pacific (except in the far eastern basin).
- From early August 2013 through the present, oceanic Kelvin wave activity has been observed.

• 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})



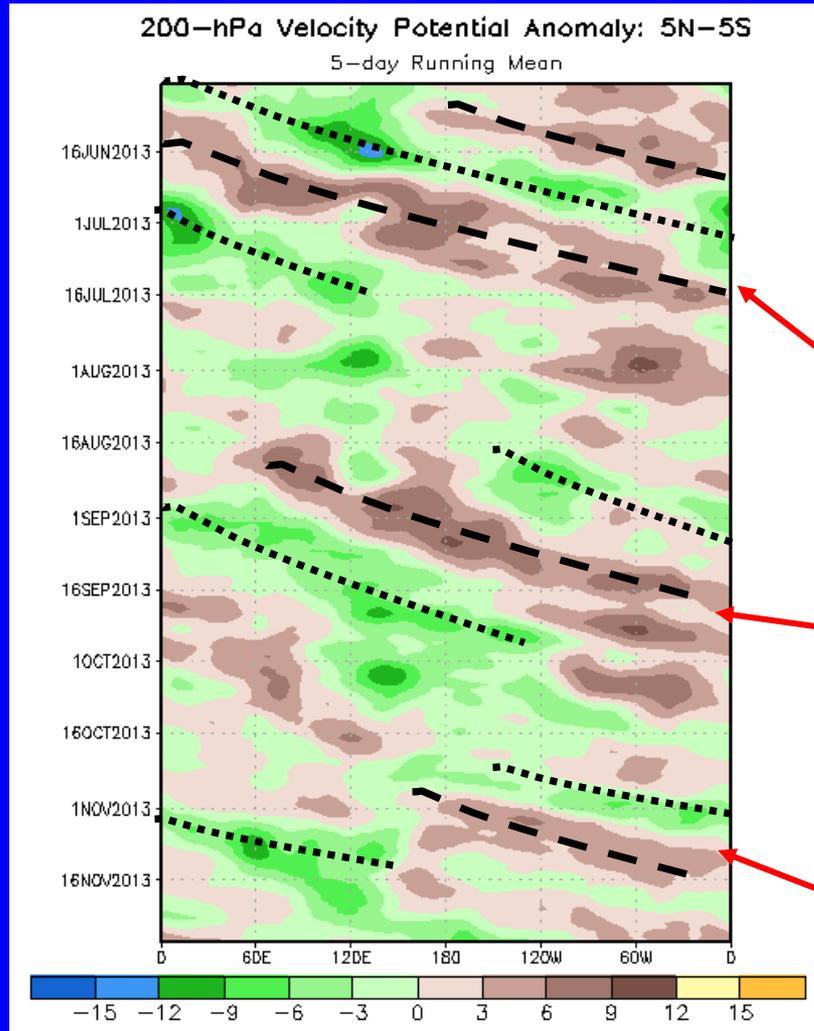
Westerly wind anomalies
(orange/red shading).

Easterly wind anomalies (blue
shading).

Over the last week, easterly anomalies
prevailed over the western equatorial
Pacific.



200-hPa Velocity Potential Anomalies (5°N-5°S)



Positive anomalies (brown shading) indicate unfavorable conditions for precipitation.

Negative anomalies (green shading) indicate favorable conditions for precipitation.

During June and early July, the Madden Julian Oscillation (MJO) was active.

From mid-August through late September, the MJO was active.

