ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
4 April 2016

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Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

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ENSO Alert System Status: El Niño Advisory

A strong El Niño is present and is weakening.*

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

A transition to ENSO-neutral is likely during late Northern Hemisphere spring or early summer 2016, with close to a 50% chance for La Niña conditions to develop by the fall.*

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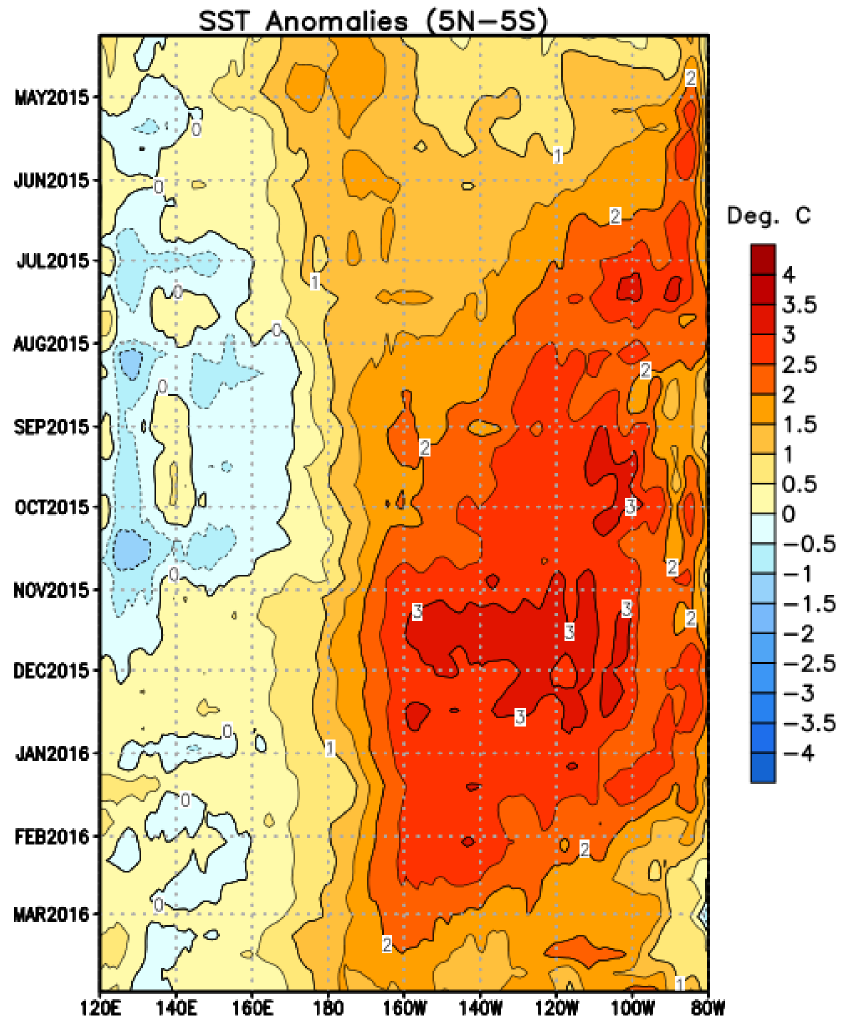
Recent Evolution of Equatorial Pacific SST Departures (ºC)



From June 2015 through September 2015, the largest positive SST anomalies shifted westward.

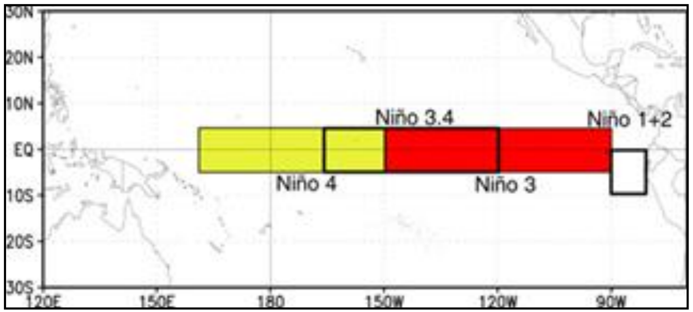
Since January 2016, sea surface temperature anomalies have decreased in the eastern equatorial Pacific Ocean.

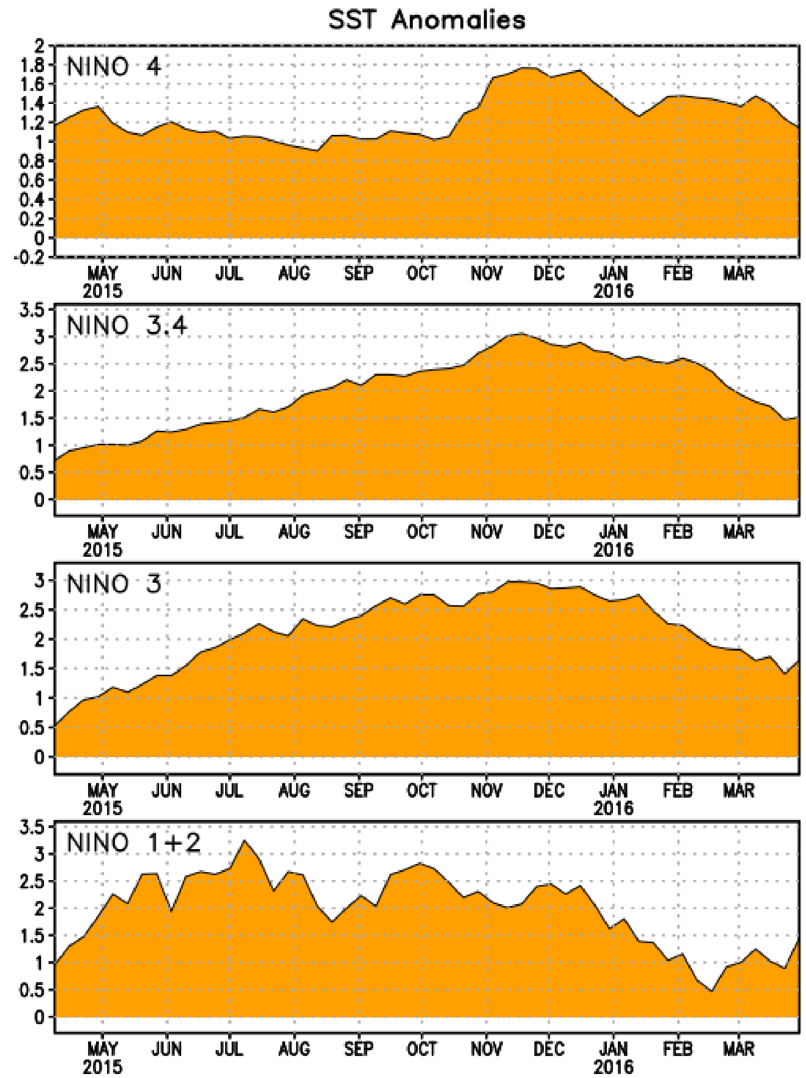
Positive SST anomalies greater than 1°C remain between ~180° and ~80°W.

Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

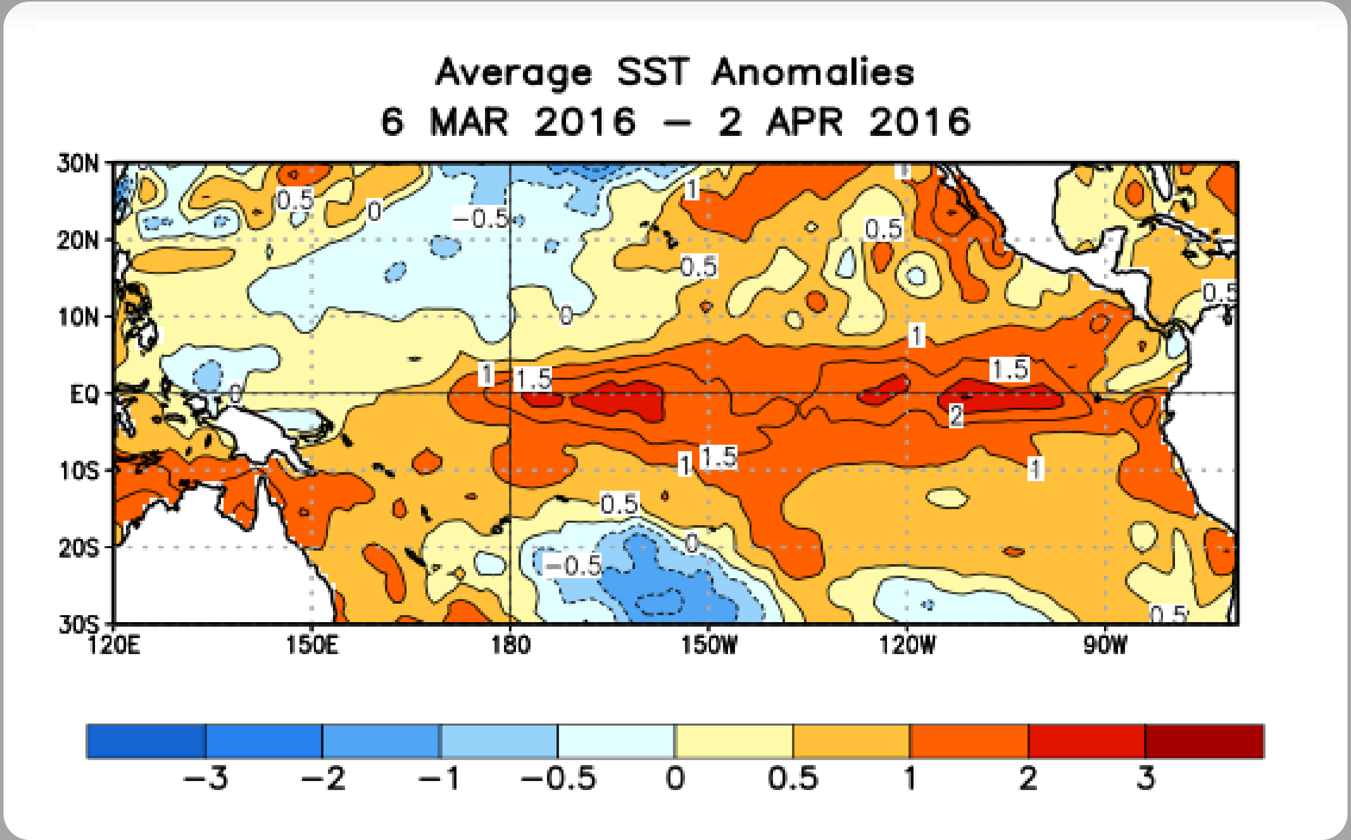
Niño 4	1.1°C
Niño 3.4	1.5°C
Niño 3	1.6°C
Niño 1+2	1.5°C





