

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
16 November 2015

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 Advisory

El Niño conditions are present.*

Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.

El Niño will likely peak during the Northern Hemisphere winter 2015-16, with a transition to ENSO-neutral anticipated during the late spring or early summer 2016.*

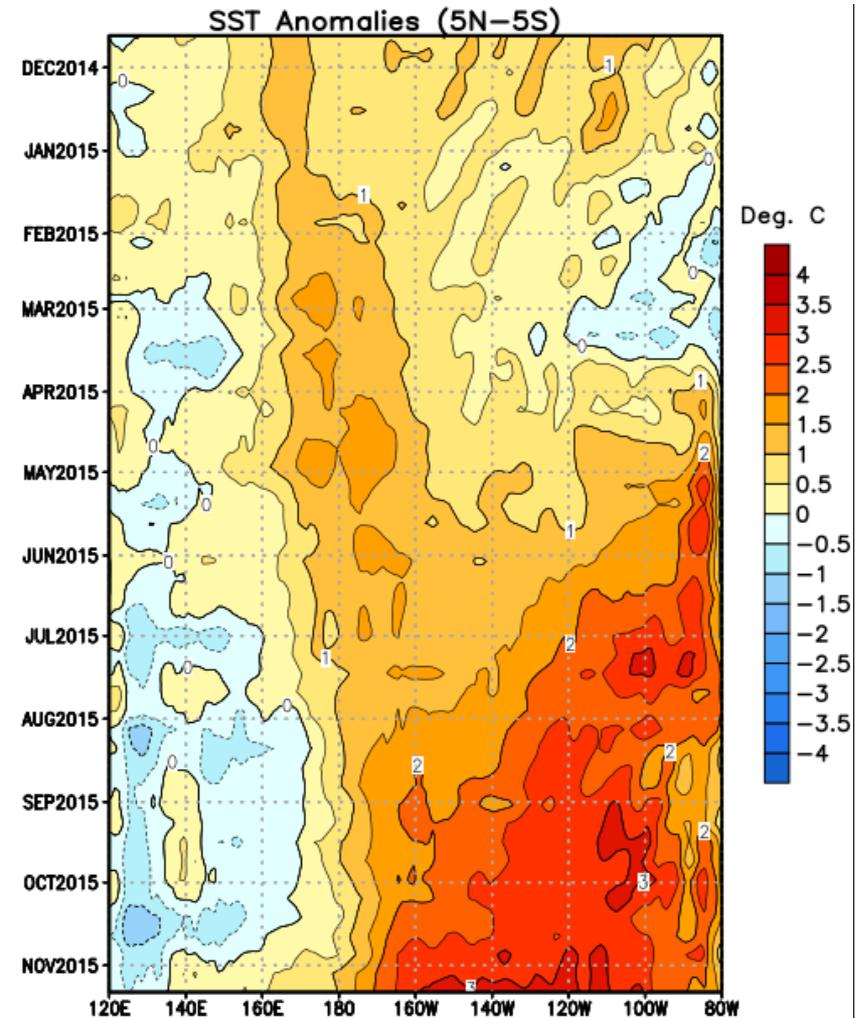
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

Recent Evolution of Equatorial Pacific SST Departures (°C)

During January through mid-March 2015, near-to-below average SSTs were observed in the eastern Pacific, and positive SST anomalies persisted across the western and central Pacific.

From June to mid-September, the largest positive SST anomalies shifted westward.

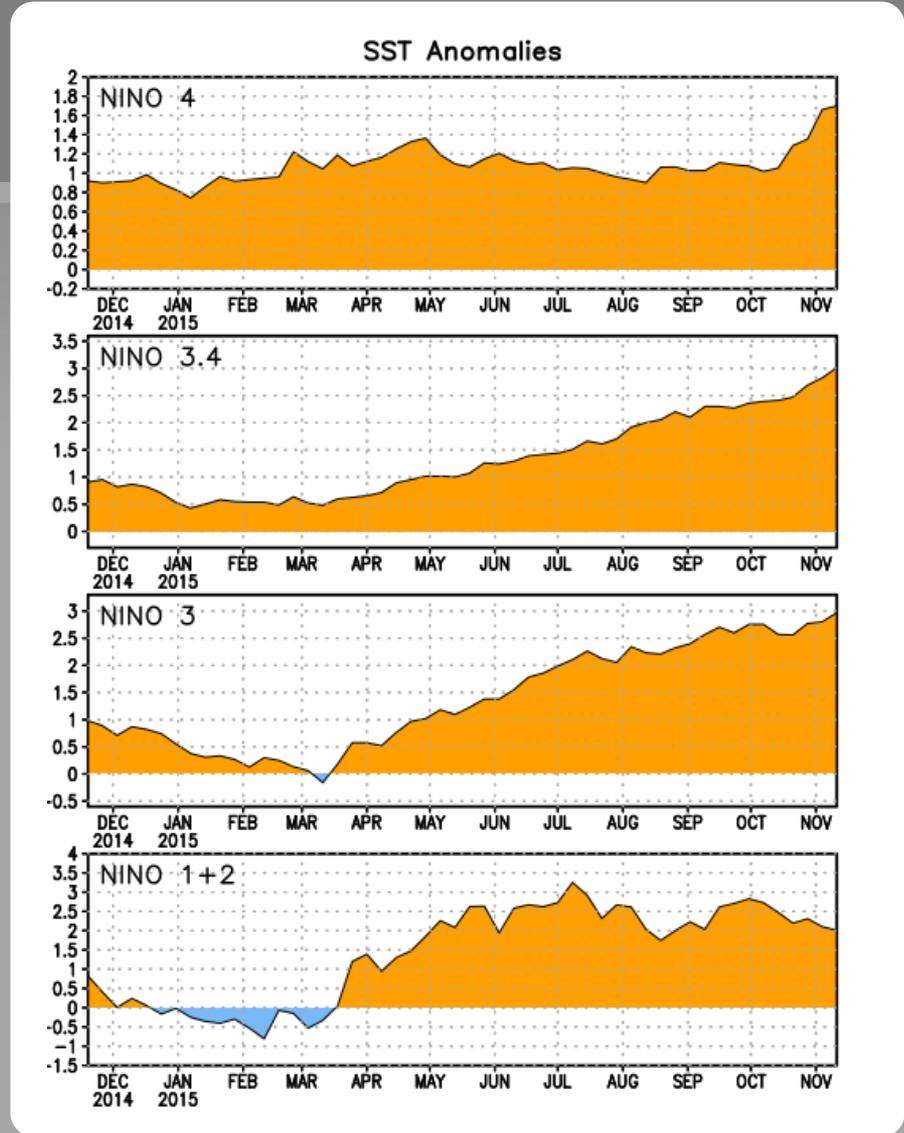
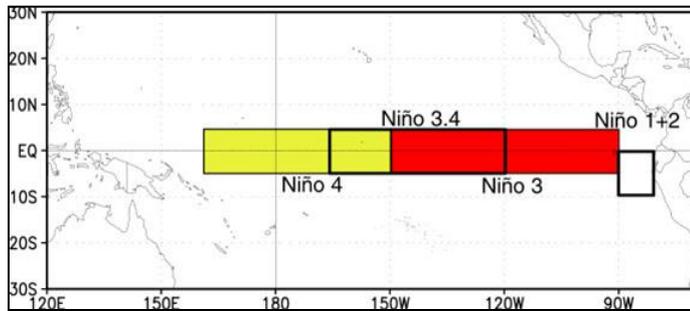
Recently, SST anomalies have increased over the east-central equatorial Pacific Ocean.



Niño Region SST Departures (°C) Recent Evolution

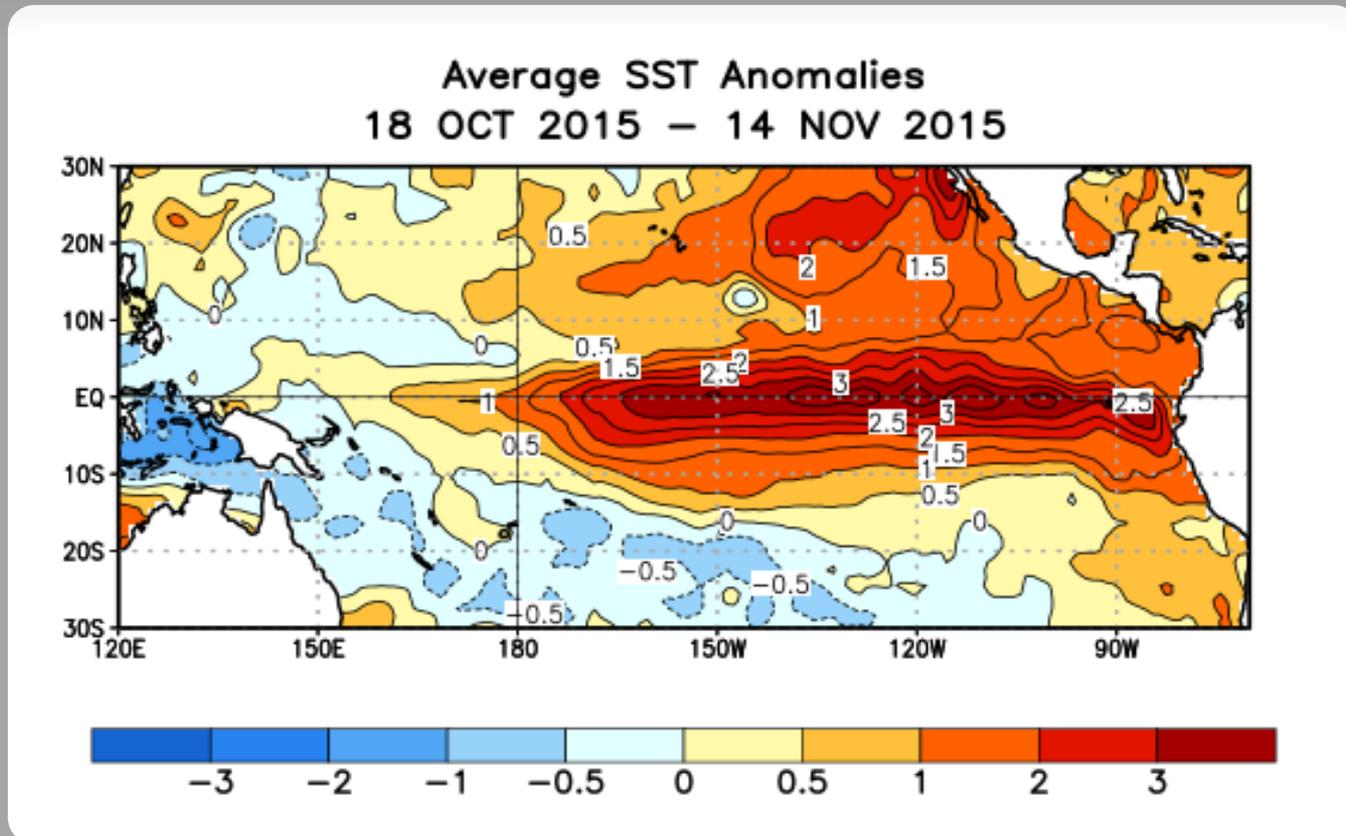
The latest weekly SST departures are:

Niño 4	1.7°C
Niño 3.4	3.0°C
Niño 3	3.0°C
Niño 1+2	2.0°C



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

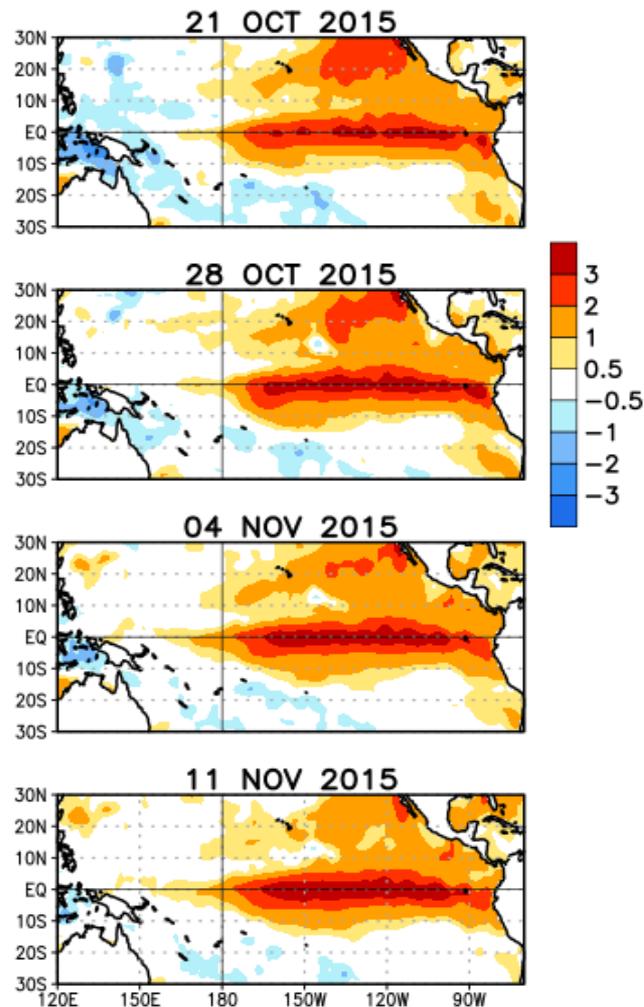
During the last four weeks, tropical SSTs were above average across most of the Pacific.



Weekly SST Departures during the Last Four Weeks

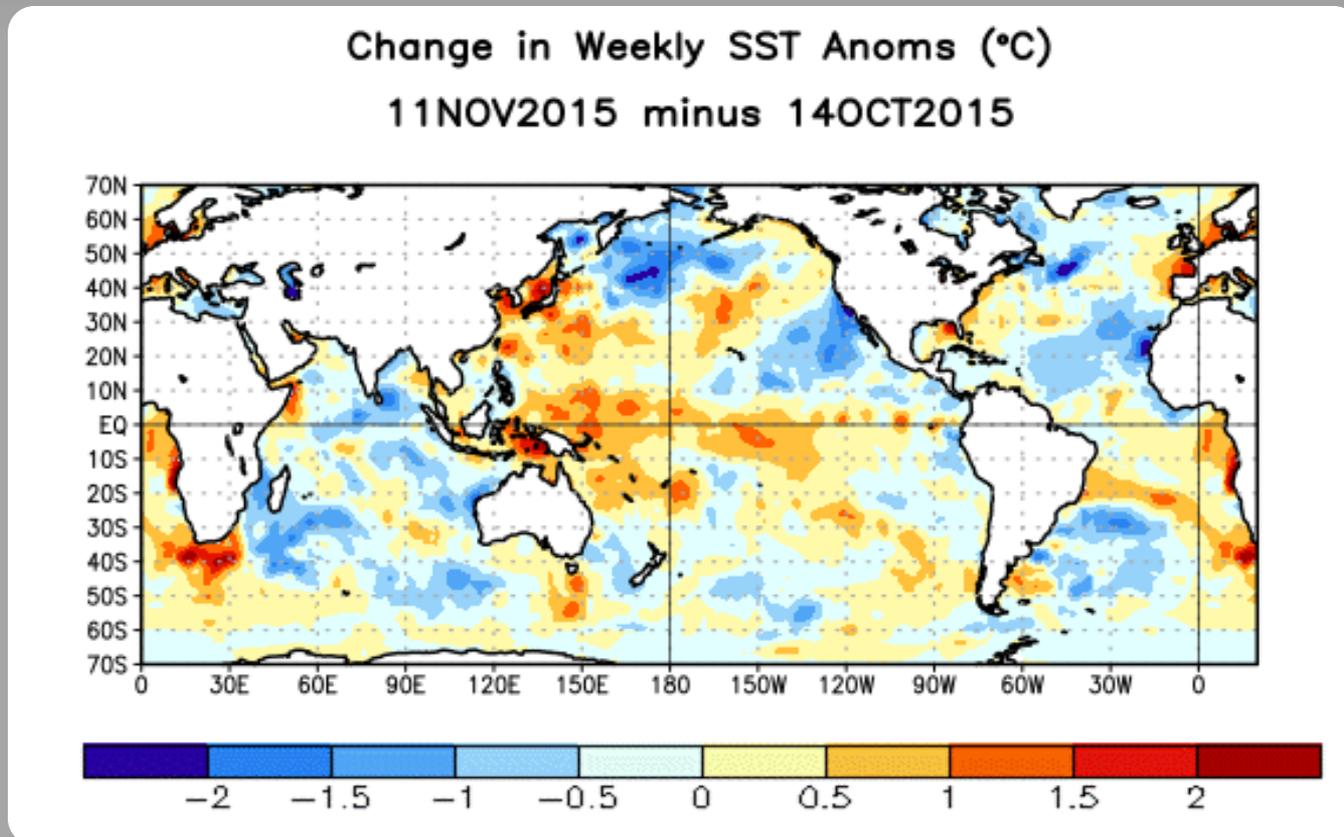
During the last four weeks, positive SST anomalies extended across most of the equatorial Pacific.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, positive changes were observed over most of the equatorial Pacific, except for negative changes near S. America.



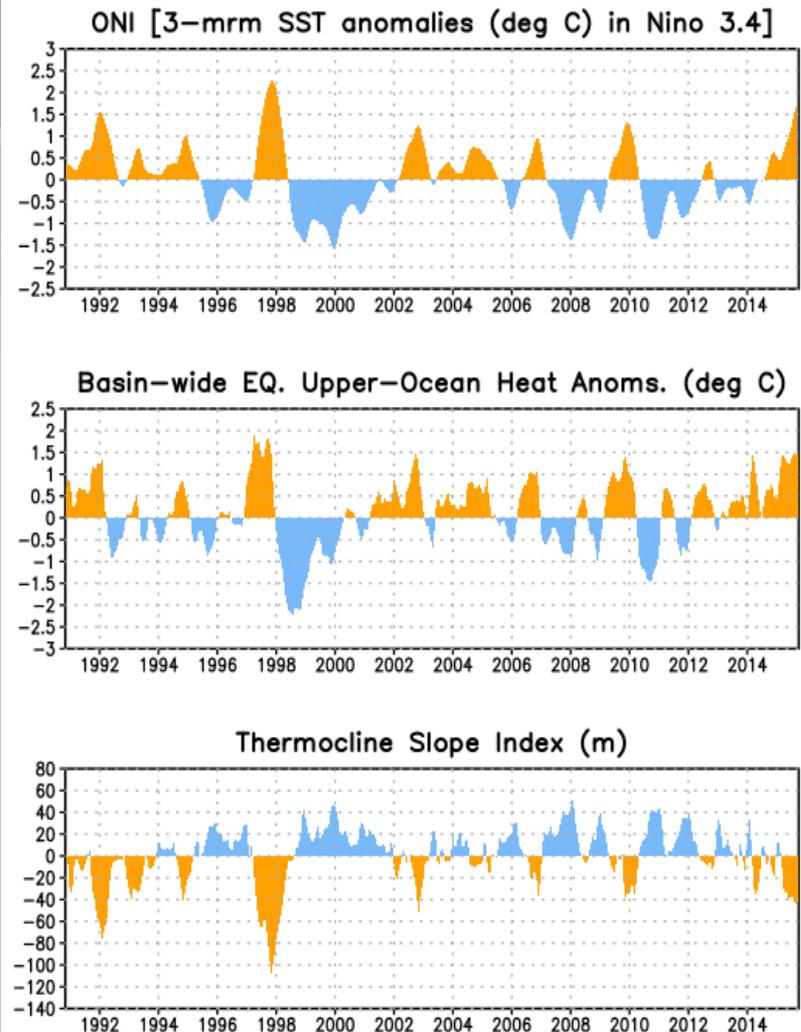
Upper-Ocean Conditions in the Equatorial Pacific

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.