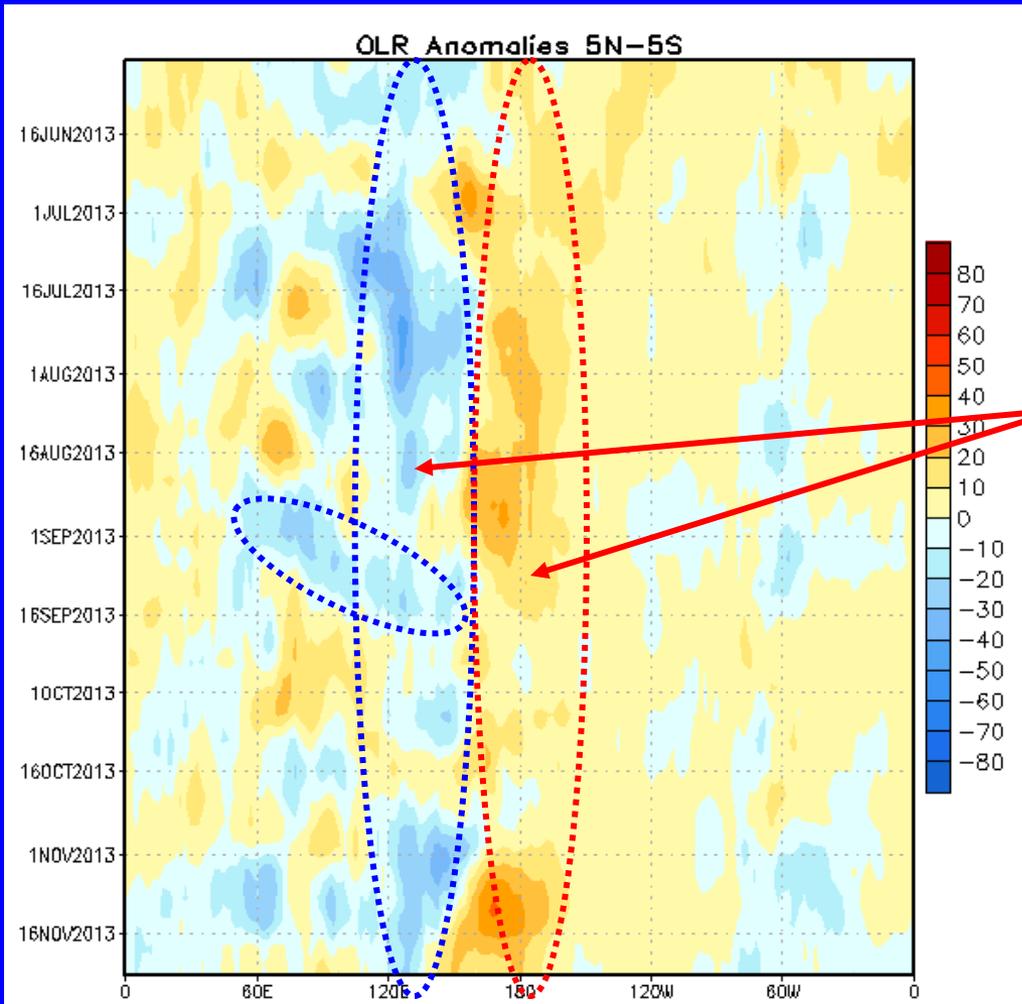
During early November, weak MJO activity was evident.

Longitude



Outgoing Longwave Radiation (OLR) Anomalies

Time



Longitude

**Drier-than-average conditions
(orange/red shading)**

**Wetter-than-average conditions
(blue shading)**

**Since April 2013, below-average OLR
has been evident over the western
Pacific, while above-average OLR
has persisted near the Date Line.**



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 $+0.5^{\circ}\text{C}$.