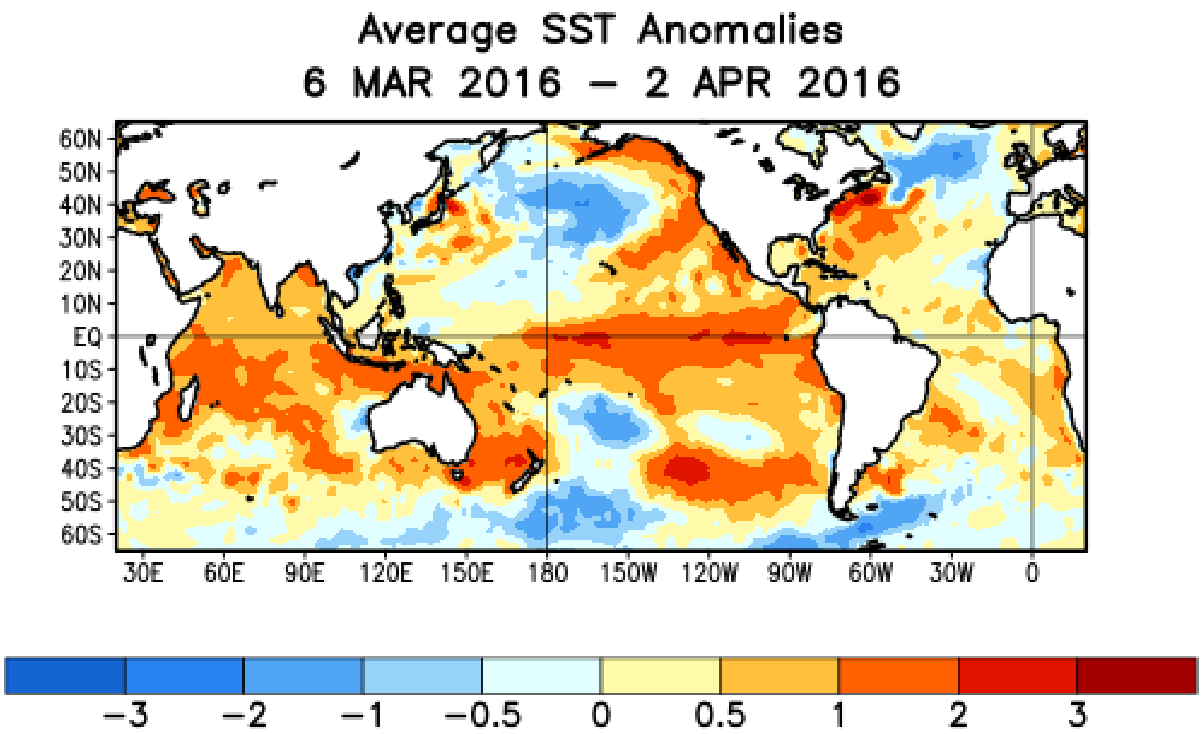
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

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



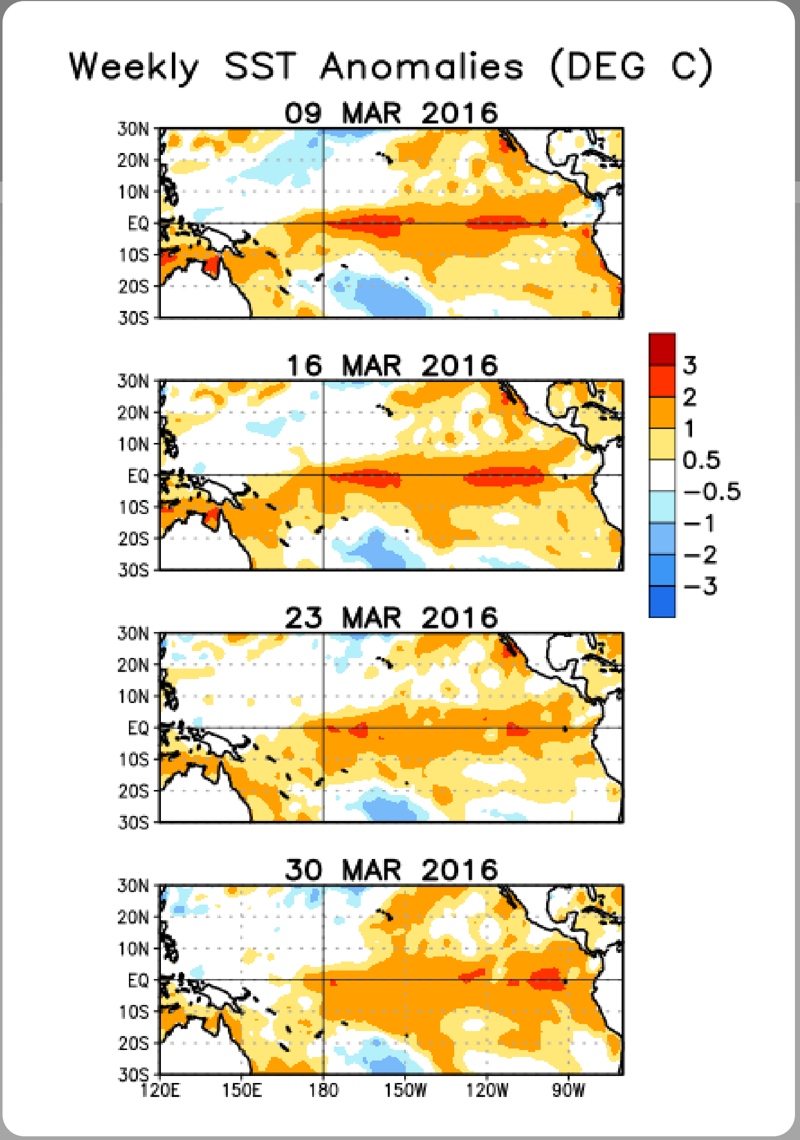
Global SST Departures (ºC) During the Last Four Weeks

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



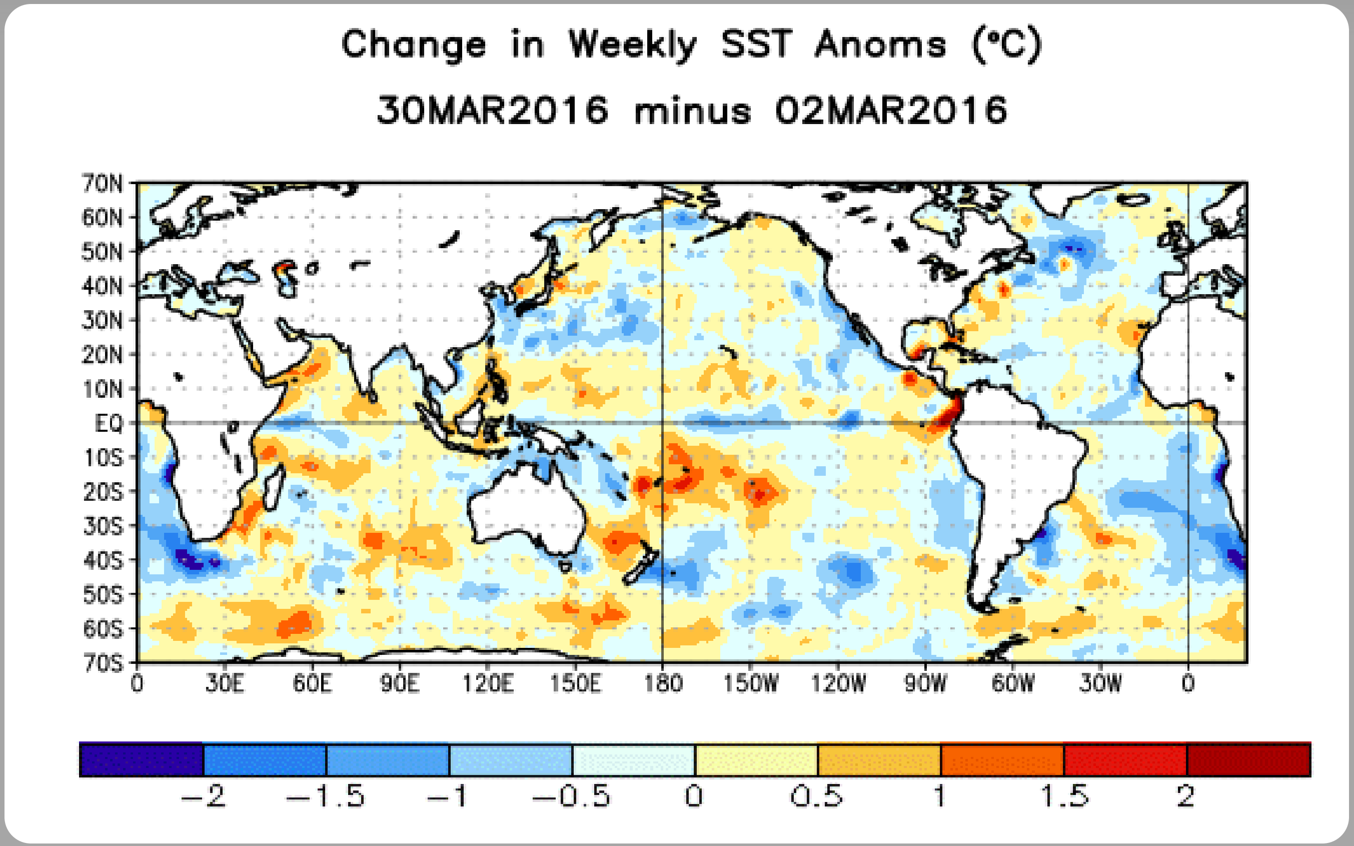
Weekly SST Departures during the Last Four Weeks

During the last four weeks, positive SST anomalies persisted across most of the equatorial Pacific, with diminishing strength.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, equatorial SST anomalies notably decreased in the central and east-central Pacific, while increasing in the far eastern Pacific.