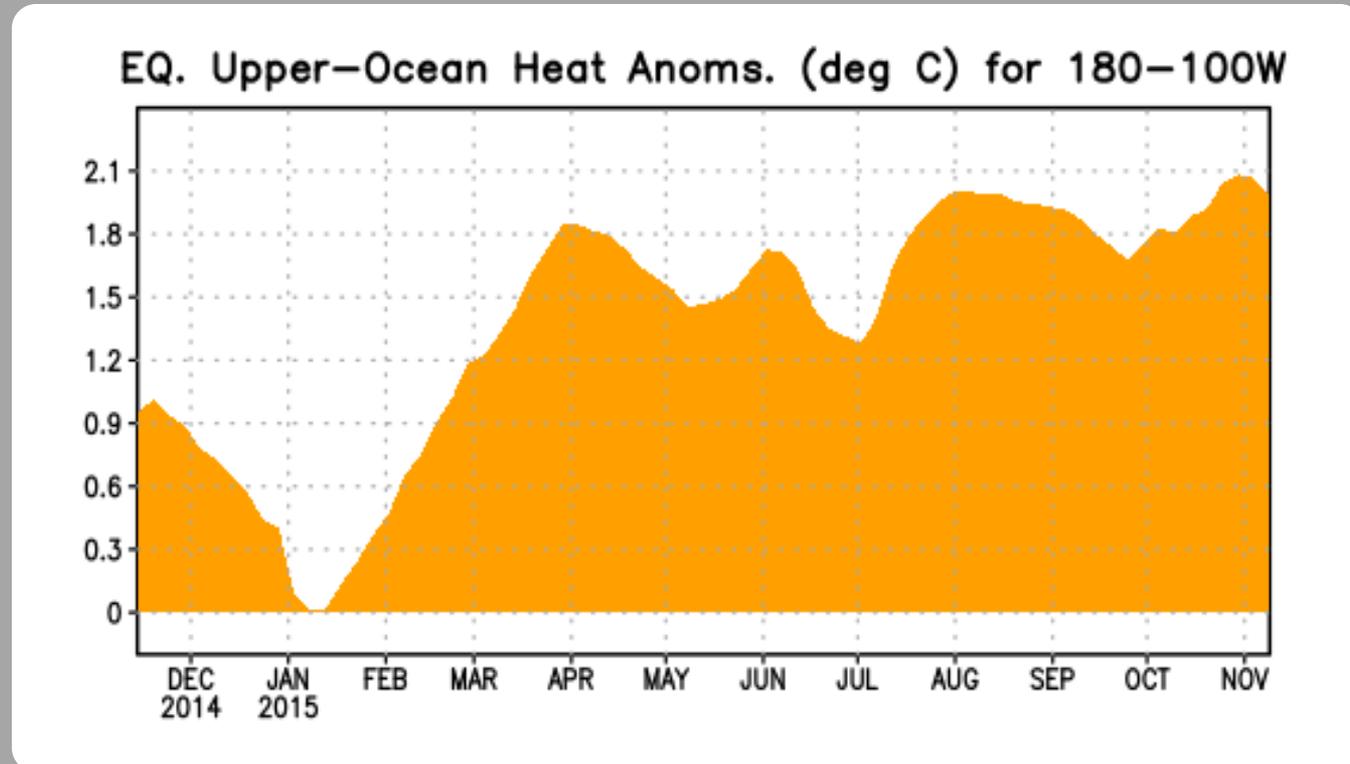
Recent values of the upper-ocean heat anomalies (positive) and thermocline slope index (negative) reflect El Niño.

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).



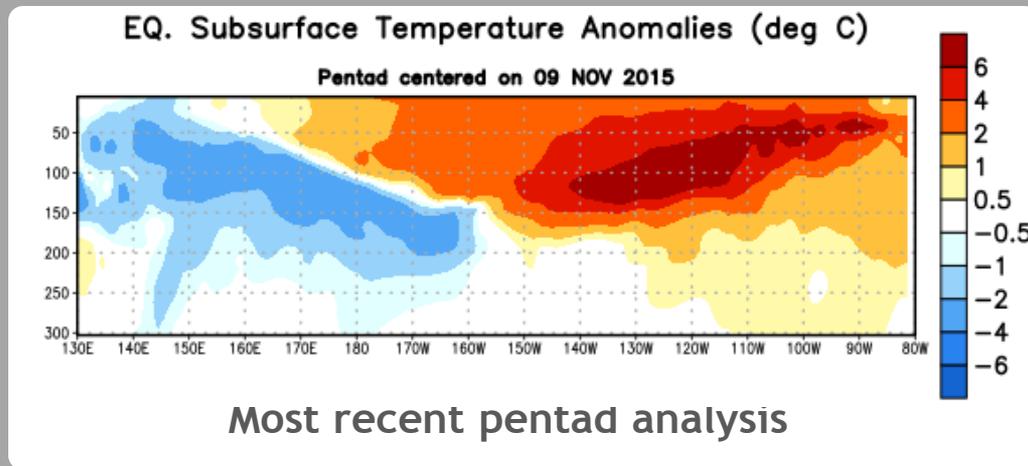
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

During January - March, a significant sub-surface warming occurred across the eastern Pacific. Since March, sub-surface temperature anomalies have remained large, but with some minor fluctuations in strength. During August through late September, positive anomalies decreased. Positive anomalies increased during October.

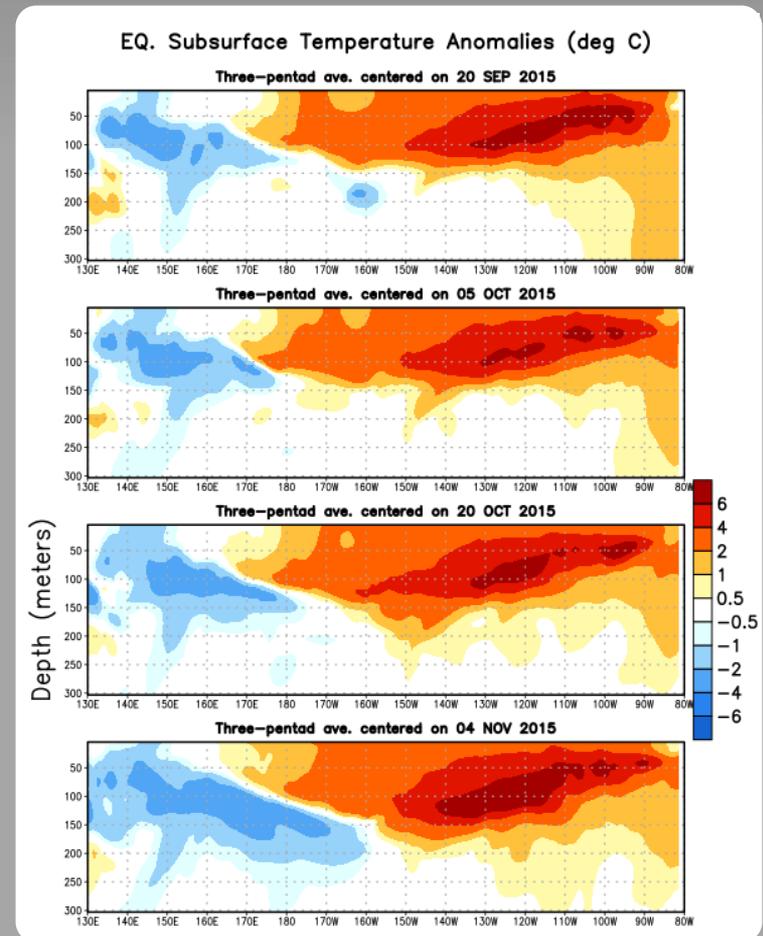


Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, positive subsurface temperature anomalies were observed across the central and eastern equatorial Pacific.



Negative anomalies in the western Pacific have shifted slightly eastward at depth.

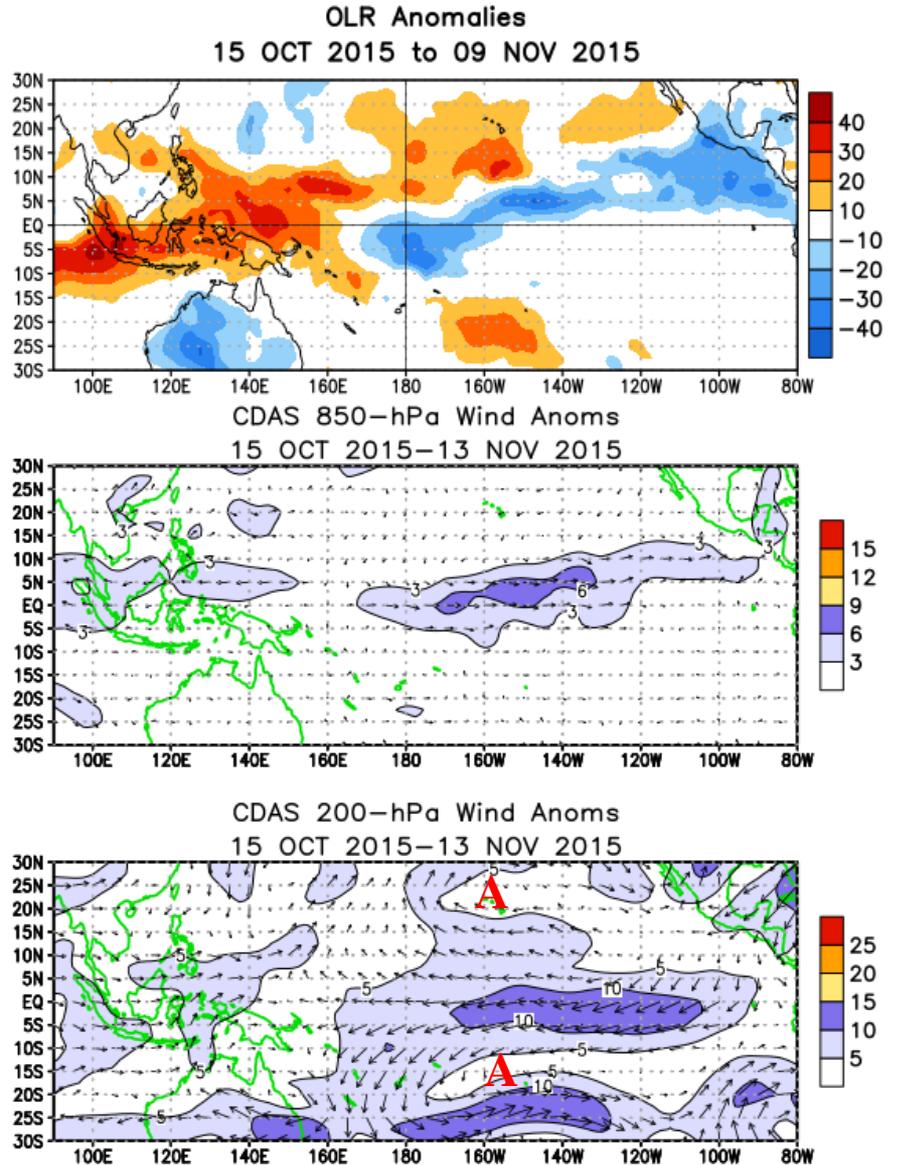


Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident across most of the tropical Pacific, mainly north of equator. Positive OLR anomalies (suppressed convection and precipitation) were observed over Indonesia, Malaysia, the Philippines, and Papua New Guinea.