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

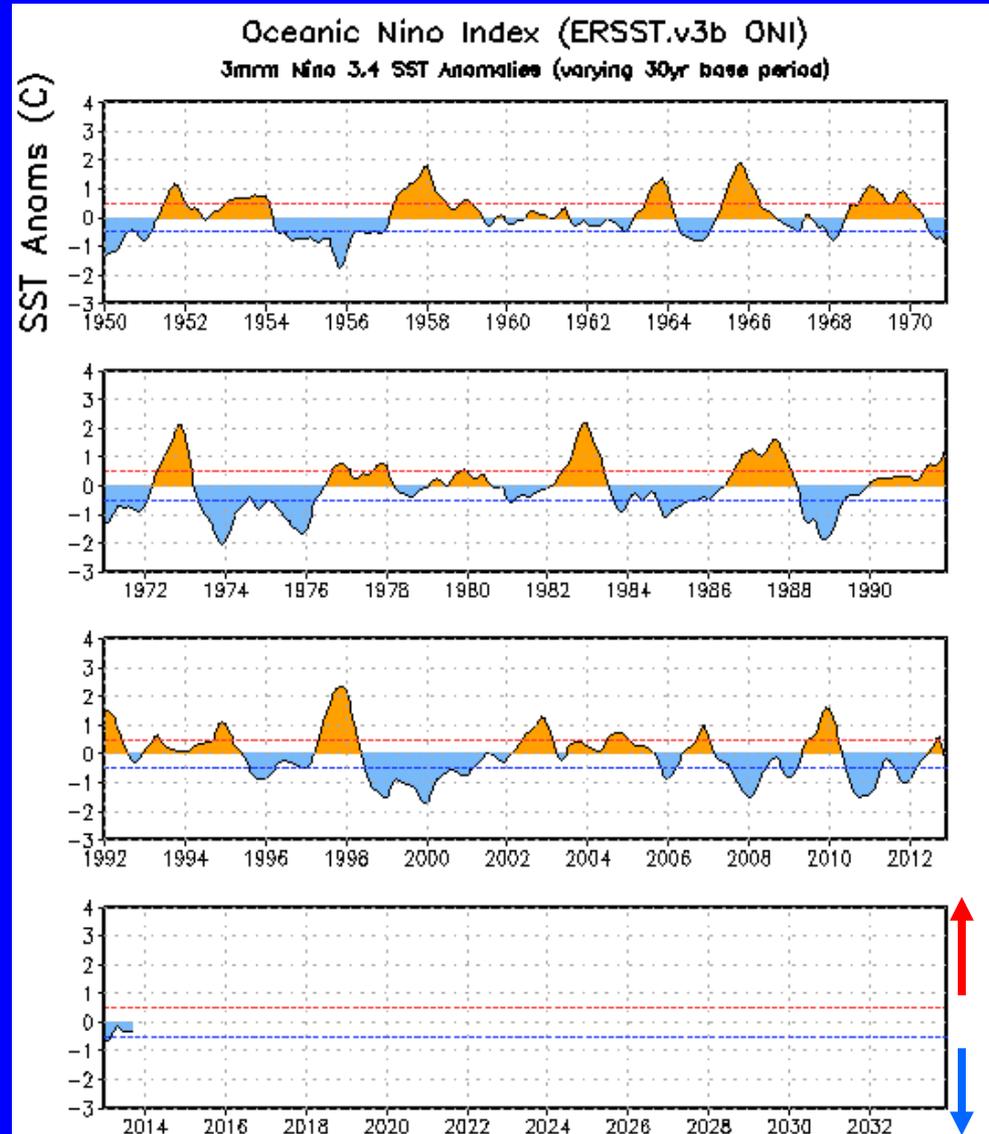
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed $\pm 0.5^{\circ}\text{C}$ 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 (August – October 2013) is **-0.3°C**.



El Niño
neutral
La Niña



Historical El Niño and La Niña Episodes

Based on the ONI computed using ERSST.v3b

<u>El Niño</u>	<u>Highest ONI Value</u>	<u>La Niña</u>	<u>Lowest ONI Value</u>
JJA 1951 – DJF 1951/52	1.2	ASO 1949 – JAS 1950	-1.4
DJF 1952/53 – JFM 1954	0.8	SON 1950 – JFM 1951	-0.8
MAM 1957 – JJA 1958	1.8	AMJ 1954 – NDJ 1956/57	-1.7
OND 1958 – FMA 1959	0.6	AMJ 1964 – DJF 1964/65	-0.8
MJJ 1963 – JFM 1964	1.4	JJA 1970 – DJF 1971/72	-1.3
AMJ 1965 – MAM 1966	1.9	AMJ 1973 – JJA 1974	-2.0
JAS 1968 – DJF 1969/70	1.1	SON 1974 – MAM 1976	-1.7
AMJ 1972 – FMA 1973	2.1	ASO 1983 – DJF 1983/84	-0.9
ASO 1976 - JFM 1977	0.8	SON 1984 – ASO 1985	-1.1
ASO 1977 – JFM 1978	0.8	AMJ 1988 – AMJ 1989	-1.9
AMJ 1982 – MJJ 1983	2.2	ASO 1995 – FMA 1996	-0.9
JAS 1986 – JFM 1988	1.6	JJA 1998 – FMA 2001	-1.7
AMJ 1991 – MJJ 1992	1.6	OND 2005 – FMA 2006	-0.9
ASO 1994 – FMA 1995	1.2	JAS 2007 – MJJ 2008	-1.5
AMJ 1997 – MAM 1998	2.4	OND 2008 – FMA 2009	-0.8
AMJ 2002 – JFM 2003	1.3	JJA 2010 – MAM 2011	-1.5
JJA 2004 – DJF 2004/05	0.7	ASO 2011 – FMA 2012	-1.0
ASO 2006 – DJF 2006/07	1.0		
JJA 2009 – MAM 2010	1.6		