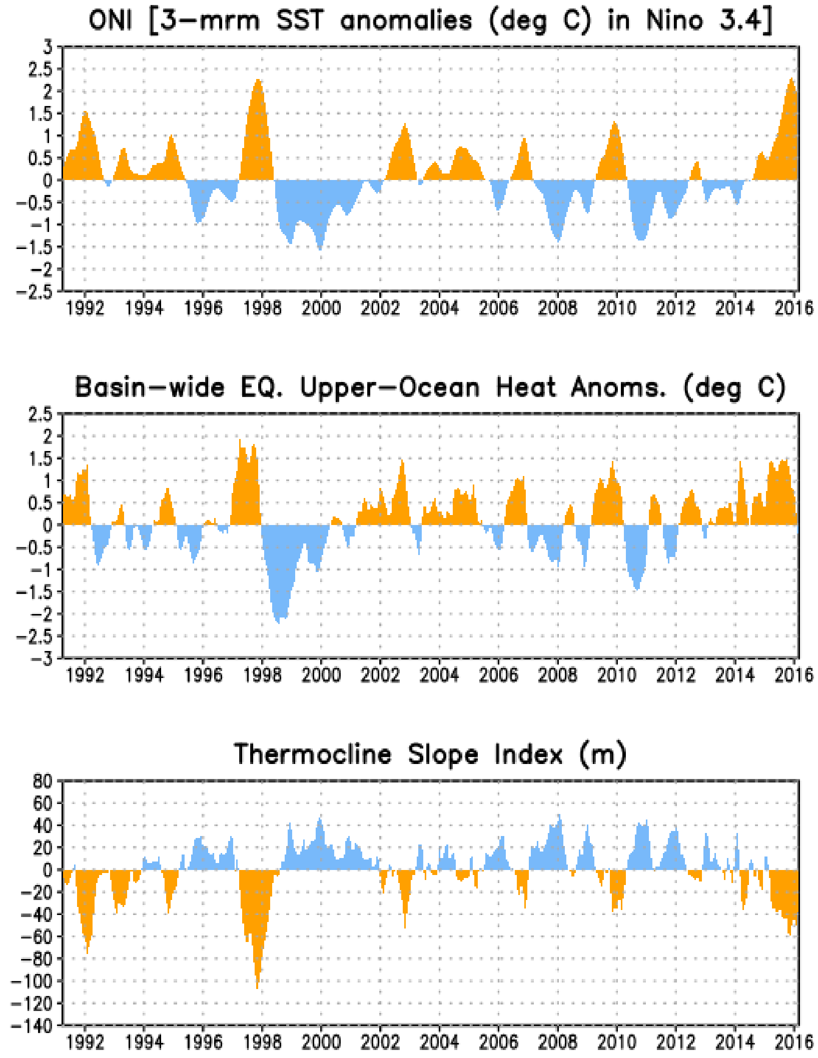


Upper-Ocean Conditions in the Equatorial Pacific

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.

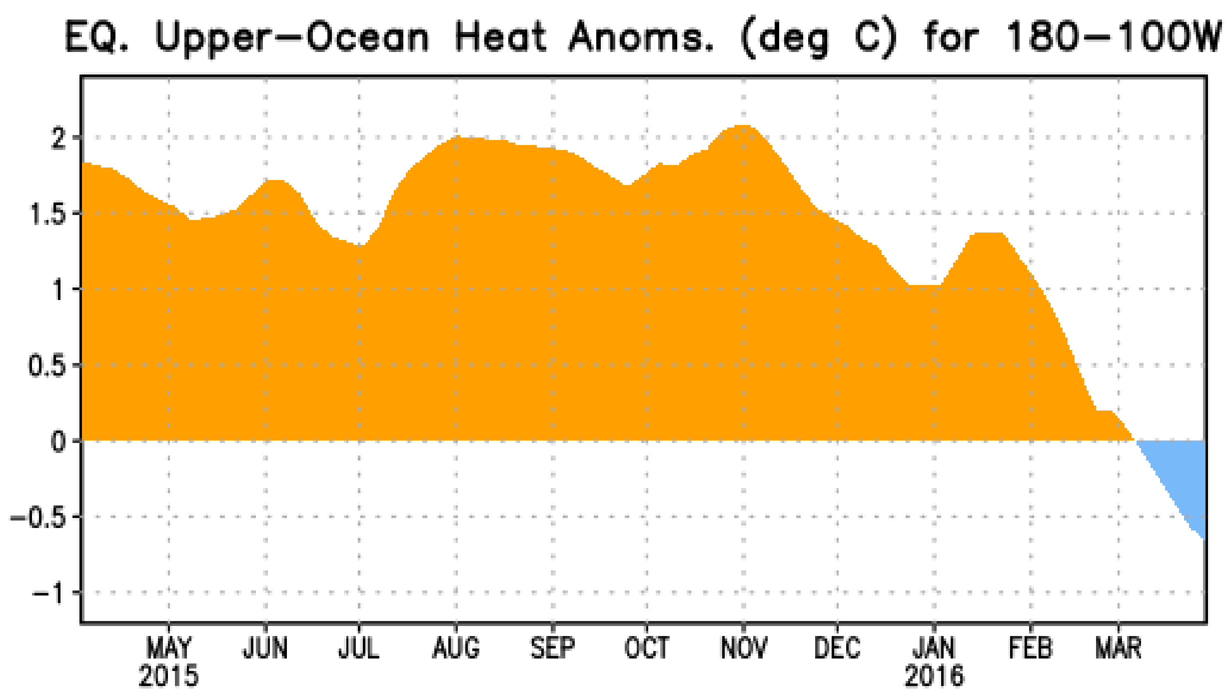
Recent values of the upper-ocean heat anomalies (positive) and thermocline slope index (negative) reflect El Niño.



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).

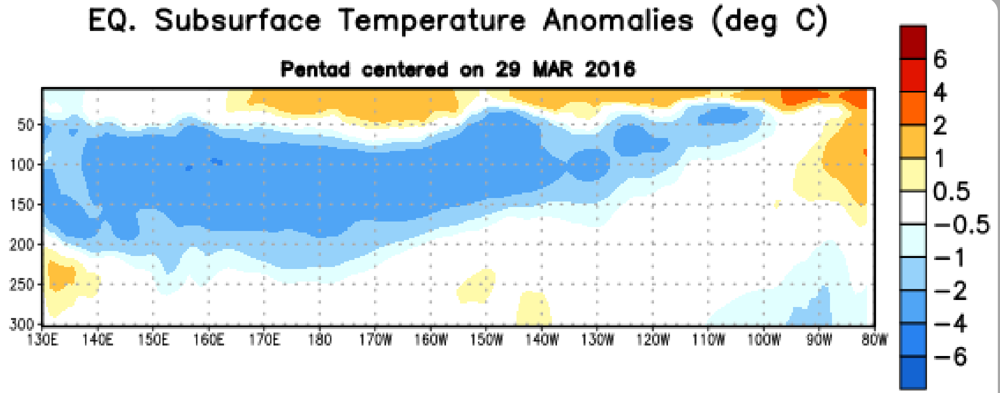
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive anomalies decreased during November and December, increased during the first half of January 2016, and have significantly decreased since late January with negative values appearing during March.



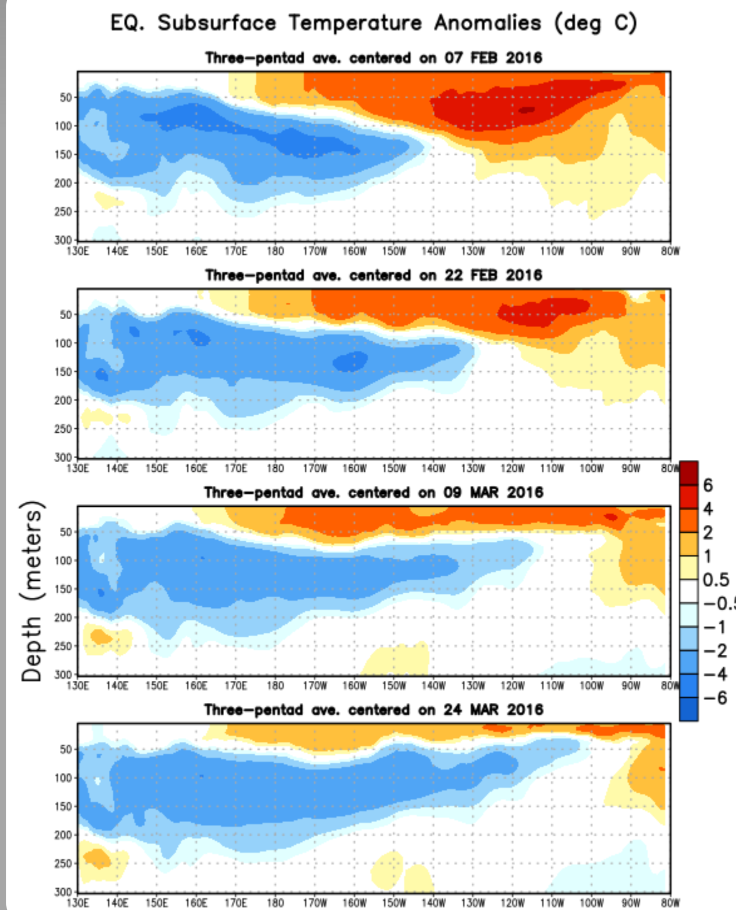
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, the vertical extent of the layer of positive subsurface temperature anomalies in the central and eastern equatorial Pacific has steadily decreased.