Anomalous low-level (850-hPa) westerly winds extended from the International Date Line to the eastern tropical Pacific.

Anomalous upper-level (200-hPa) easterlies were observed over most of the equatorial Pacific. Anomalous anti-cyclones were evident in the subtropics of both hemisphere.



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.

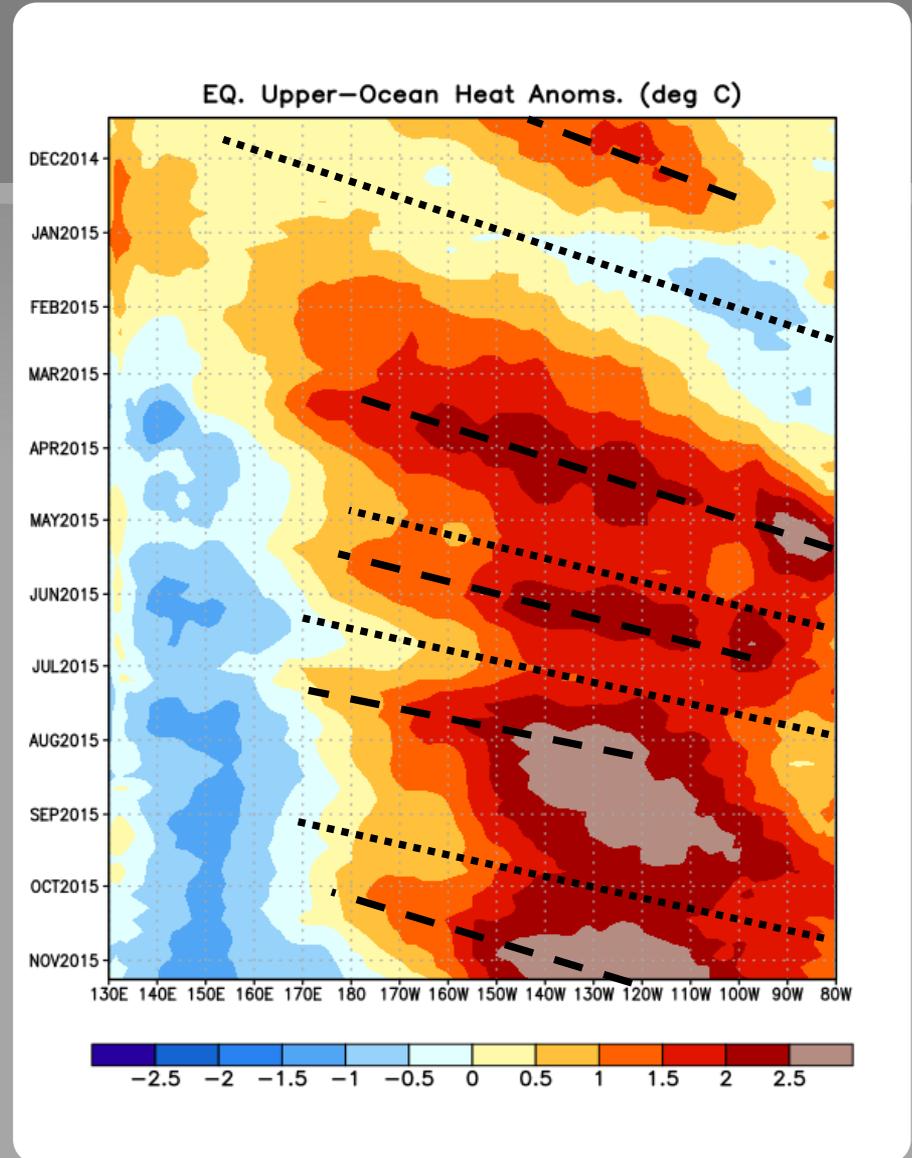
Weekly Heat Content Evolution in the Equatorial Pacific

Downwelling phases of a Kelvin wave were observed in March-April, mid-May to late June, and July to August.

During August and September, positive subsurface temperature anomalies slowly shifted eastward.

Another downwelling Kelvin wave was initiated in early October.

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.



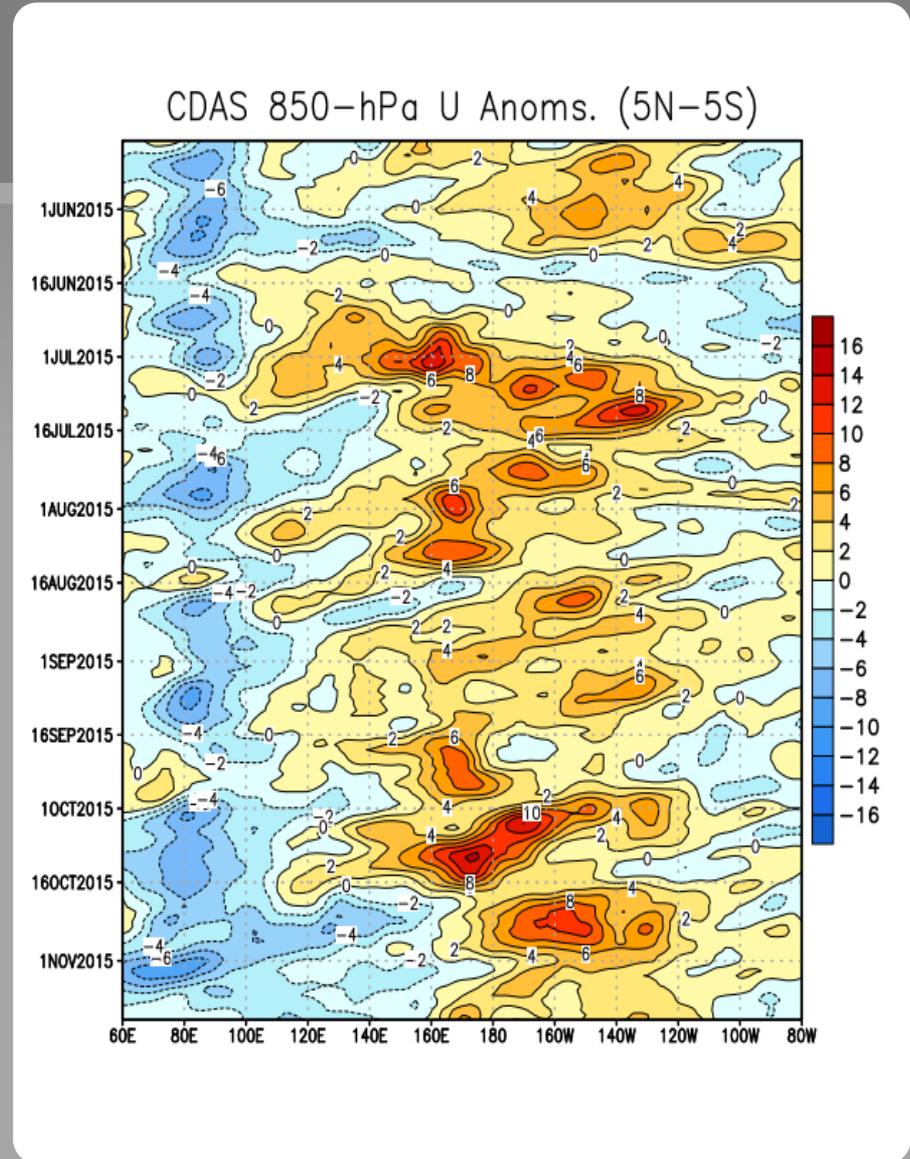
Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

During early May, late June/early July, early August, late September and early October westerly wind bursts were observed between 140°E and 180° .

Recently, westerly wind anomalies continue over the equatorial Pacific between 160°E and 110°W .

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



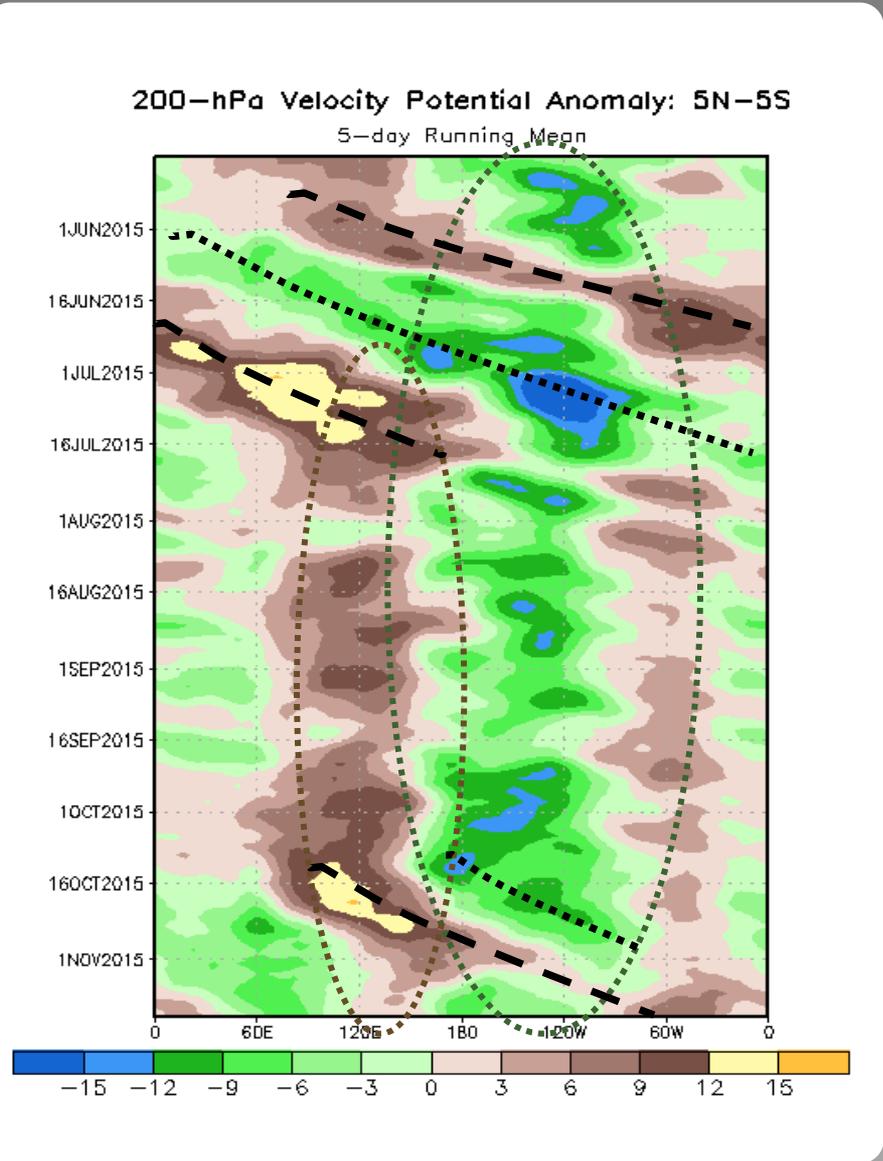
Upper-level (200-hPa) Velocity Potential Anomalies

From late May through early July, the Madden-Julian Oscillation (MJO) contributed to an eastward propagation of regions of upper-level divergence and convergence.

Throughout the period, anomalous upper-level divergence (green shading) and convergence (brown shading) have generally persisted over Indonesia and the Central/Eastern Pacific.

Sub-seasonal/MJO activity was evident during late October and early November.

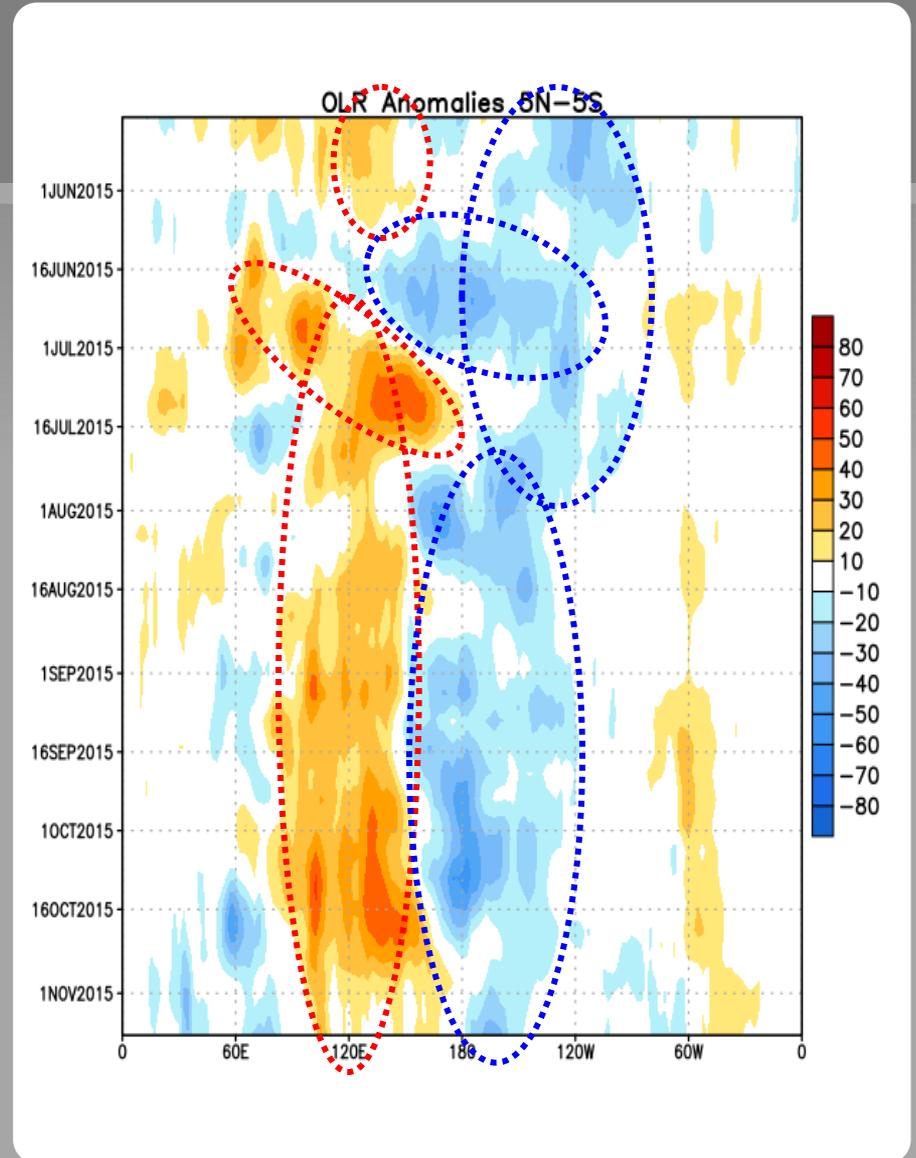
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)



Outgoing Longwave Radiation (OLR) Anomalies

Since early May, negative anomalies have been observed over the central and/or eastern Pacific. Since early July, positive anomalies have persisted near Indonesia.

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.v4). The SST reconstruction methodology is described in Huang et al., 2015, J. Climate, vol. 28, 911-930.)

It is one index that helps to place current events into a historical perspective

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 .

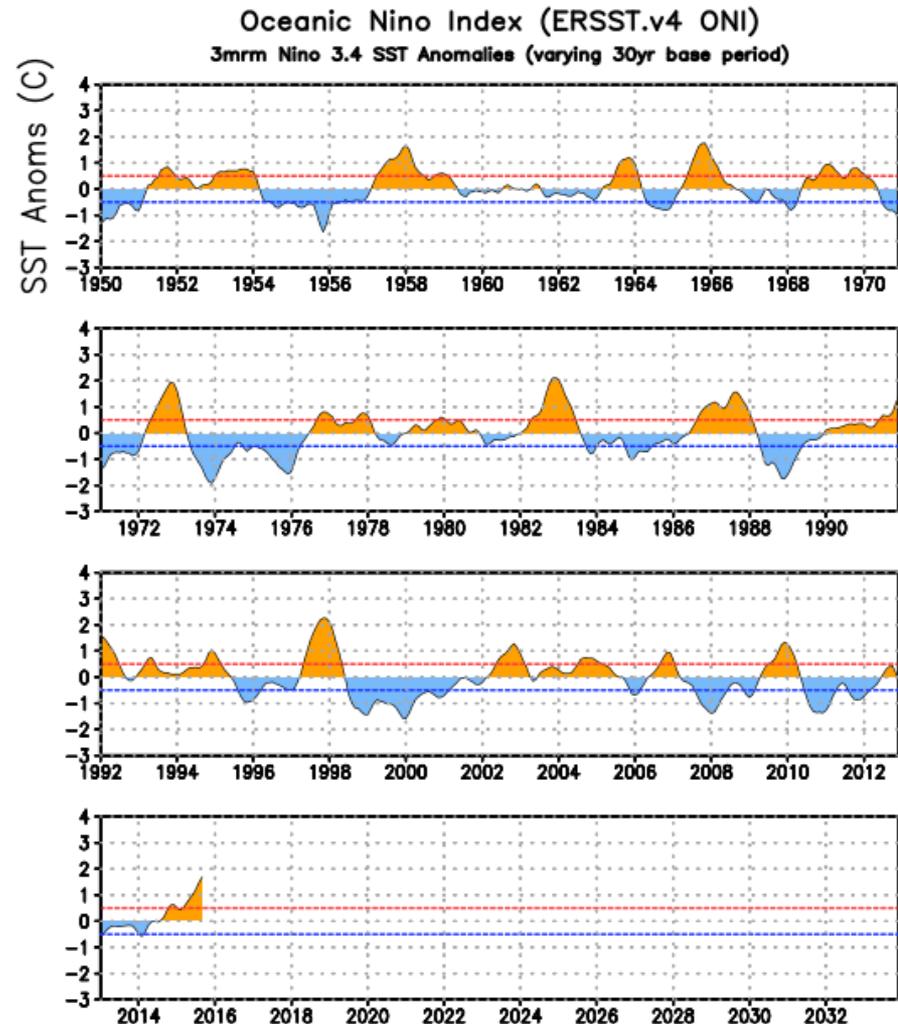
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 2015) is 1.7°C.

El Niño ↑
Neutral
La Niña ↓



Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v4

Recent Pacific warm (red) and cold (blue) periods based on a threshold of ± 0.5 °C for the Oceanic Niño Index (ONI) [3 month running mean of ERSST.v4 SST anomalies in the Niño 3.4 region (5N-5S, 120-170W)]. For historical purposes, periods of below and above normal SSTs are colored in blue and red when the threshold is met for a minimum of 5 consecutive over-lapping seasons.

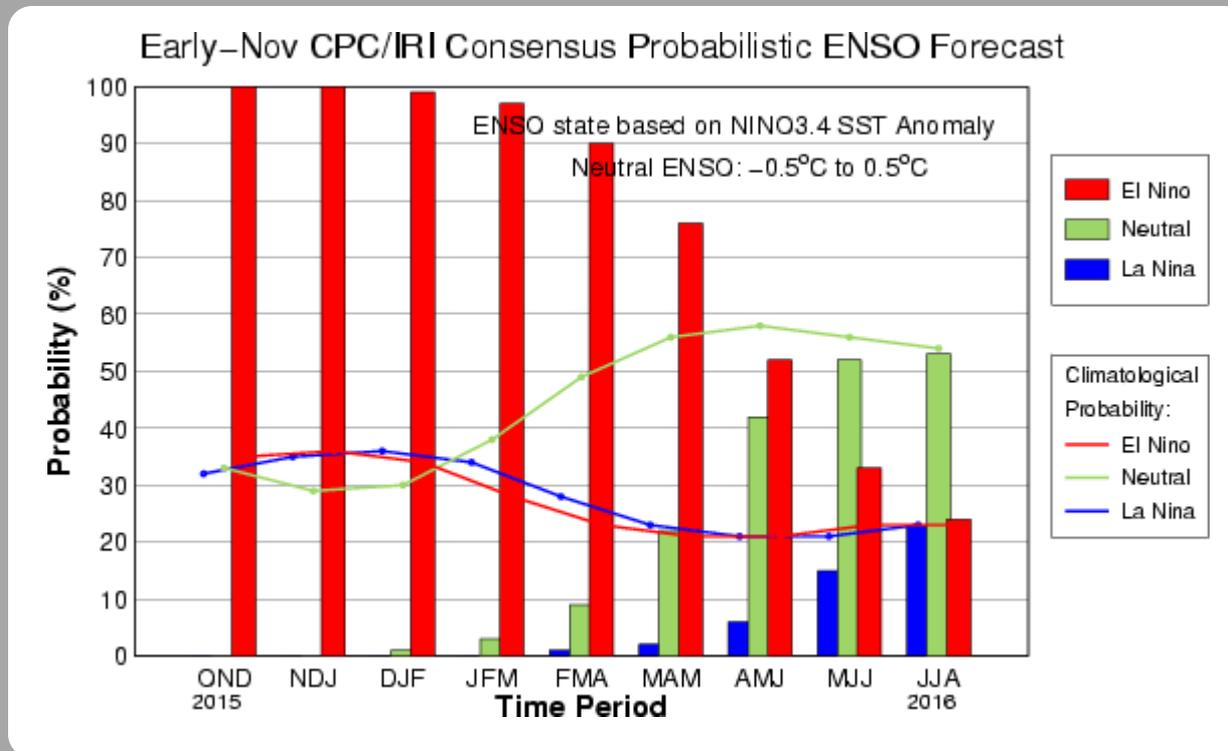
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2003	0.9	0.6	0.4	0.0	-0.2	-0.1	0.1	0.2	0.3	0.4	0.4	0.4
2004	0.3	0.2	0.1	0.1	0.2	0.3	0.5	0.7	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.5	0.5	0.4	0.2	0.1	0.0	0.0	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.1	0.2	0.3	0.5	0.8	0.9	1.0
2007	0.7	0.3	0.0	-0.1	-0.2	-0.2	-0.3	-0.6	-0.8	-1.1	-1.2	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.3	-0.2	-0.2	-0.3	-0.5	-0.7
2009	-0.8	-0.7	-0.4	-0.1	0.2	0.4	0.5	0.6	0.7	1.0	1.2	1.3
2010	1.3	1.1	0.8	0.5	0.0	-0.4	-0.8	-1.1	-1.3	-1.4	-1.3	-1.4
2011	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.3	-0.5	-0.7	-0.9	-0.9	-0.8
2012	-0.7	-0.6	-0.5	-0.4	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.2
2013	-0.4	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
2014	-0.5	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.6
2015	0.5	0.4	0.5	0.7	0.9	1.0	1.2	1.5	1.7			

CPC/IRI Probabilistic ENSO Outlook

Updated: 12 November 2015

The chance of El Niño gradually decreases into the spring and ENSO-neutral is favored by May-June-July (MJJ) 2016.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

Most models indicate that Niño 3.4 will be above +1.5°C (a “strong” El Niño) during late 2015 into early 2016.

Positive anomalies are predicted to weaken through the Northern Hemisphere Spring 2016.

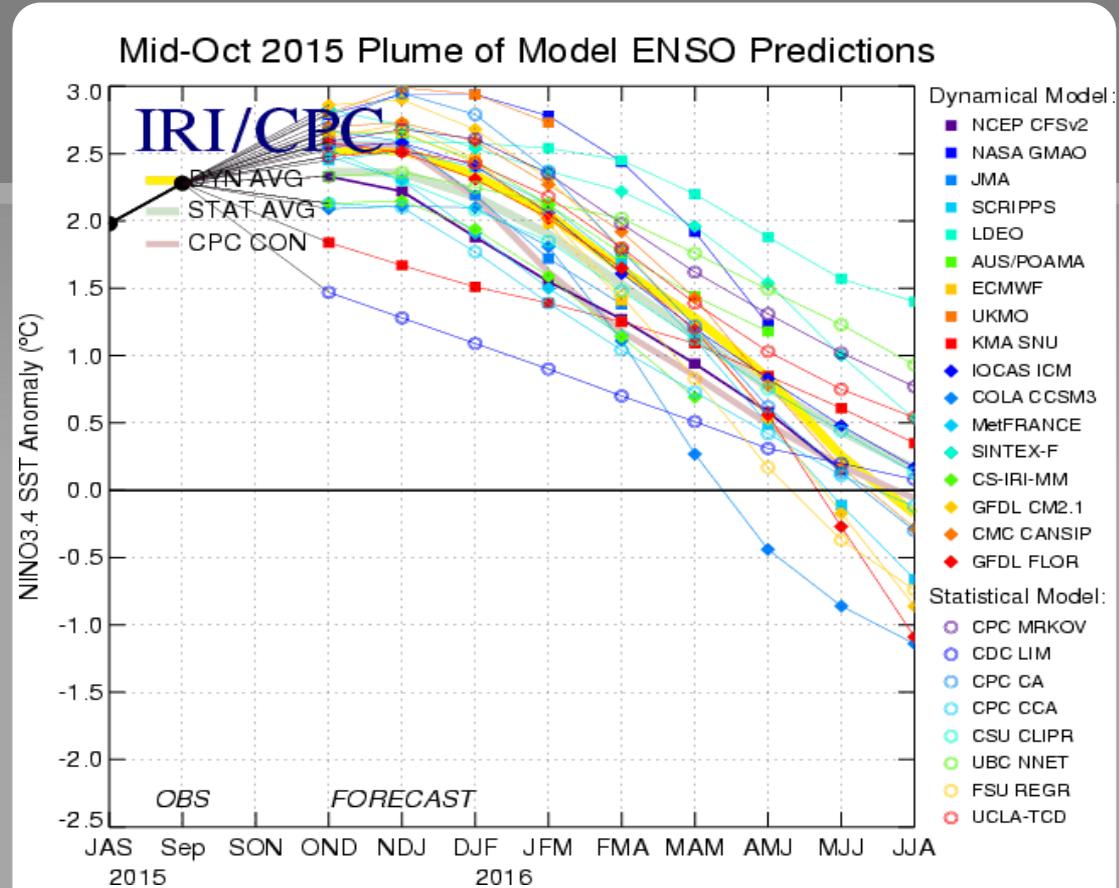
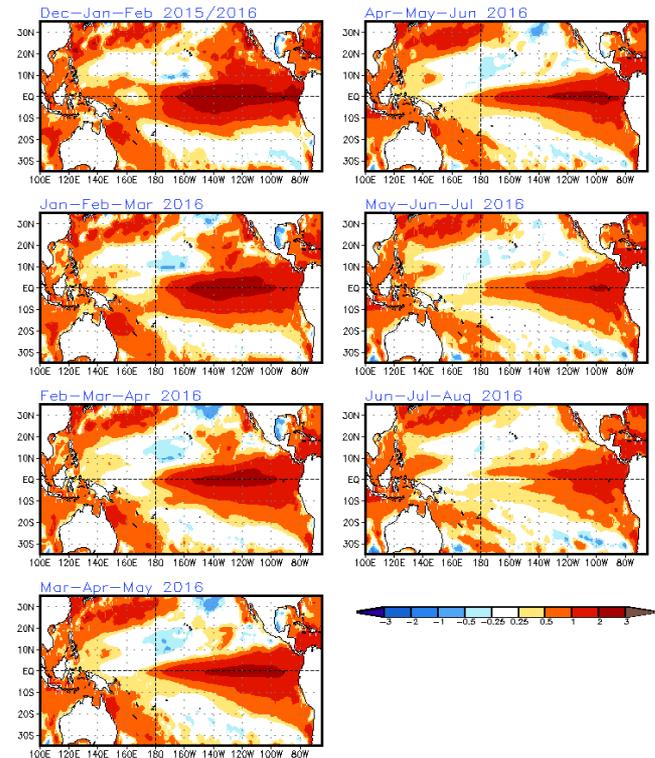
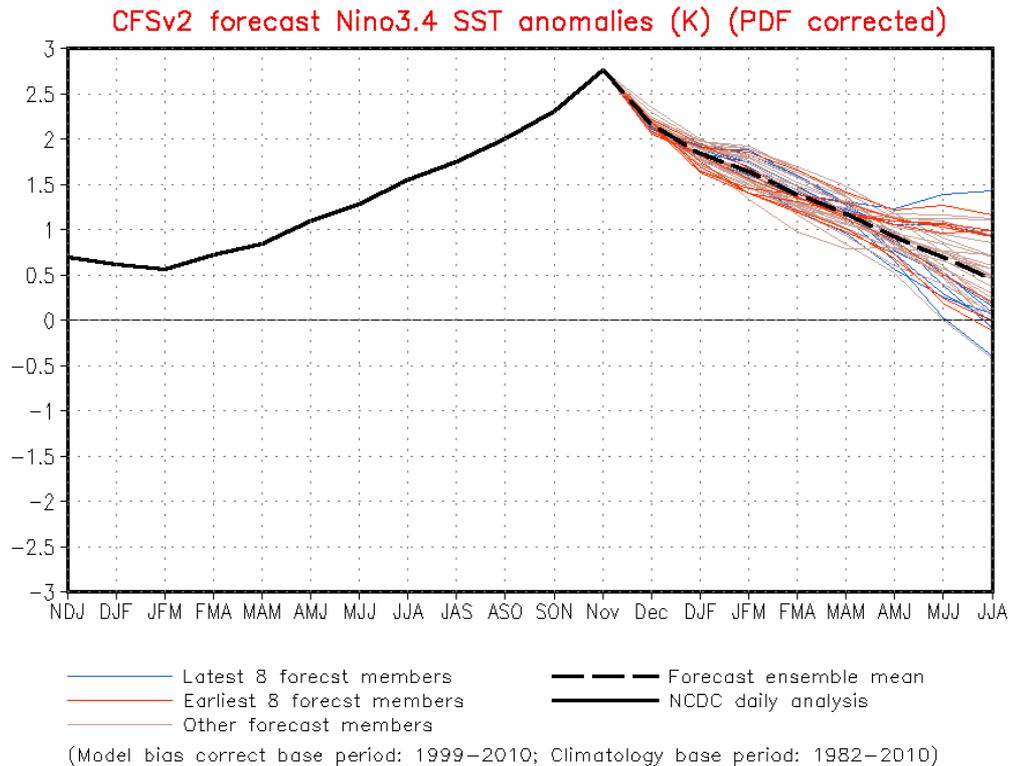


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 13 October 2015).

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

Issued: 16 November 2015

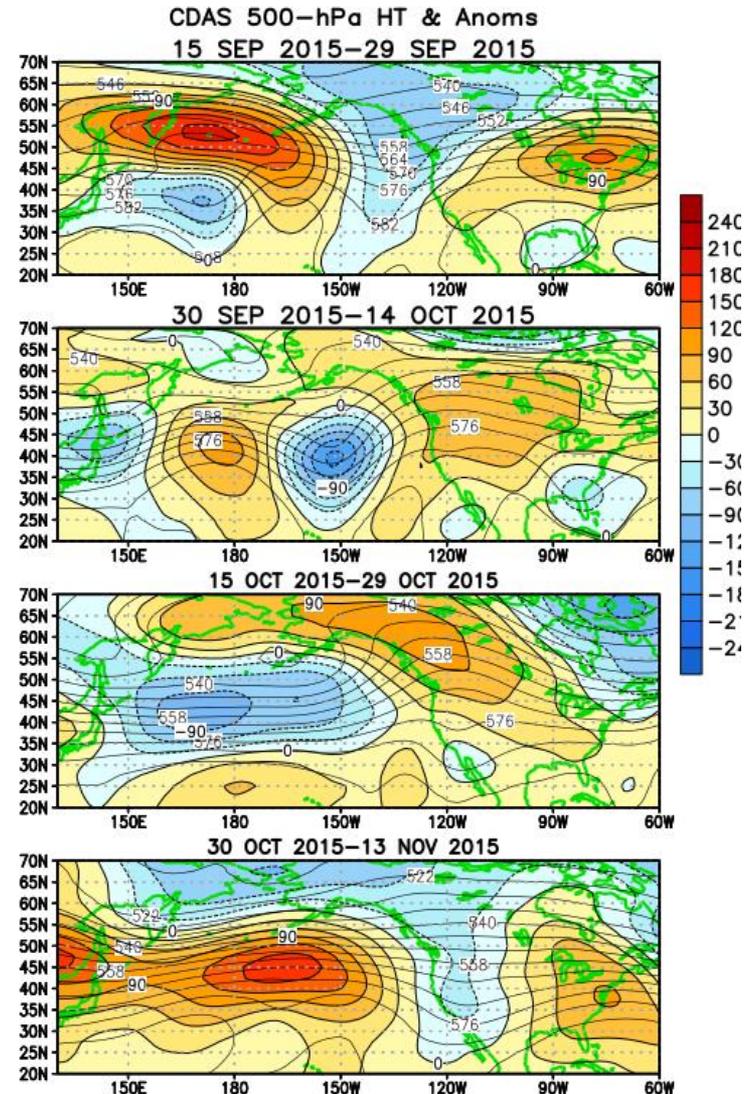
The CFS.v2 ensemble mean (black dashed line) predicts El Niño through JJA 2016.



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

During late September through October, above-average heights/temperatures prevailed over western and central North America.

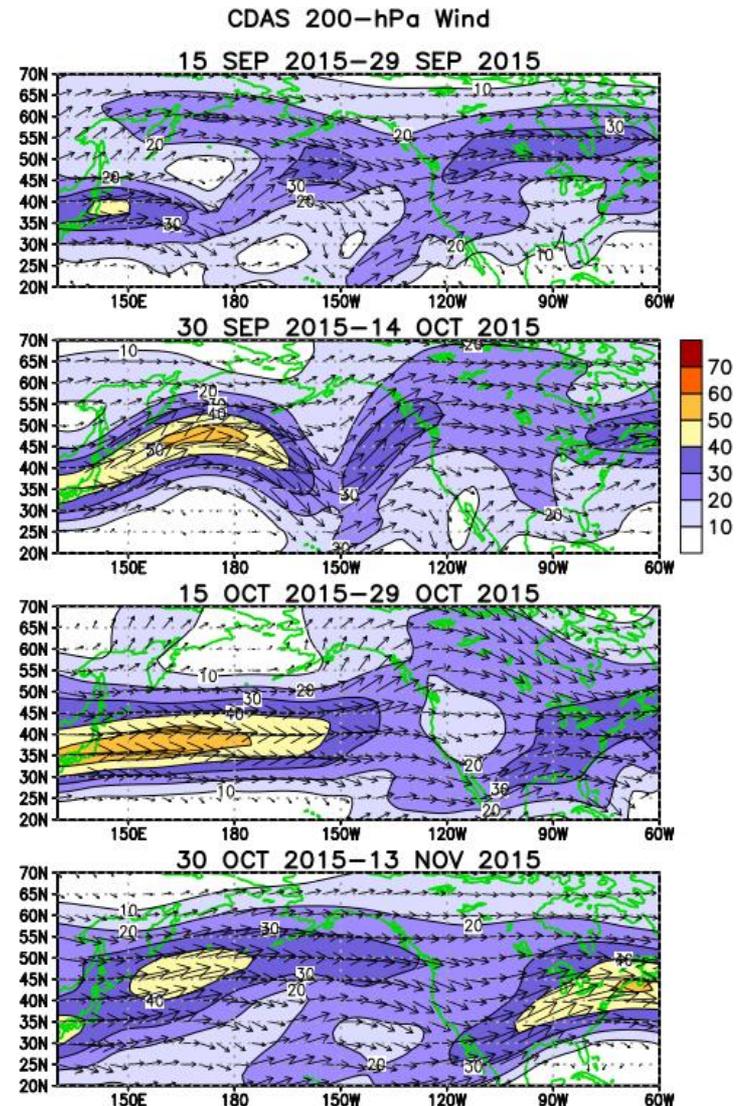
Recently, above-average heights/temperatures dominated over the East and near-to-below average heights/temperatures were observed over the West.



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

During late September through October, above-average heights/temperatures prevailed over western and central North America.

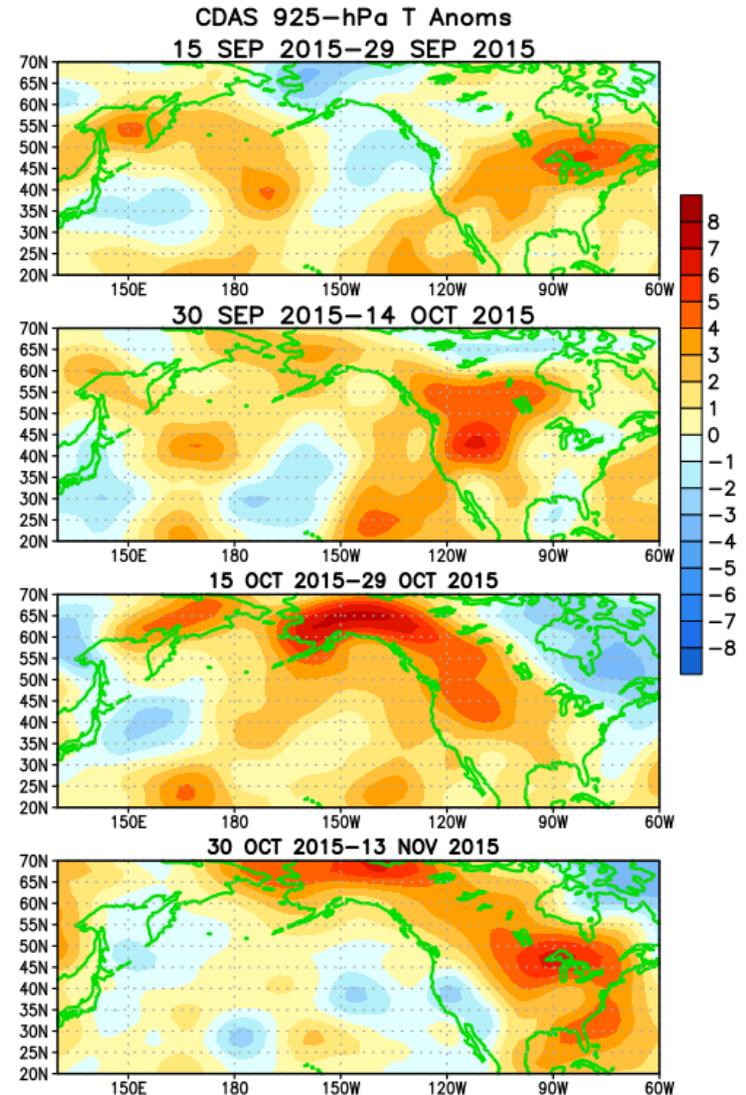
Recently, above-average heights/temperatures dominated over the East and near-to-below average heights/temperatures were observed over the West.



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

During late September through October, above-average heights/temperatures prevailed over western and central North America.

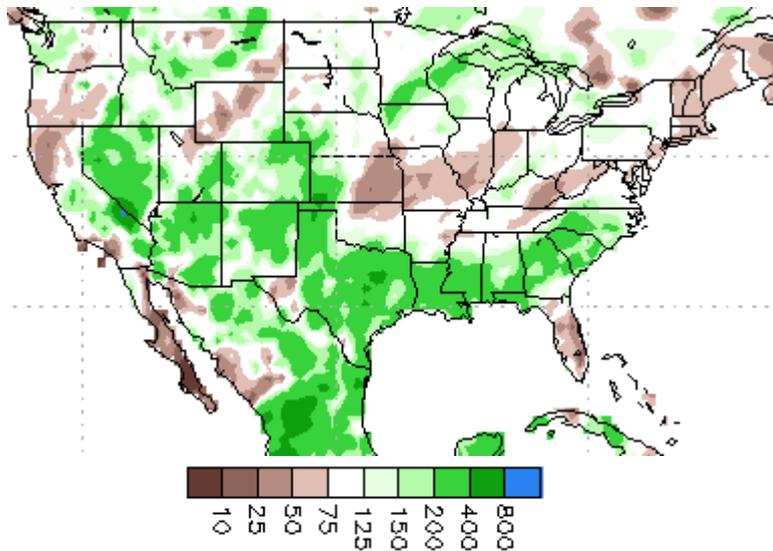
Recently, above-average heights/temperatures dominated over the East and near-to-below average heights/temperatures were observed over the West.



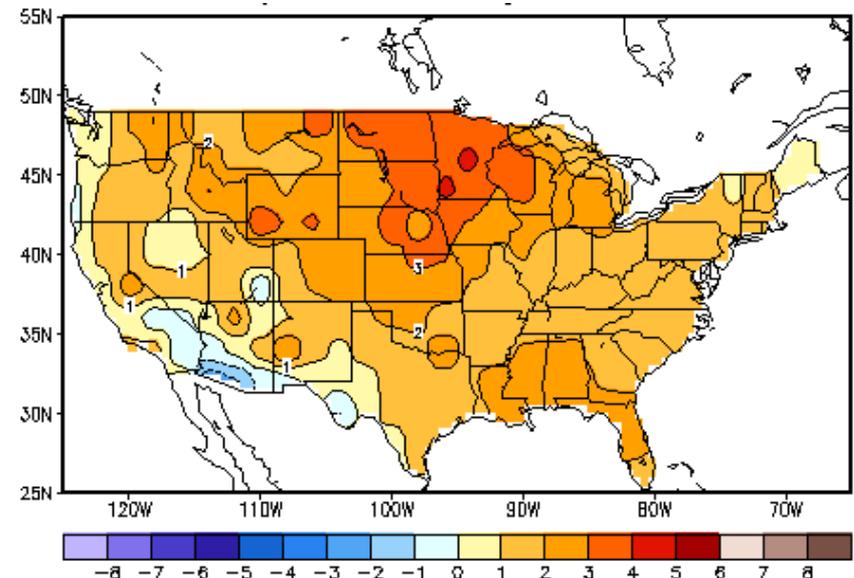
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 14 November 2015

Percent of Average Precipitation



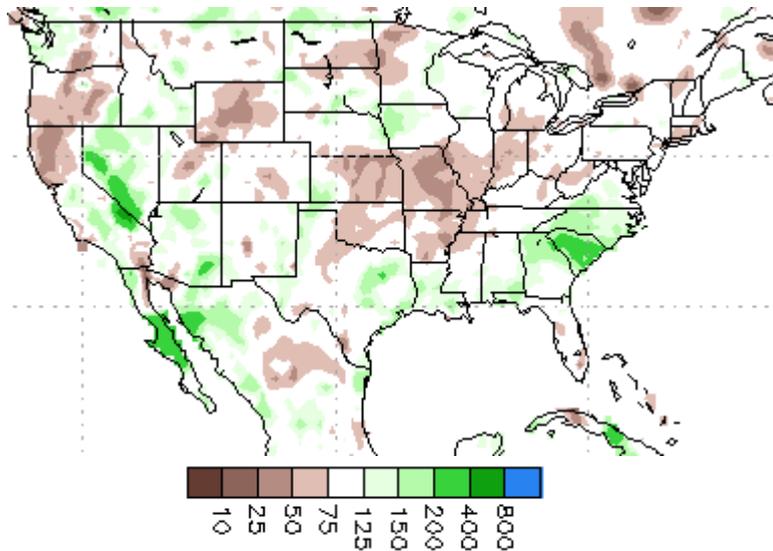
Temperature Departures (degree C)



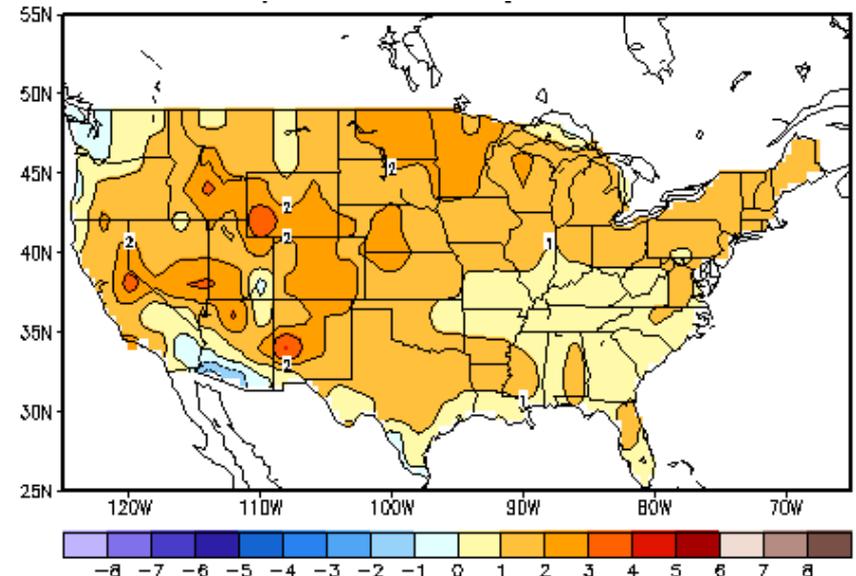
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 14 November 2015

Percent of Average Precipitation



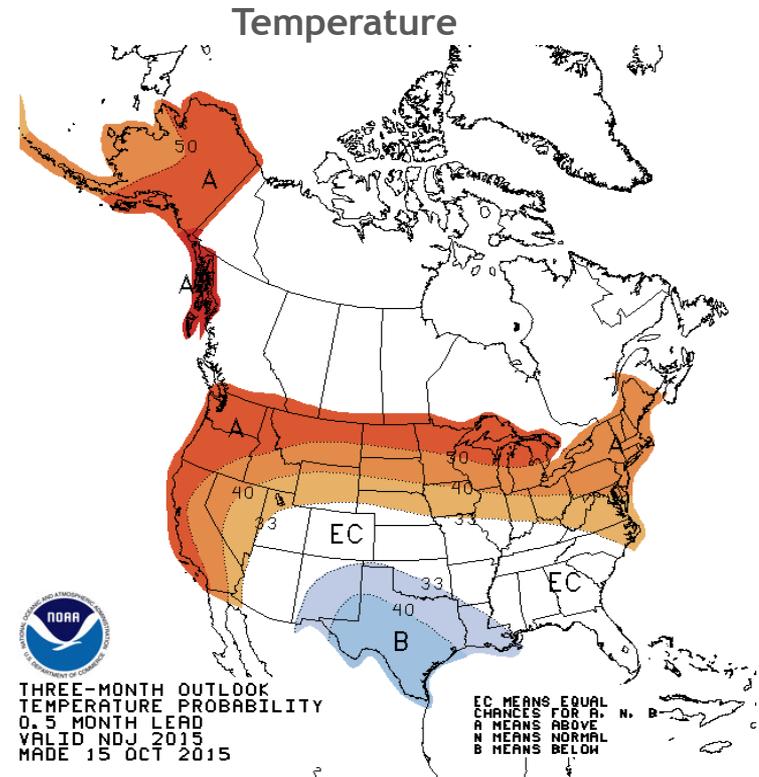
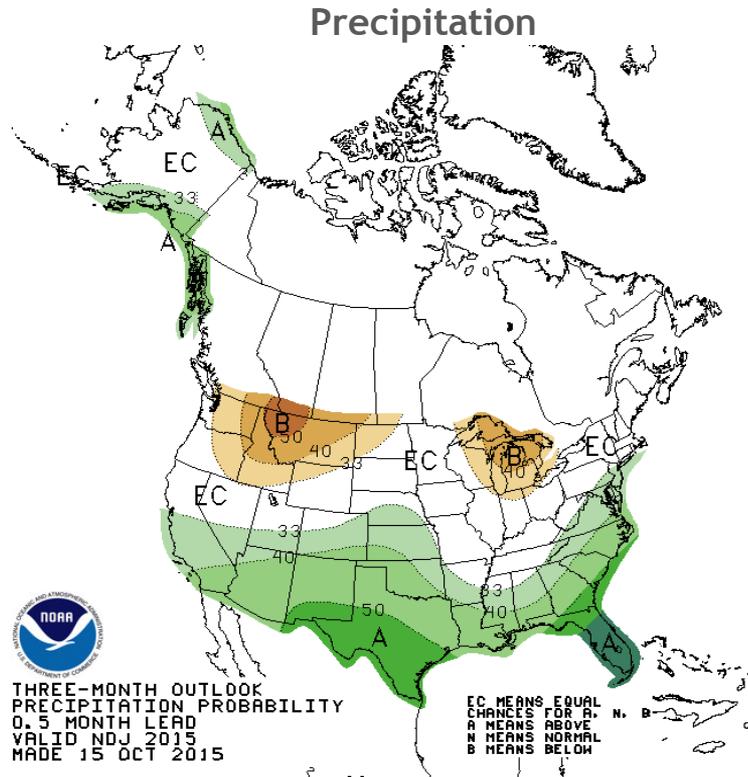
Temperature Departures (degree C)



U. S. Seasonal Outlooks

November 2015 - January 2016

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



Summary

ENSO Alert System Status: El Niño Advisory

El Niño conditions are present.*

Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.

El Niño will likely peak during the Northern Hemisphere winter 2015-16, with a transition to ENSO-neutral anticipated during the late spring or early summer 2016.*

* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).