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:

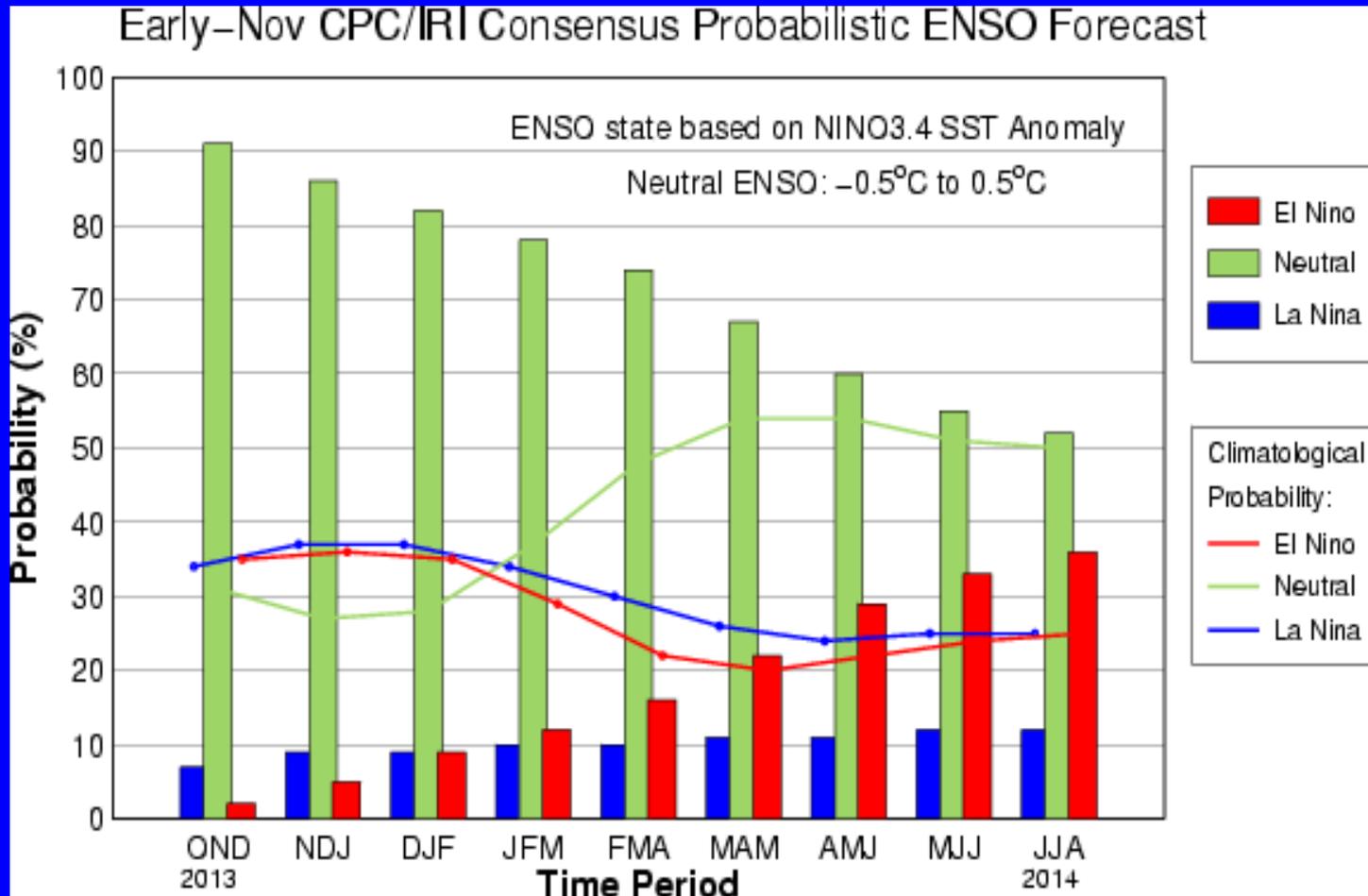
[Historical ONI Values](#)



CPC/IRI Probabilistic ENSO Outlook

(updated 7 November 2013)

ENSO-neutral is expected through the Northern Hemisphere spring 2014.