Most recent pentad analysis

Since early February 2016, subsurface negative anomalies have extended eastward and by late March reached to 100°W.

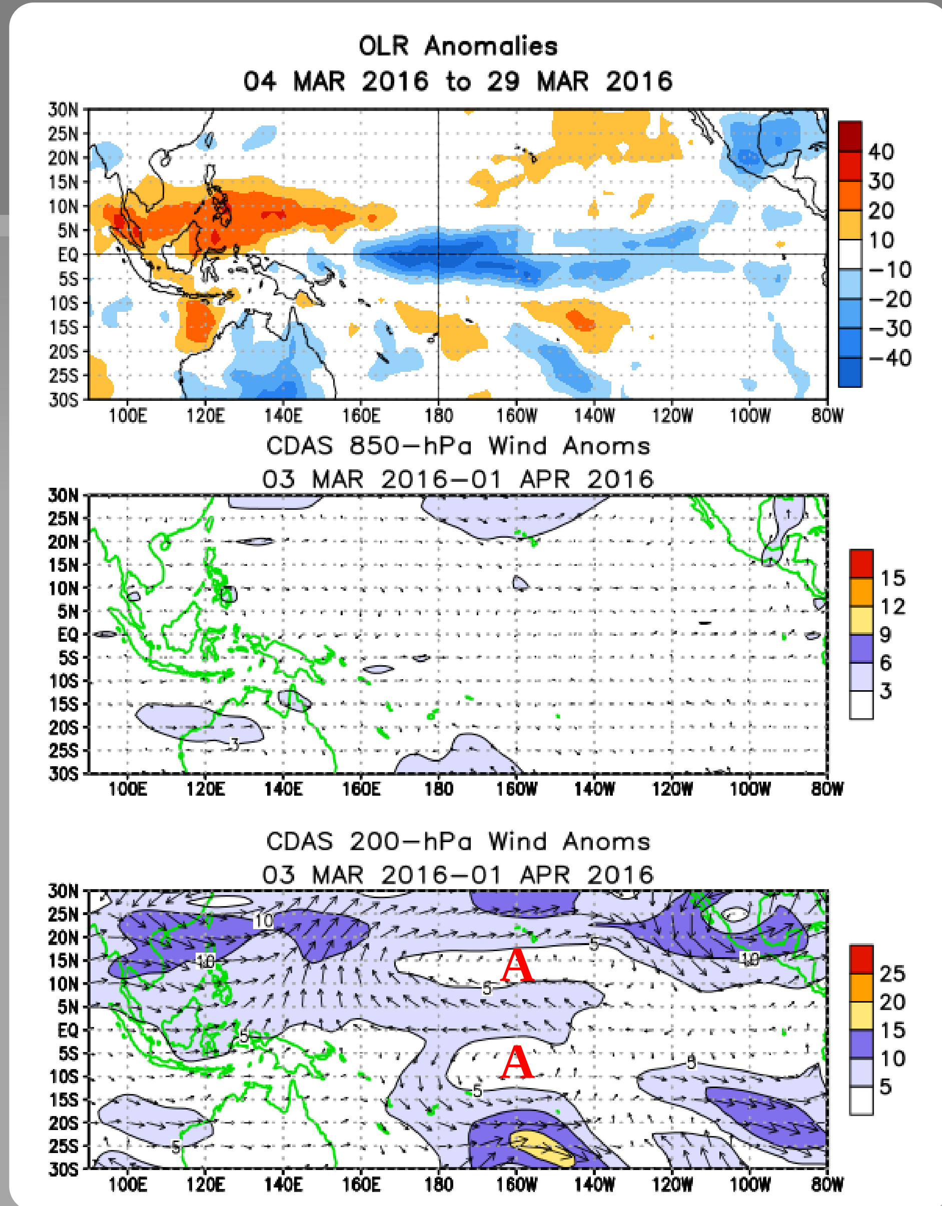


Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident over the central and east-central Pacific. Positive OLR anomalies (suppressed convection and precipitation) were observed over the Philippines and Malaysia.

Low-level (850-hPa) westerly winds were near average across the Pacific.

Anomalous upper-level (200-hPa) easterlies were observed over the central equatorial Pacific. Anomalous anti-cyclones straddled the equator.



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:

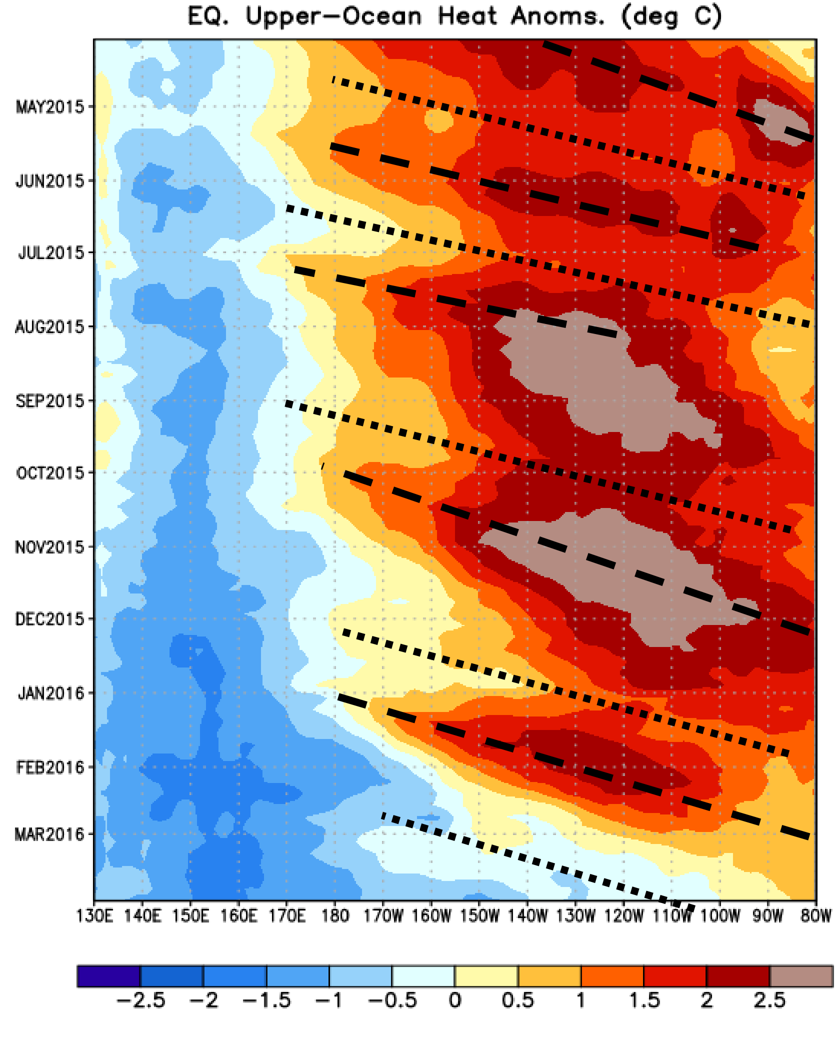
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

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

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

More recently, an upwelling phase is apparent in the eastern Pacific.

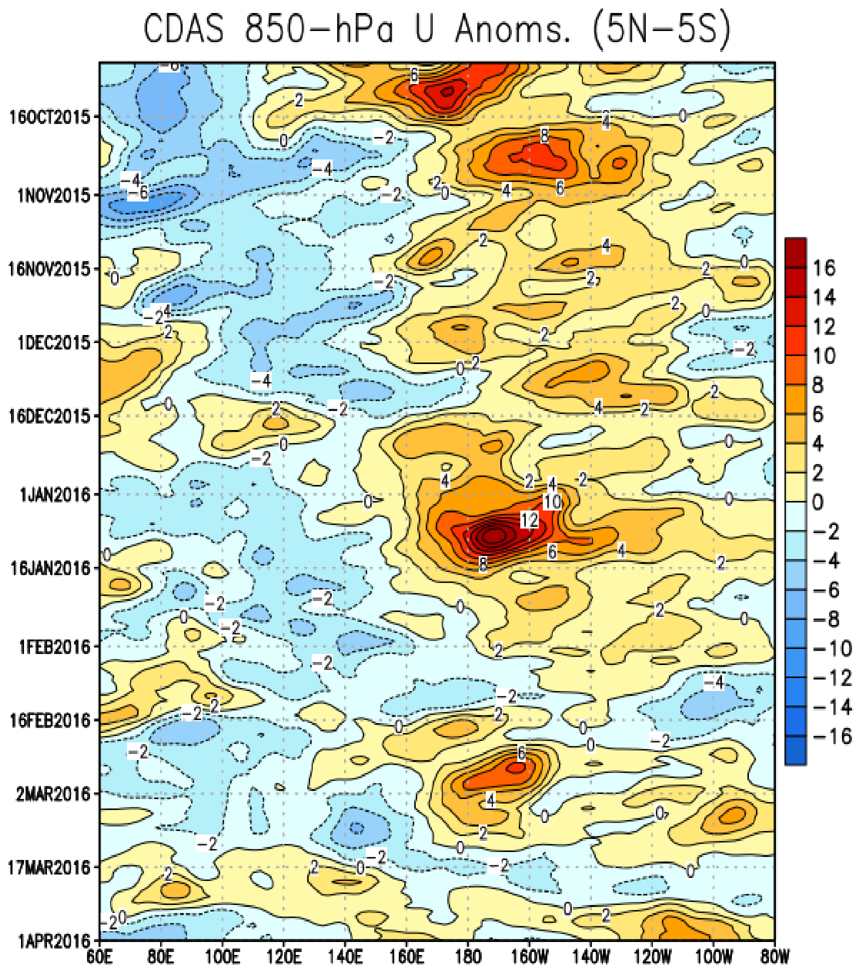


Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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

During late September and early October 2015, early January 2016, and late February 2016 westerly wind bursts were observed between 140°E and 140°W.

In the past week, wind anomalies were westerly in the eastern equatorial Pacific.

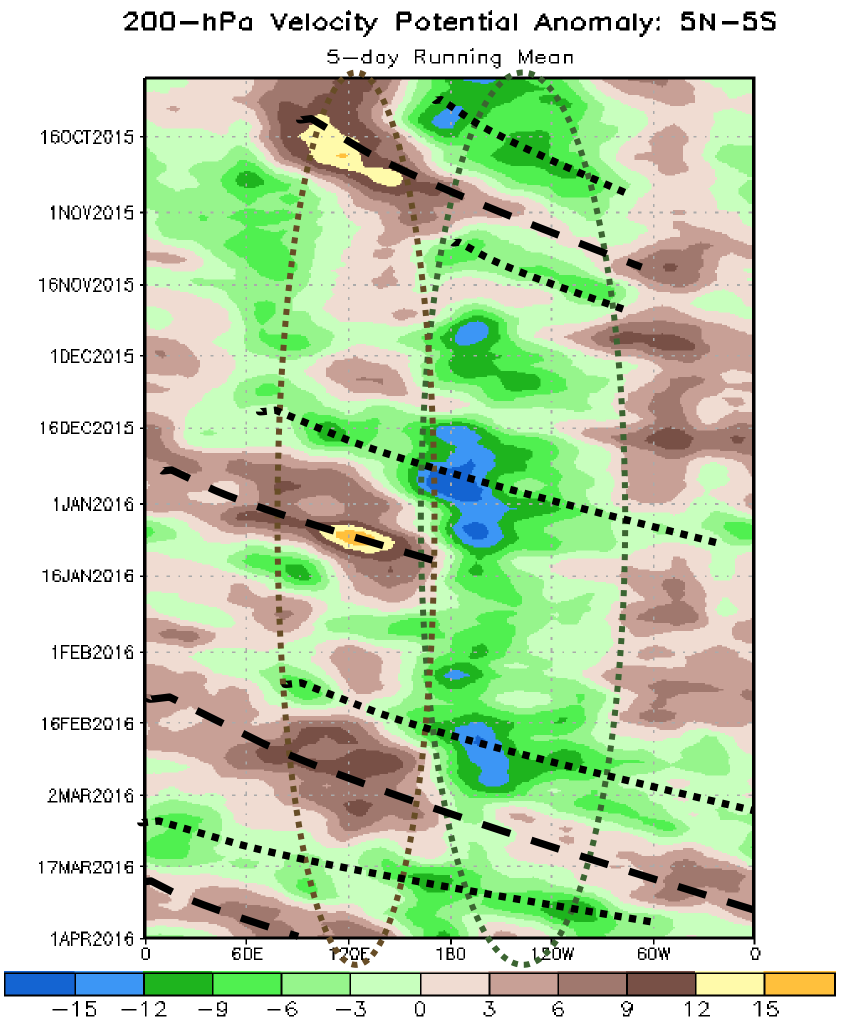


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

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

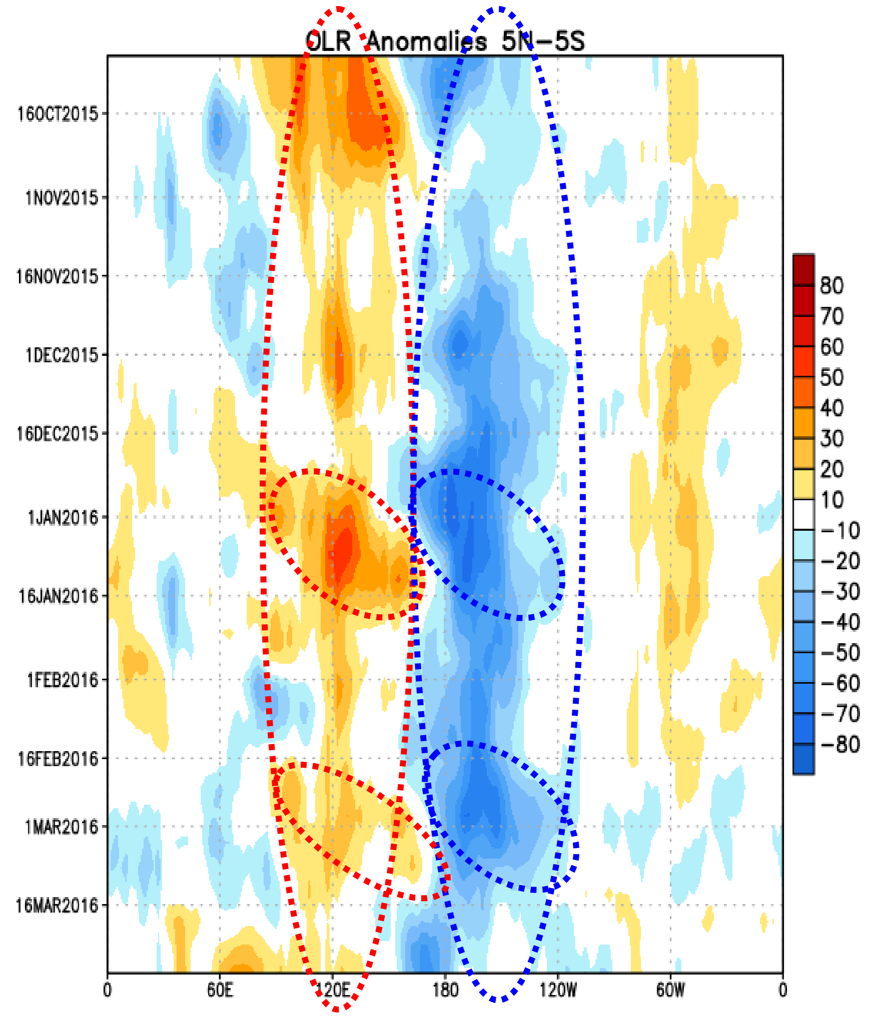
Sub-seasonal or Madden-Julian Oscillation (MJO) activity contributed to an eastward propagation of regions of upper-level divergence and convergence during late October-early November 2015, December-January 2016, and is apparent more recently.



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

Outgoing Longwave Radiation (OLR) Anomalies

Throughout the period negative anomalies have been observed over the central and/or eastern Pacific, and 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 +0.5ºC.

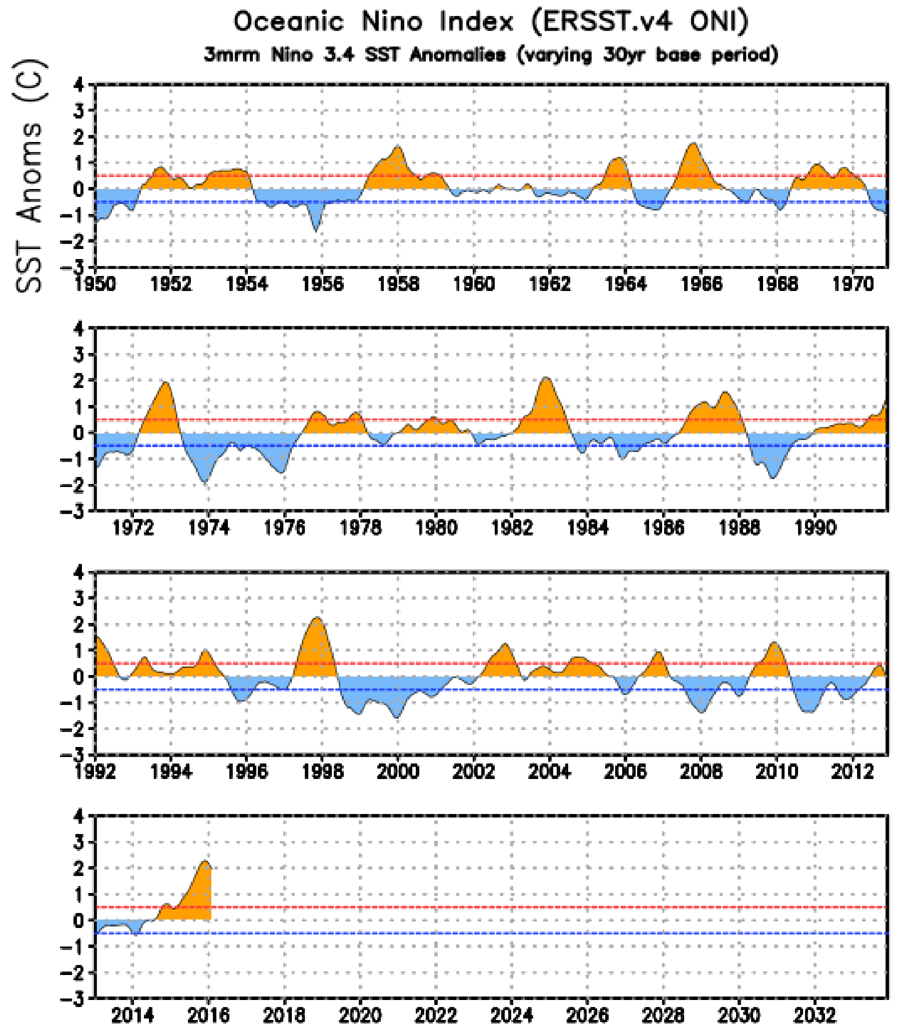
La Niña: characterized by a negative ONI less than or equal to -0.5ºC.

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 +/- 0.5ºC 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 (January - March 2016) is 2.0°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 Nino Index (ONI) [3 month running mean of ERSST.v4 SST anomalies in the Nino 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.

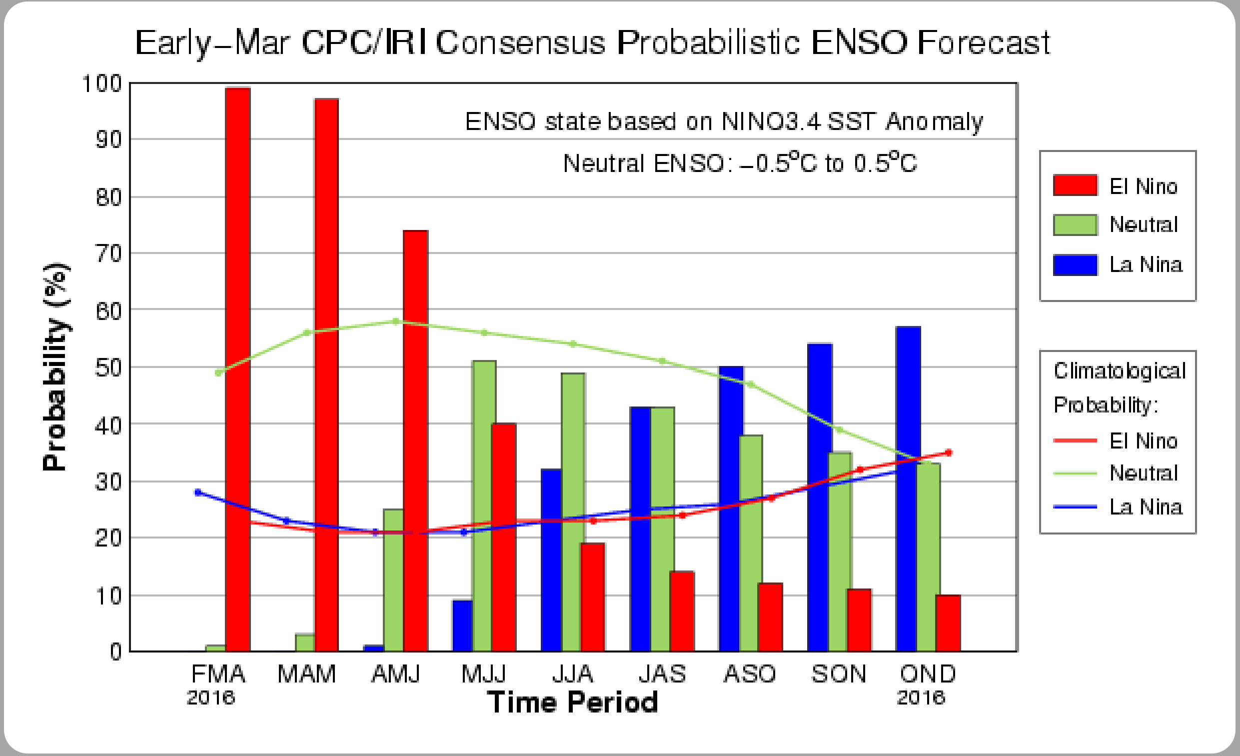
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
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	1.8	2.1	2.2	2.3
2016	2.2	2.0										

CPC/IRI Probabilistic ENSO Outlook

Updated: 10 March 2016

The chance of El Niño gradually decreases during the spring and ENSO-neutral is favored by May-June-July (MJJ) 2016. The chance of La Niña increases to 50% in August-September-October (ASO) 2016.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

Positive Niño 3.4 SST anomalies are predicted to weaken through 2016.

Most models suggest a transition to ENSO-neutral by May-June-July (MJJ) 2016 with the possibility of La Niña conditions during the Northern Hemisphere fall.

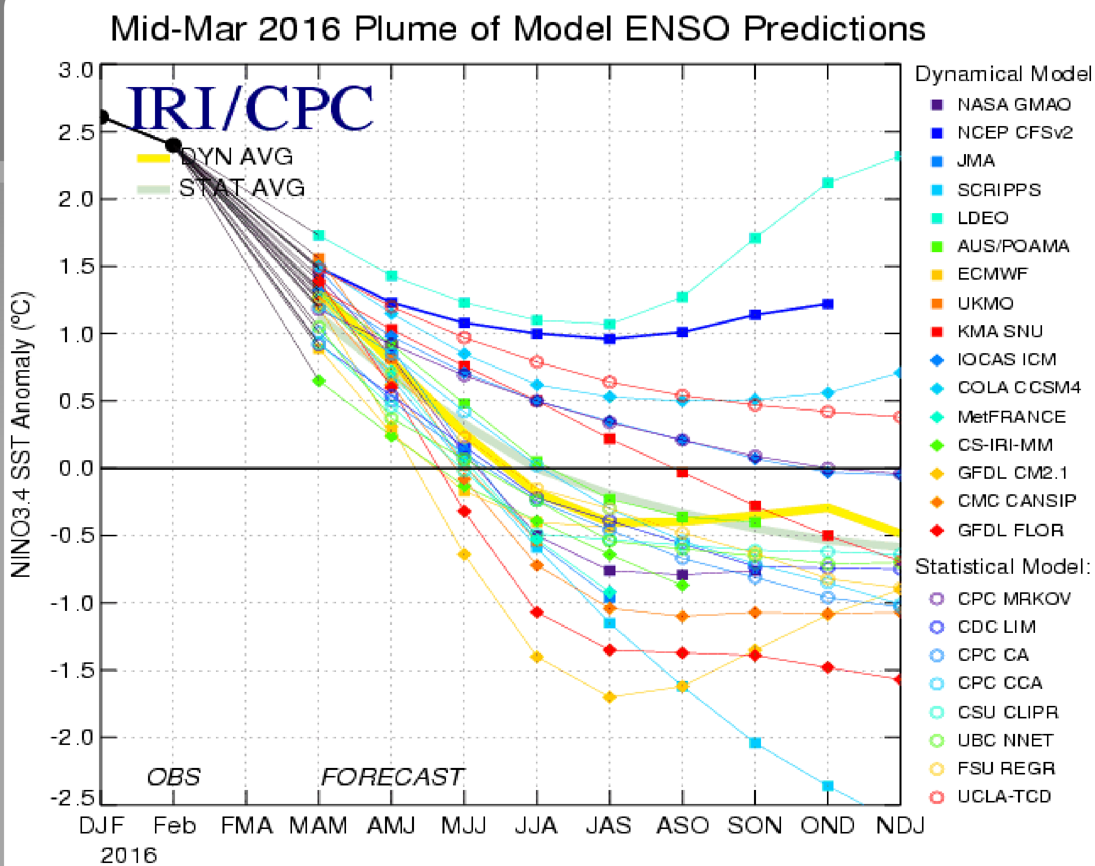
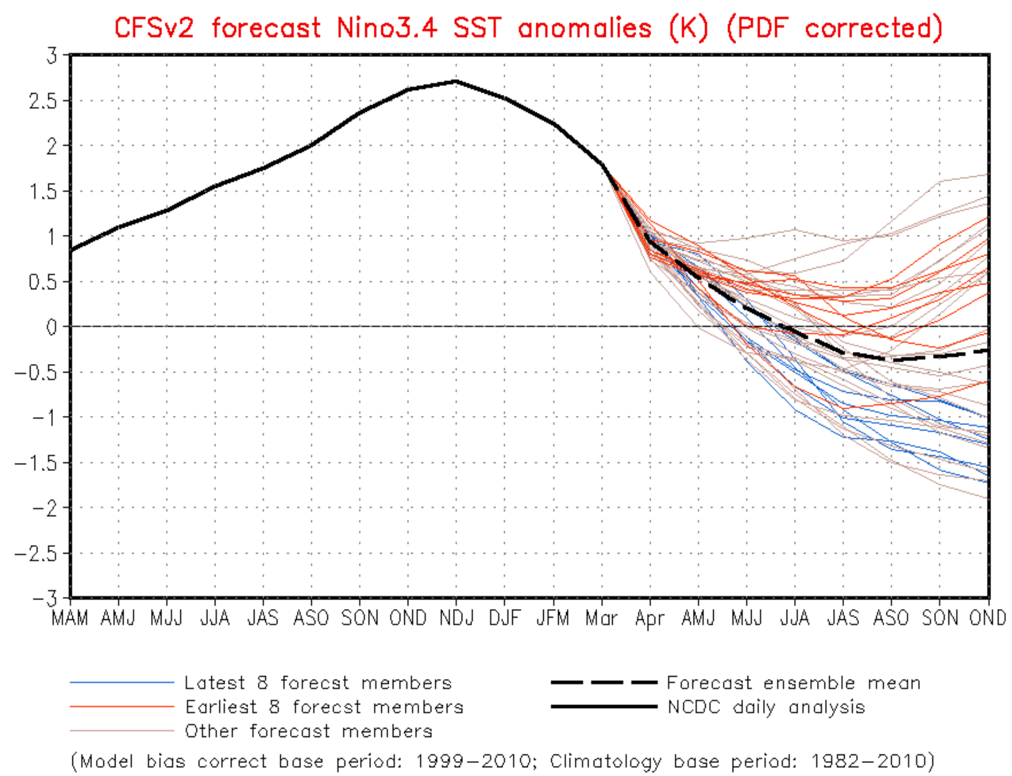


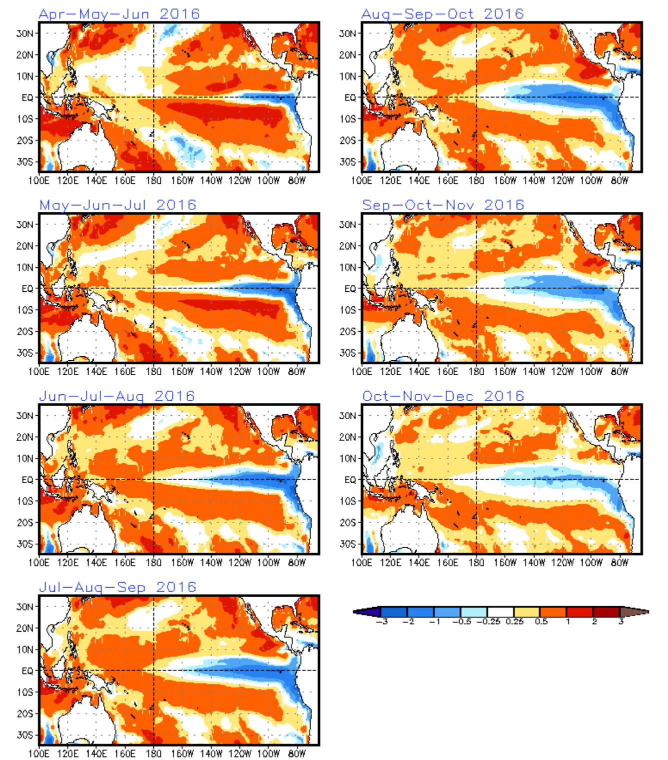
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 15 March 2016).

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

Issued: 4 April 2016

The CFS.v2 ensemble mean (black dashed line) predicts ENSO-neutral by MJJ.



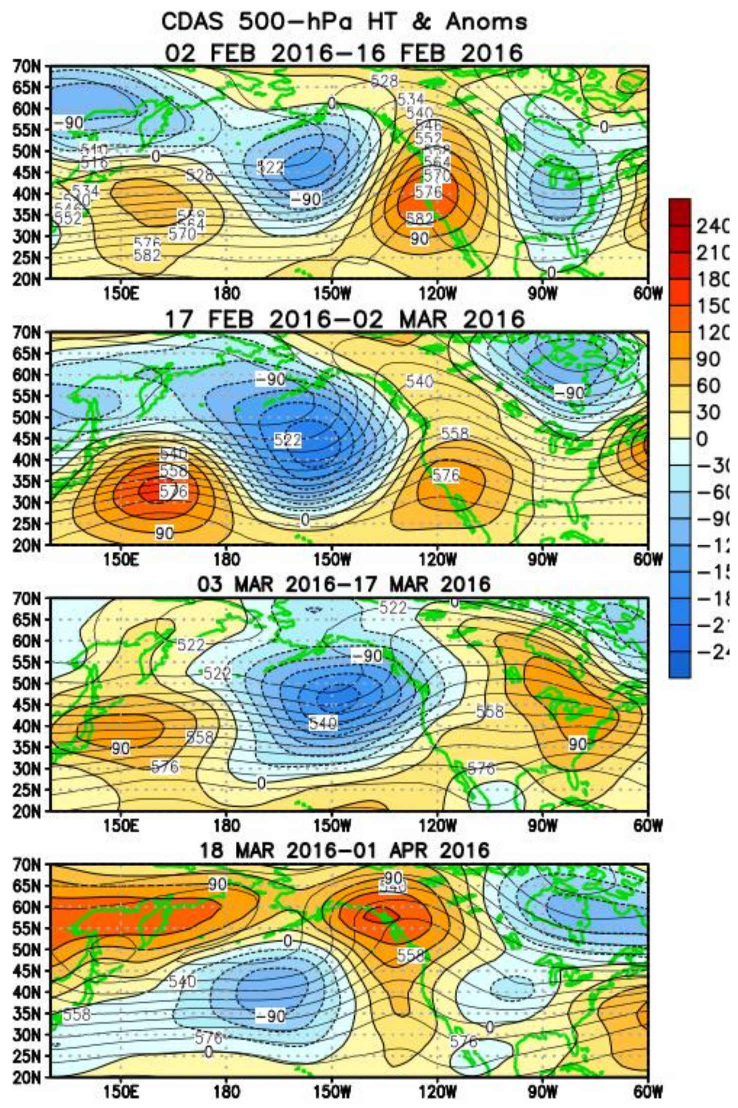


Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Over the North Pacific, an anomalous trough and extended jet has dominated most of the period.

During February, the overall pattern was characterized by anomalous ridging (and above-average temperatures) over western N. America and an anomalous trough (and below-average temperatures) over portions of eastern N. America.

The anomalous trough in the N. Pacific and the associated jet weakened during March.



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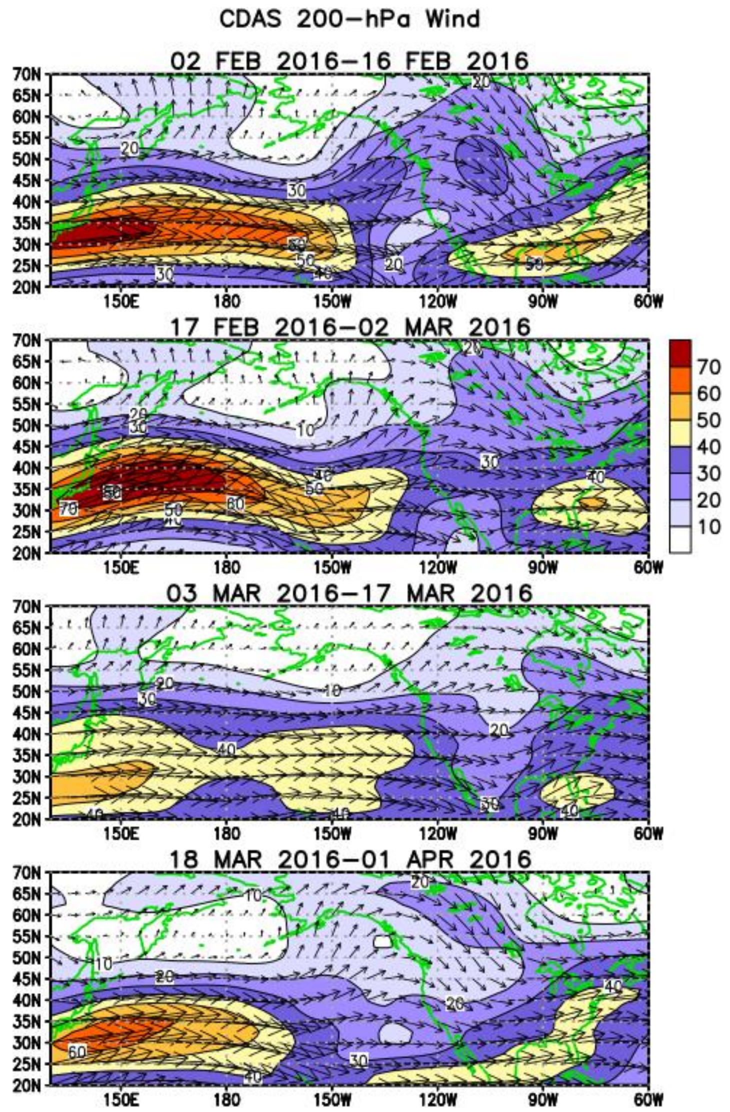

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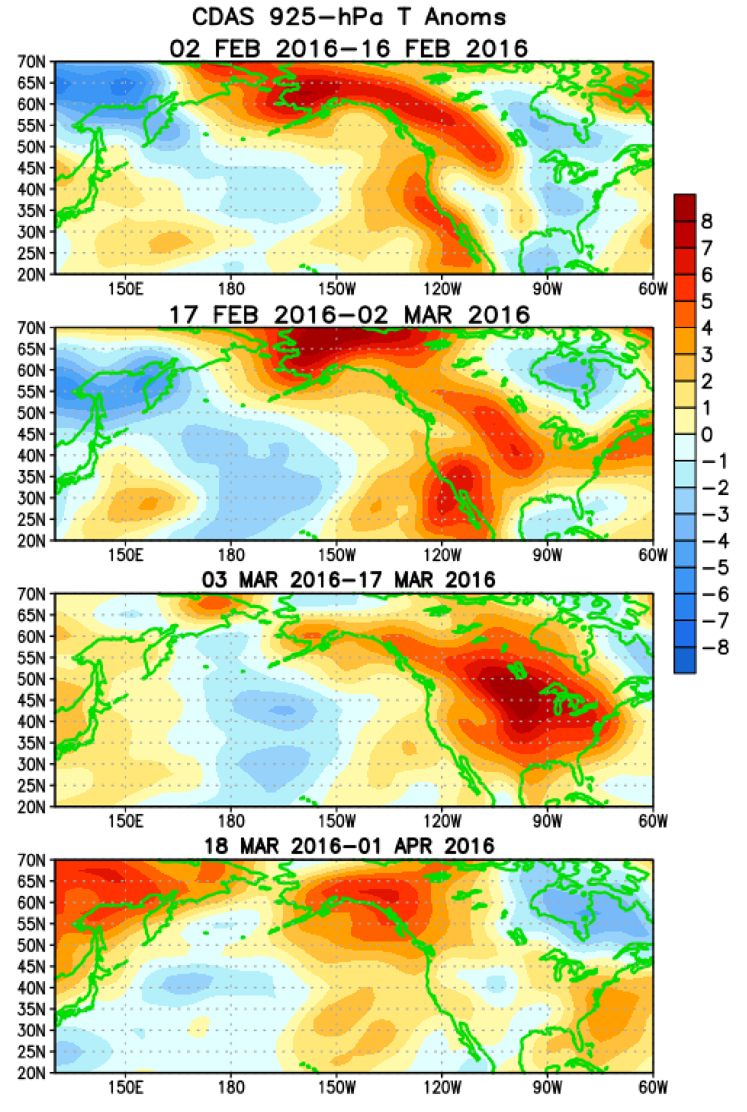
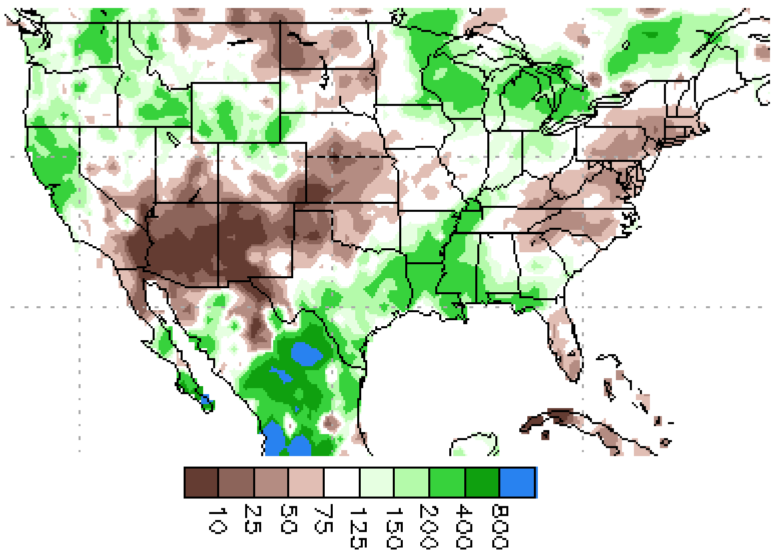


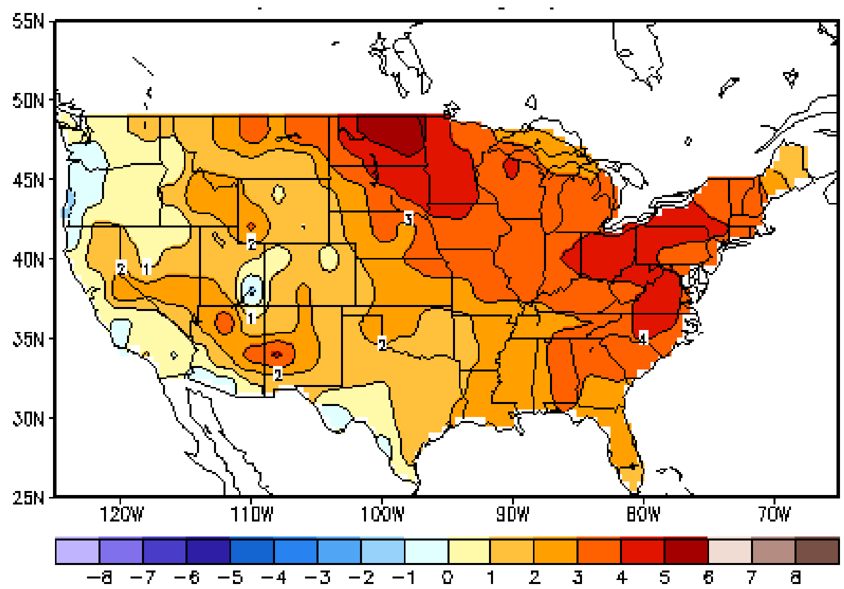
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 2 April 2016

Percent of Average Precipitation



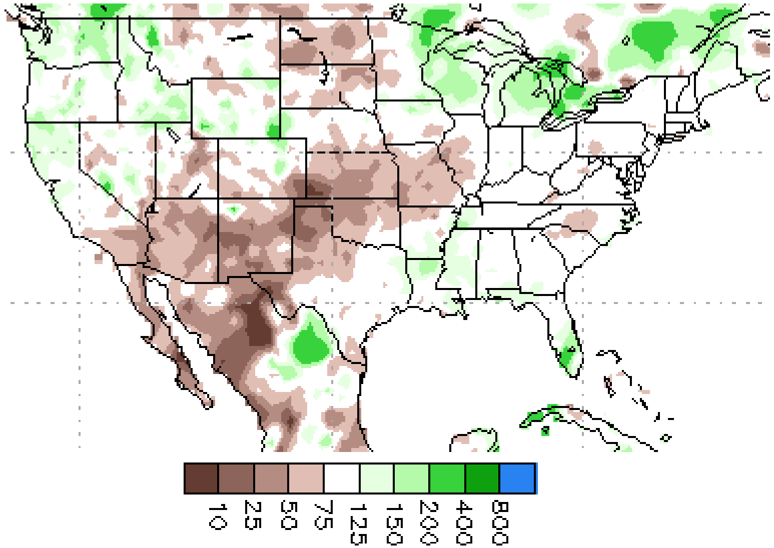
Temperature Departures (degree C)



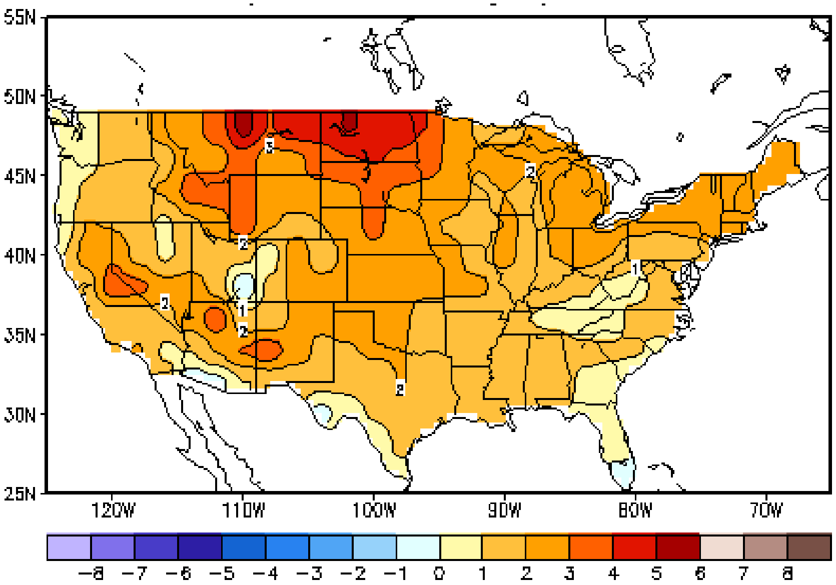
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 2 April 2016

Percent of Average Precipitation



Temperature Departures (degree C)

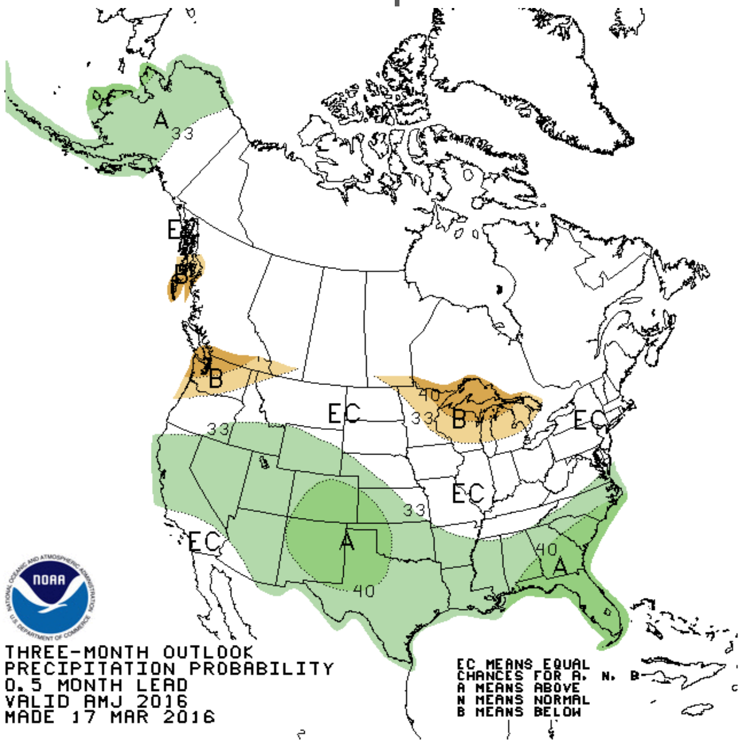


U. S. Seasonal Outlooks

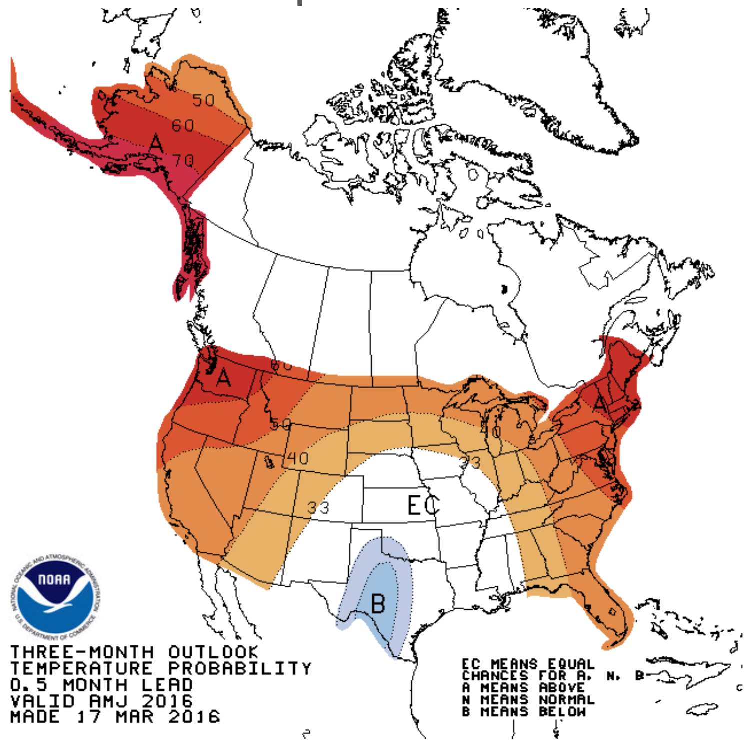
April – June 2016

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

Precipitation



Temperature



Summary

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A transition to ENSO-neutral is likely during late Northern Hemisphere spring or early summer 2016, with close to a 50% chance for La Niña conditions to develop by the fall.*

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