Pacific Niño 3.4 SST Outlook

- Most models predict ENSO-neutral (-0.5°C to $+0.5^{\circ}\text{C}$) continuing through Northern Hemisphere spring 2014.

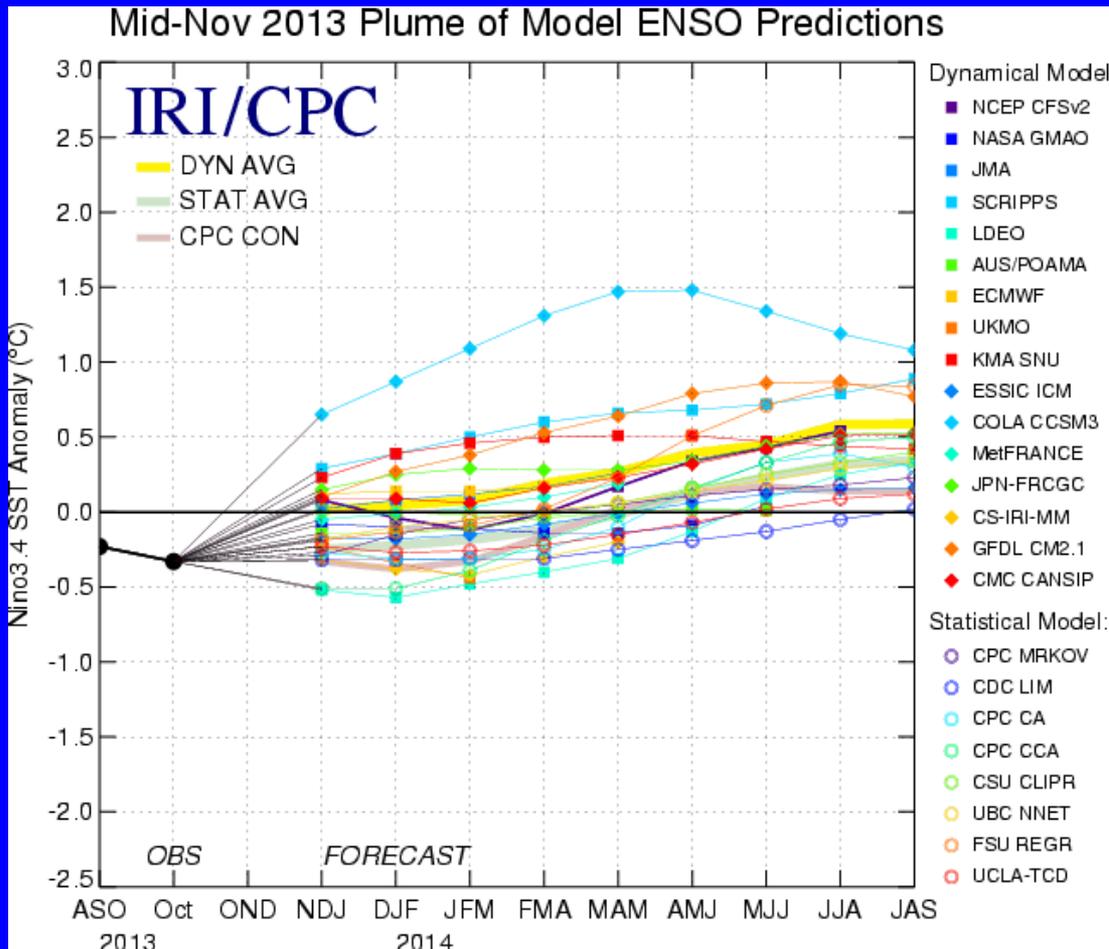


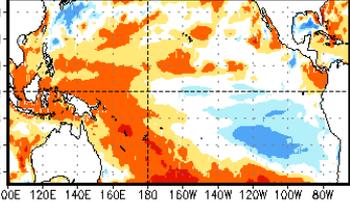
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 November 2013).



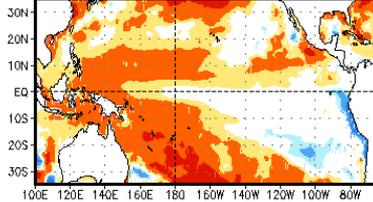
SST Outlook: NCEP CFS.v2 Forecast

Issued 2 December 2013

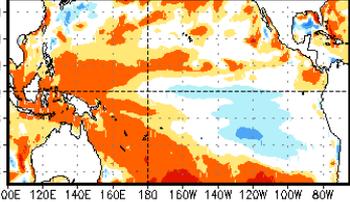
Dec-Jan-Feb 2013/2014



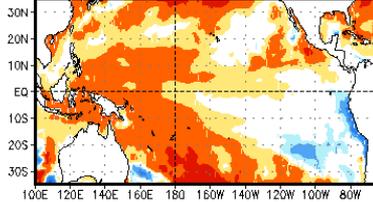
Apr-May-Jun 2014



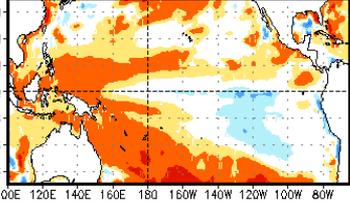
Jan-Feb-Mar 2014



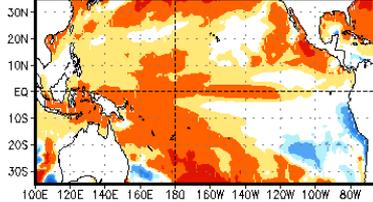
May-Jun-Jul 2014



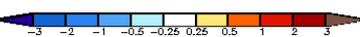
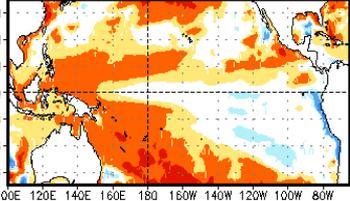
Feb-Mar-Apr 2014



Jun-Jul-Aug 2014

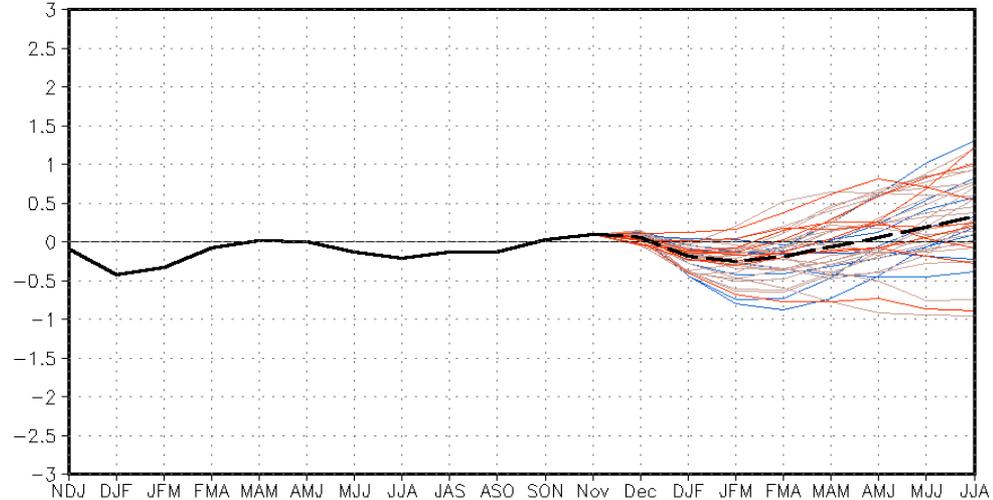


Mar-Apr-May 2014



The CFS.v2 ensemble mean (black dashed line) predicts ENSO-neutral conditions into summer 2014.

CFSv2 forecast Nino3.4 SST anomalies (K)



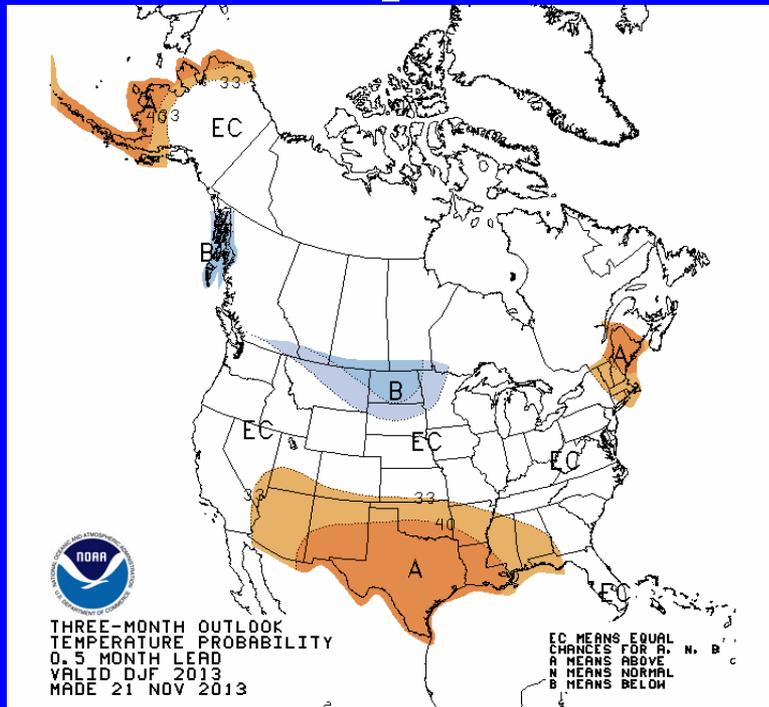
— Latest 8 forecast members
 — Earliest 8 forecast members
 — Other forecast members
 - - - Forecast ensemble mean
 — NCDC daily analysis
 (Model bias correct base period: 1999–2010; Climatology base period: 1982–2010)

(Model bias correction base period: 1999–2010; Climatology base period: 1982–2010)

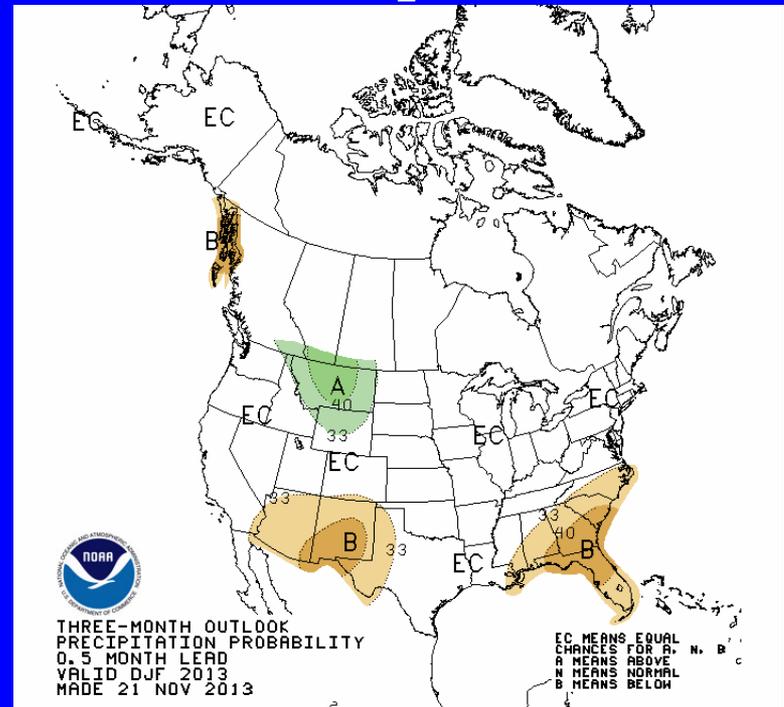


U. S. Seasonal Outlooks December 2013 – February 2014

Temperature



Precipitation



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



Summary

ENSO Alert System Status: Not Active

- **ENSO-neutral conditions continue.***
- **Equatorial sea surface temperatures (SST) are near average across much of the Pacific Ocean.**
- **ENSO-neutral is expected into the Northern Hemisphere spring 2014.***

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http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory