



ENSO Cycle: Recent Evolution, Current Status and Predictions

**Update prepared by
Climate Prediction Center / NCEP
17 August 2009**



Outline

- Overview
- Recent Evolution and Current Conditions
- Oceanic Niño Index (ONI) – **“Revised December 2008”**
- Pacific SST Outlook
- U.S. Seasonal Precipitation and Temperature Outlooks
- Summary



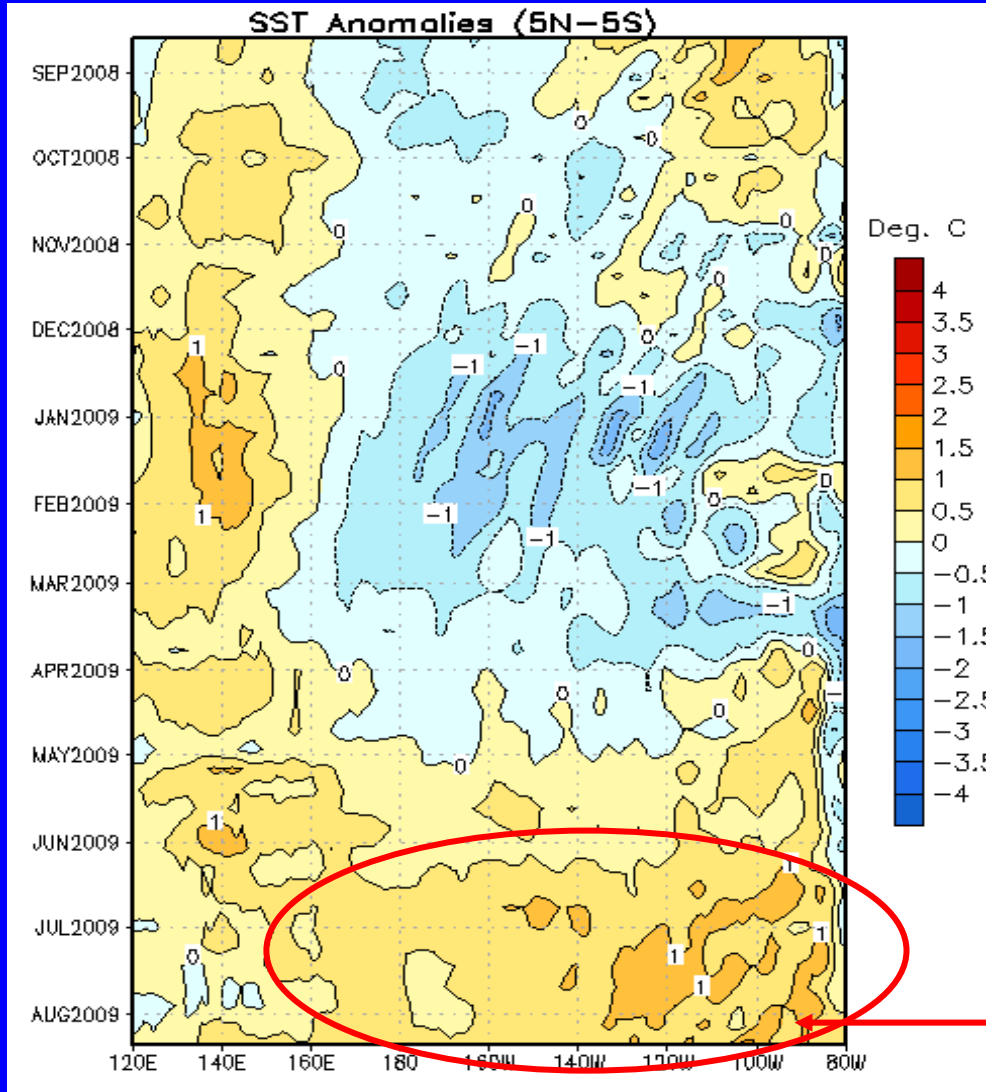
Summary

- **El Niño is present across the equatorial Pacific Ocean.**
- **Sea surface temperatures (SST) remain +0.5 to +1.5 above-average across much of the equatorial Pacific Ocean.**
- **Current observations and dynamical model forecasts indicate El Niño is expected to strengthen and last through Northern Hemisphere winter 2009-10.**



Recent Evolution of Equatorial Pacific SST Departures (°C)

Time



During October 2008- February 2009, negative sea surface temperature (SST) anomalies covered the central and east-central equatorial Pacific Ocean.

During February- April 2009, negative SST anomalies weakened across the equatorial Pacific.

Since the beginning of June 2009, SST anomalies have been at least +0.5°C across much of the equatorial Pacific.



Niño Region SST Departures (°C) Recent Evolution

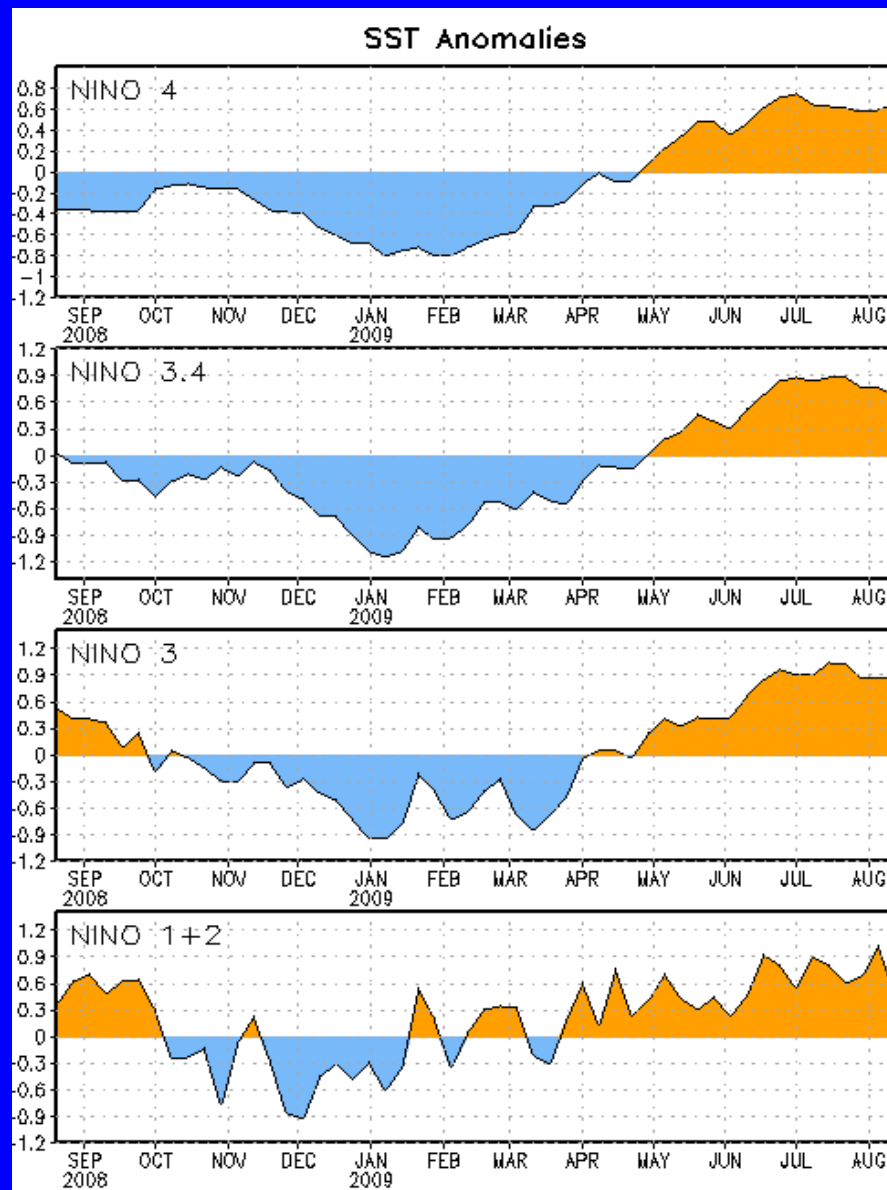
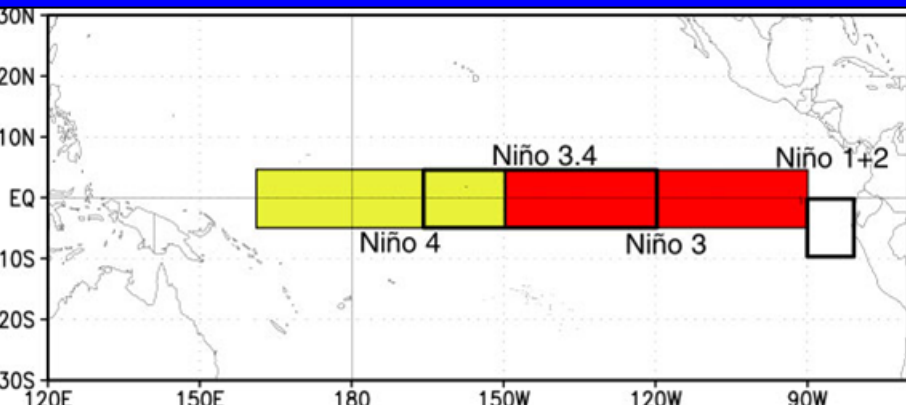
The latest weekly SST departures are:

Niño 4 0.7°C

Niño 3.4 0.7°C

Niño 3 0.9°C

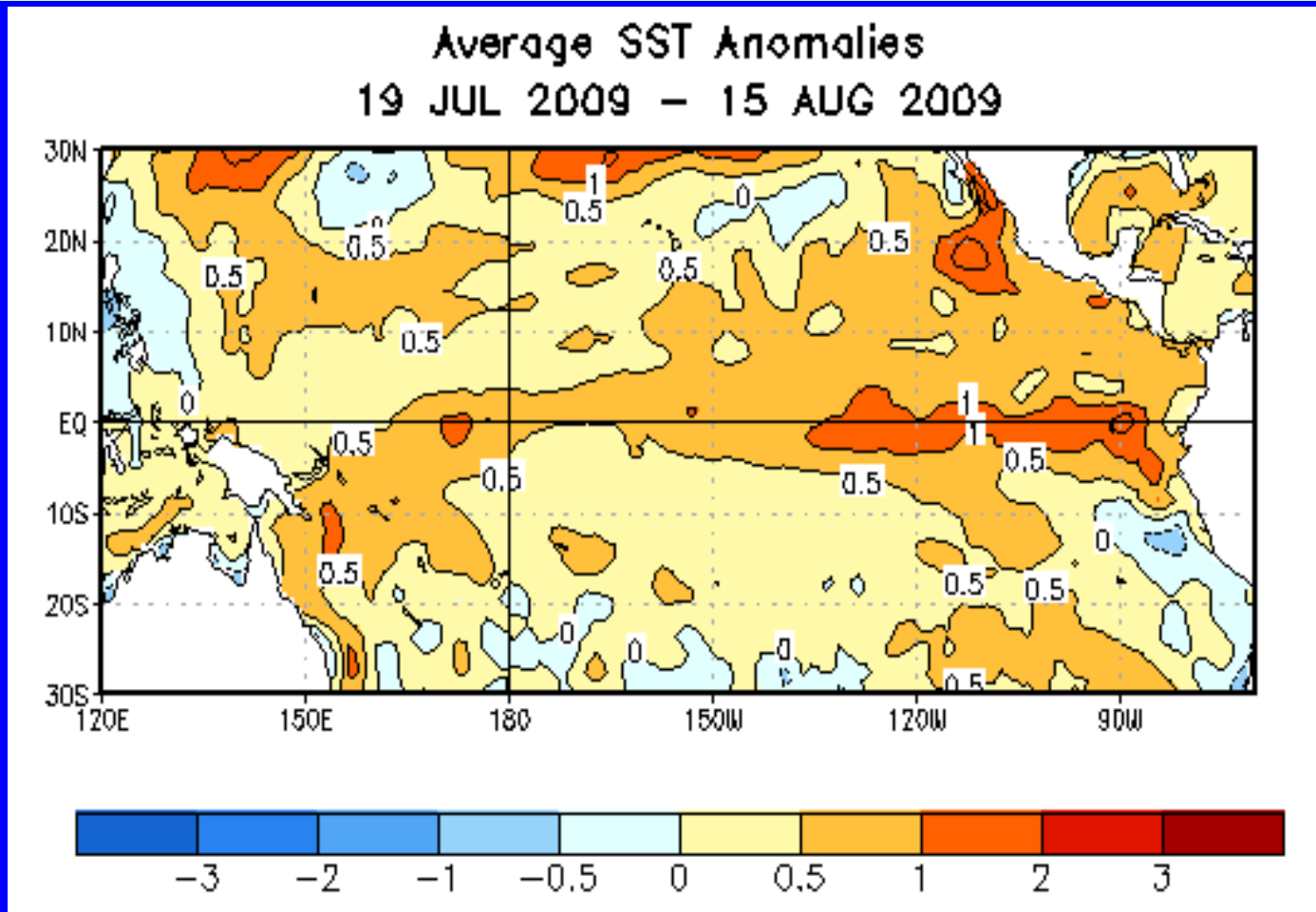
Niño 1+2 0.5°C





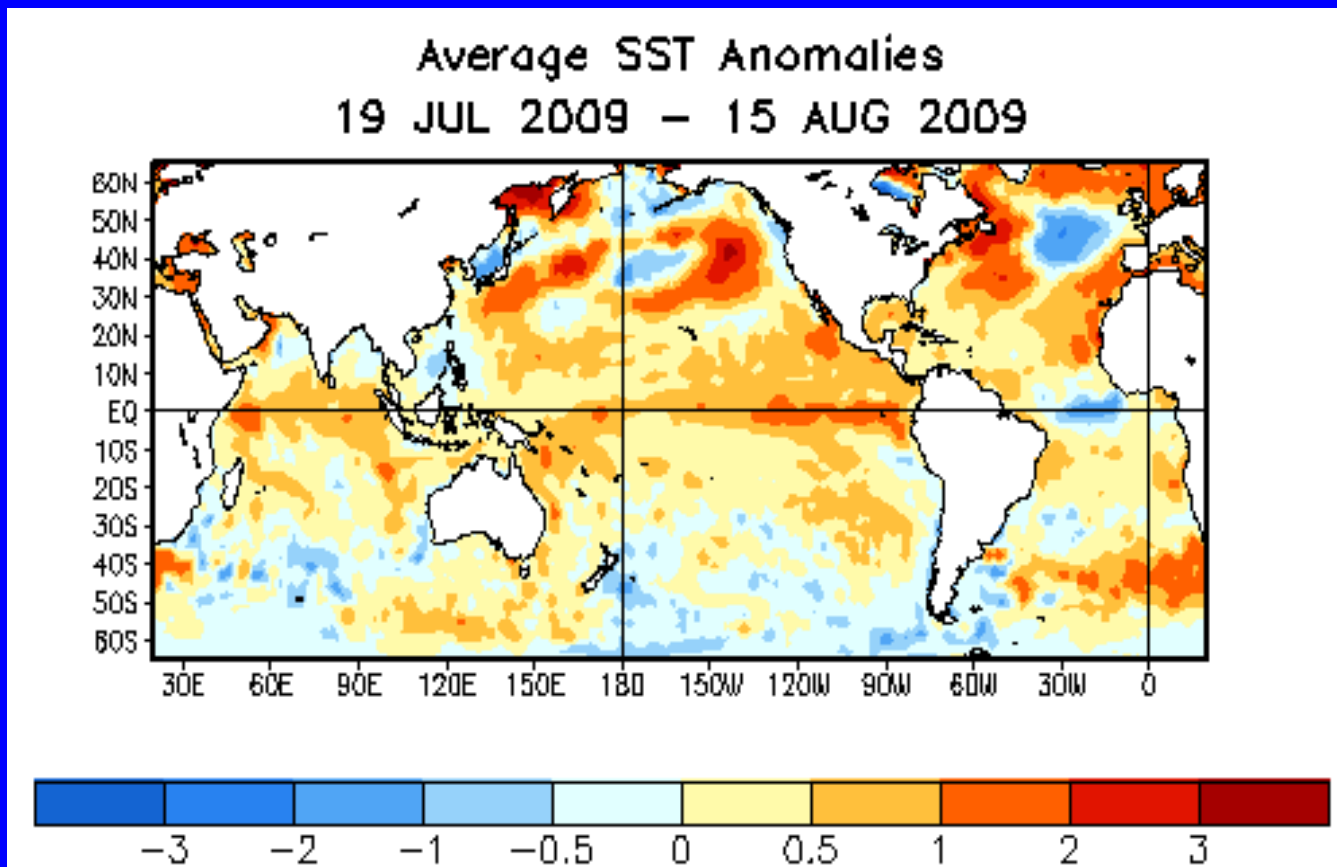
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last 4 Weeks

During the last 4-weeks, equatorial SSTs were at least 0.5°C above-average across most of the Pacific Ocean and at least 1.0°C above average in the east-central and eastern Pacific.





Global SST Departures (°C)

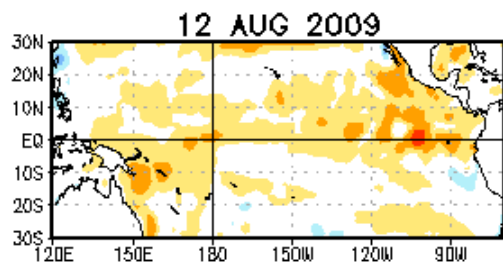
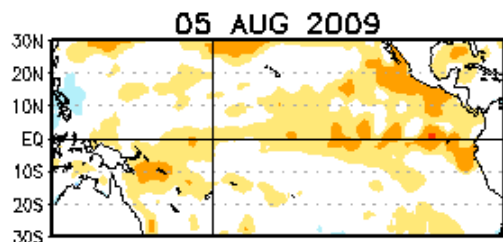
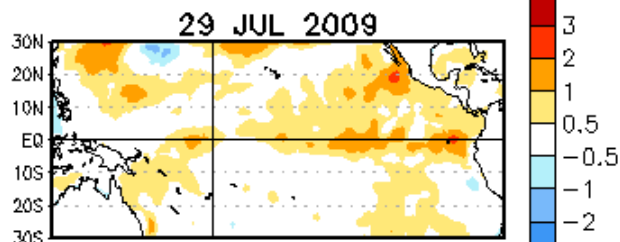
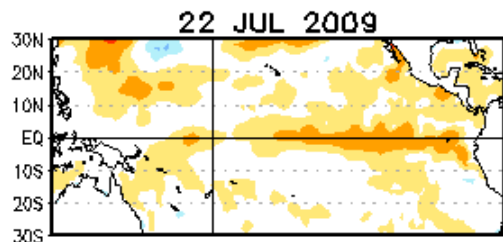


During the last four weeks, equatorial SSTs were above-average in the Pacific and Indian Oceans. Also, above-average SSTs covered large areas of the Northern Hemisphere mid-to-high latitudes.



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

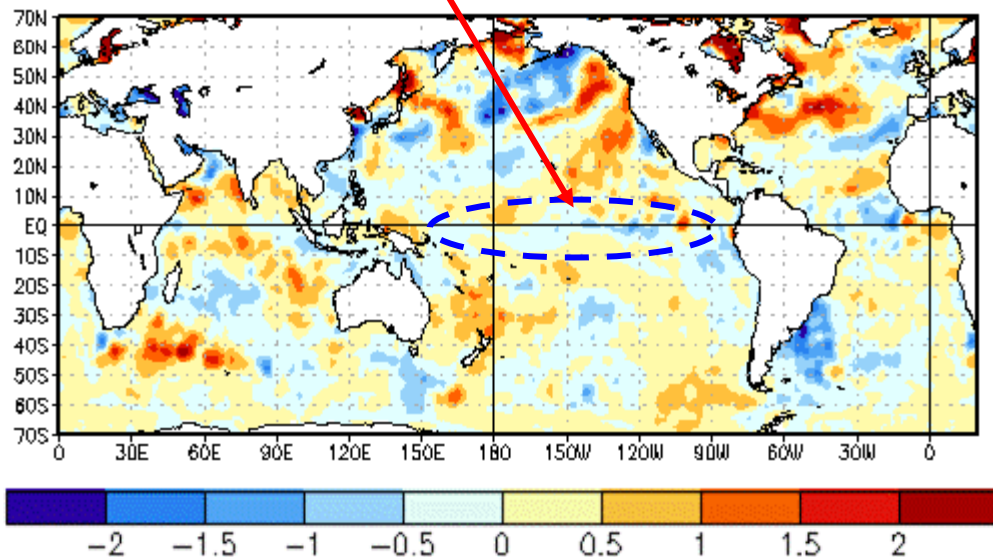
Weekly SST Anomalies (DEG C)



• During the last four weeks, SST anomalies have been positive across the equatorial Pacific Ocean.

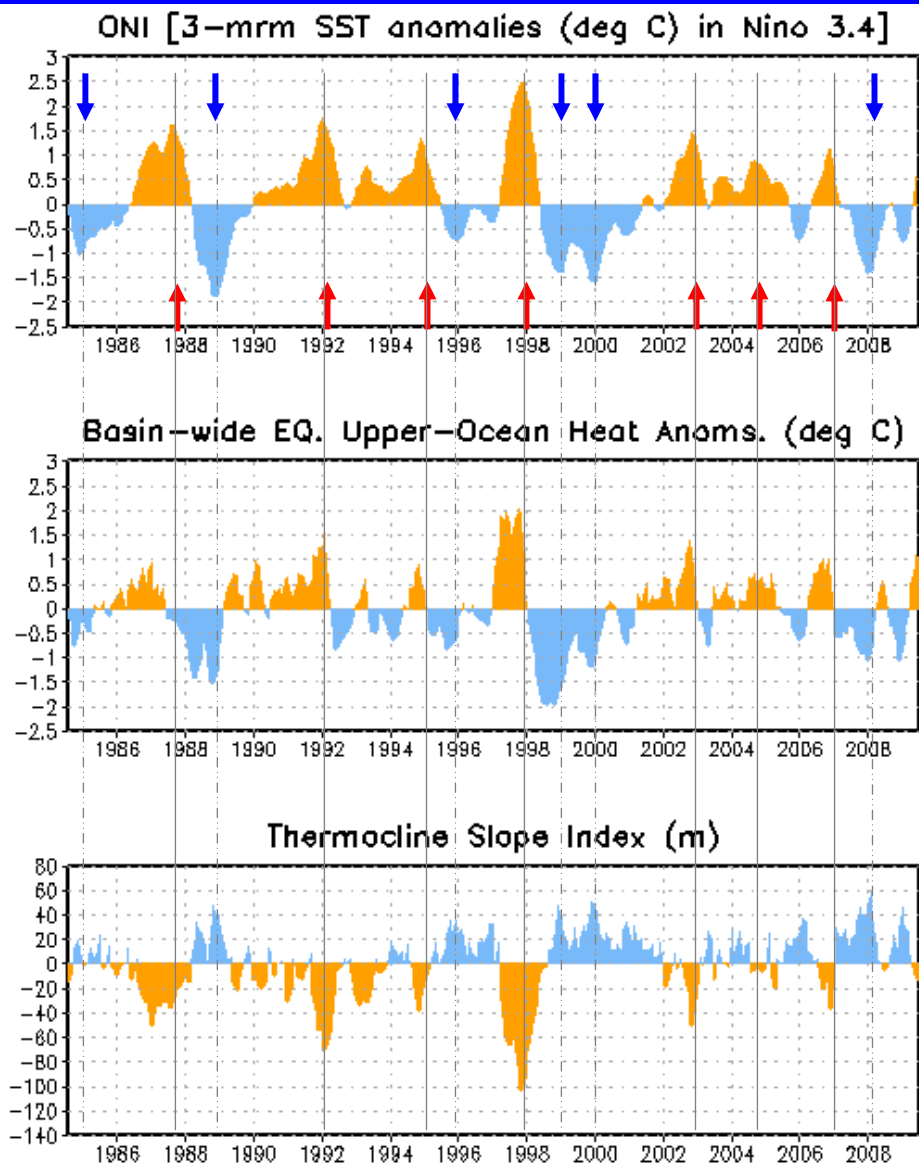
• During the last month, there has been little change in SST anomalies across the equatorial Pacific Ocean.

Change in Weekly SST Anoma (°C)
12AUG2009 minus 15JUL2009





Upper-Ocean Conditions in the Eq. 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.

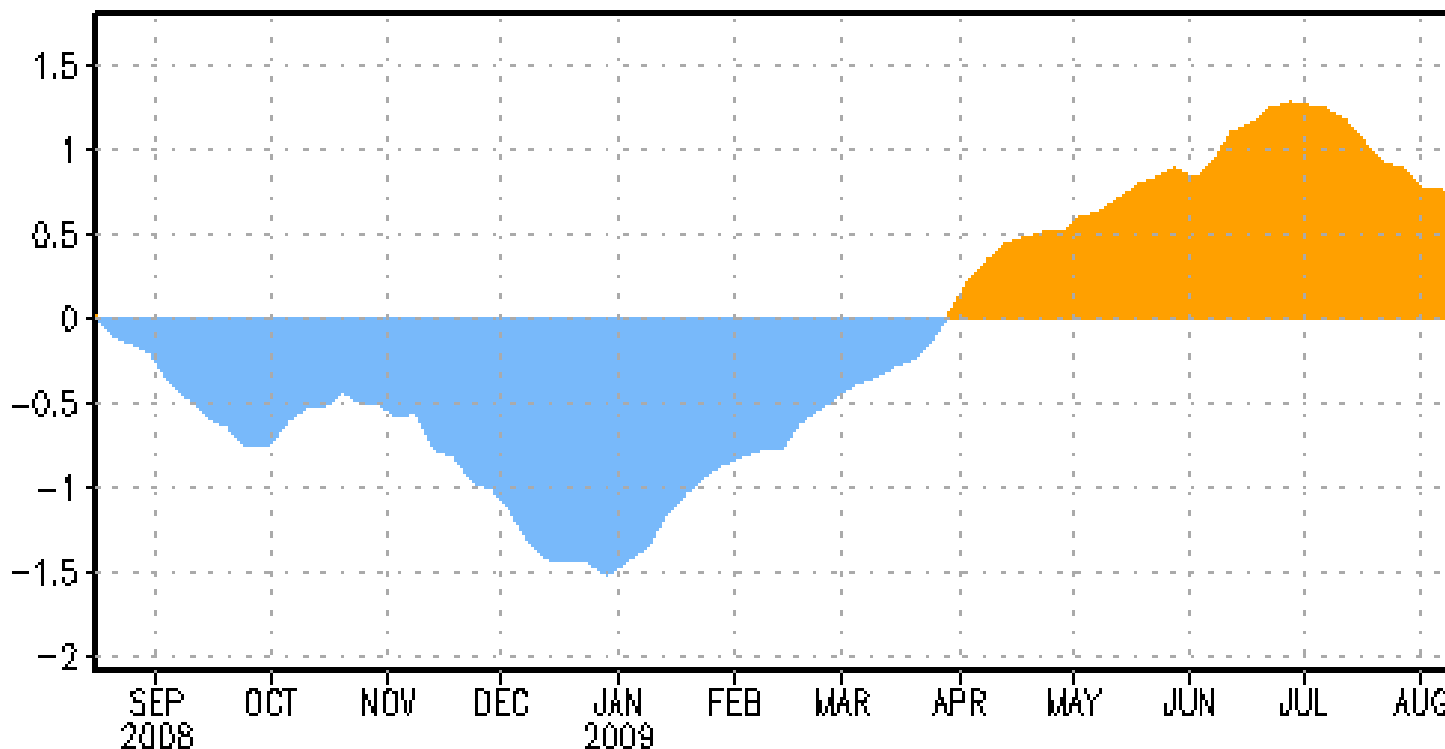
- Recent values of the upper-ocean heat anomalies (positive) and the thermocline slope index (negative) reflect El Niño conditions.

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).



Central & Eastern Pacific Upper-Ocean (0-300 m) Weekly Heat Content Anomalies

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



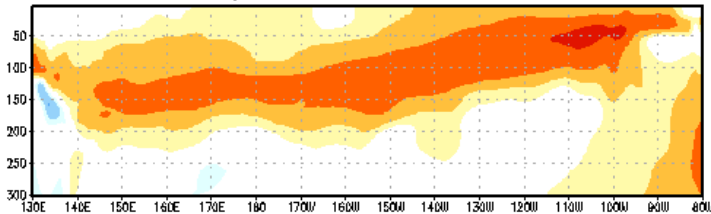
The upper ocean heat content was below-average across the eastern half of the equatorial Pacific Ocean between mid-August 2008 and March 2009, with a minimum reached in late December 2008. The heat content anomalies have remained positive since April 2009.



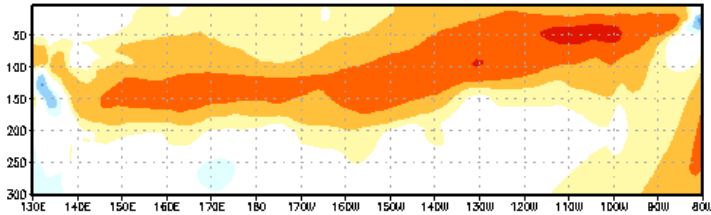
Sub-Surface Temperature Departures (°C) in the Equatorial Pacific

EQ. Subsurface Temperature Anomalies (deg C)

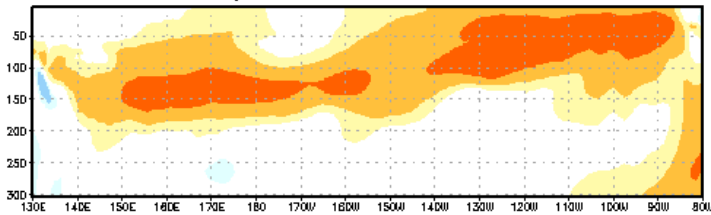
Three-pentad ave. centered on 22 JUN 2009



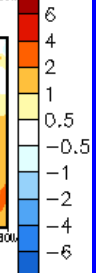
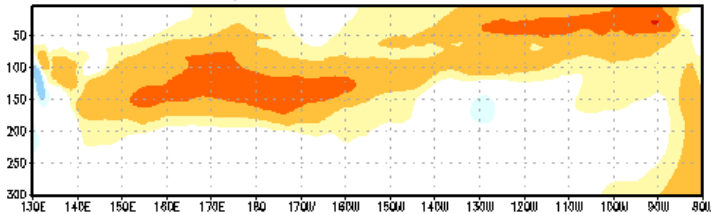
Three-pentad ave. centered on 07 JUL 2009



Three-pentad ave. centered on 22 JUL 2009



Three-pentad ave. centered on 06 AUG 2009



Time



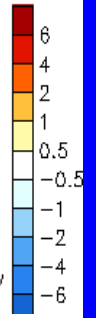
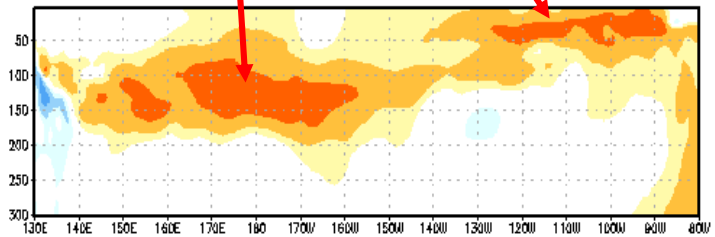
Longitude

- During late- June through early August 2009, positive sub-surface temperature anomalies extended across the equatorial Pacific.

- The most recent period (below) shows positive anomalies across the equatorial Pacific, with the largest anomalies near 50m depth in the eastern Pacific and near 125m in the western Pacific.

EQ. Subsurface Temperature Anomalies (deg C)

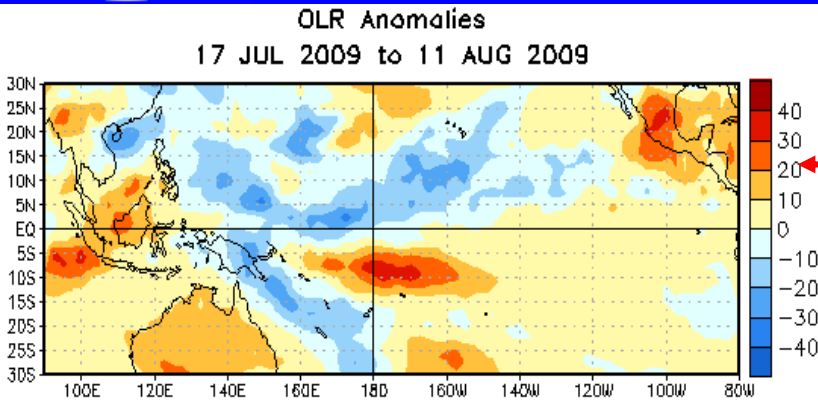
Pentad centered on 11 AUG 2009



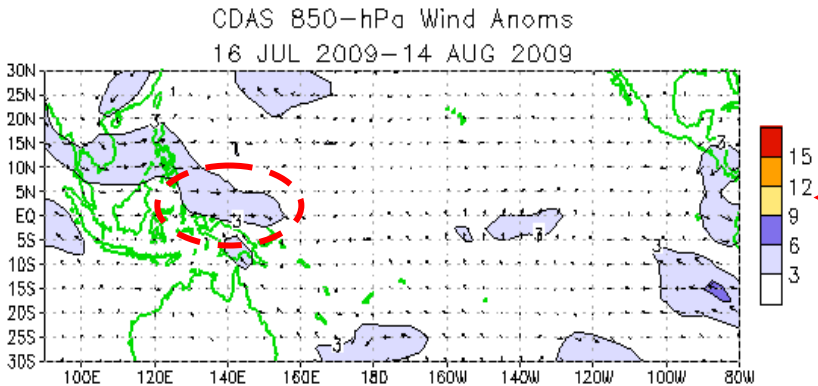
Most recent pentad analysis



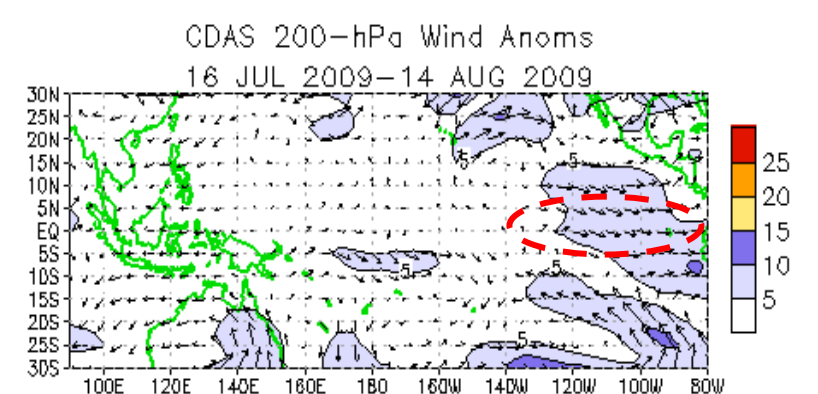
Tropical OLR and Wind Anomalies During the Last 30 Days



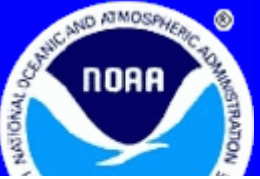
Positive OLR anomalies (suppressed convection and precipitation, red shading) were present over Indonesia, Malaysia, Borneo, and Australia, while negative anomalies (enhanced convection, blue shading) covered the west-central Pacific.



Low-level (850-hPa) equatorial winds were near-average over the eastern Pacific. Westerly anomalies were observed in the far western Pacific.

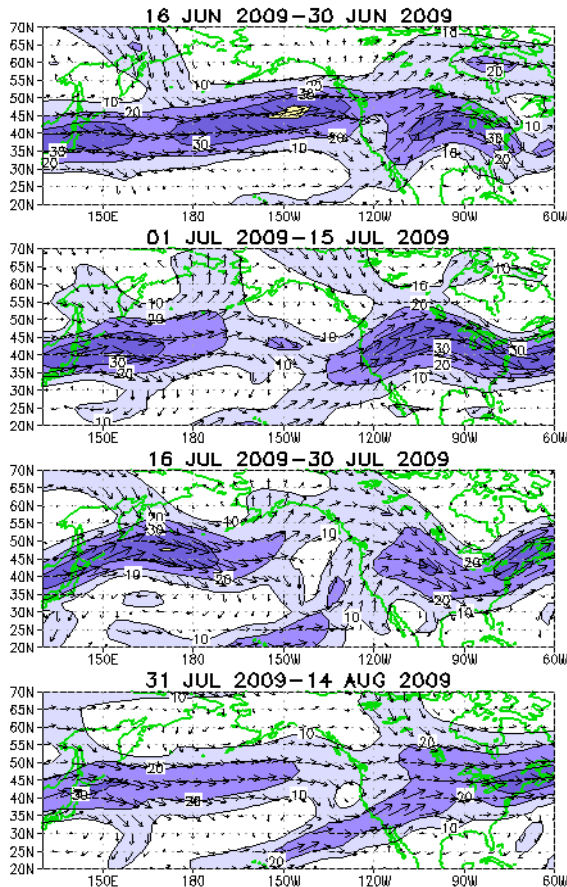


Upper-level (200-hPa) winds remained near-average across much of the Pacific, except for westerly wind anomalies in the eastern Pacific.

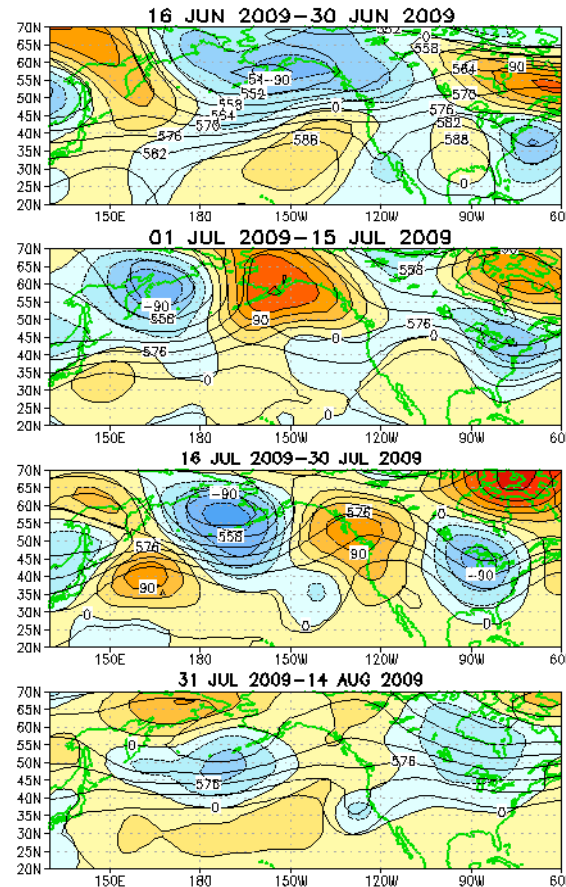


Atmospheric Circulation over the North Pacific & North America During the Last 60 Days

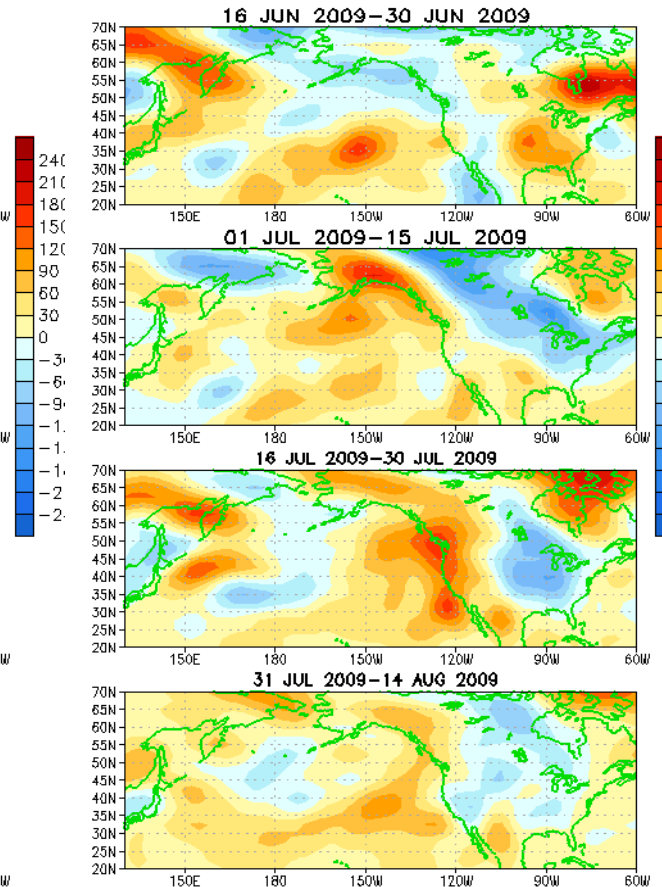
200-hPa Wind



500-hPa Height & Anoms.



925-hPa Temp. Anoms. (°C)



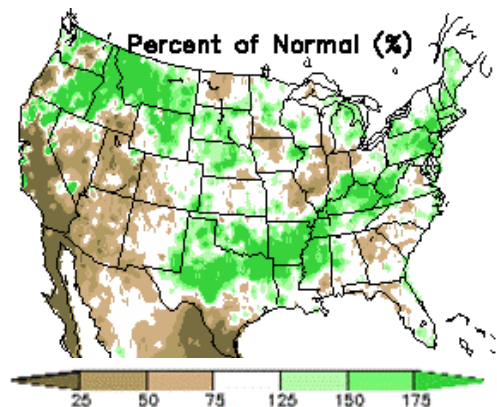
During mid-June and July, an anomalous north-south dipole of height anomalies (below-average heights over the eastern U.S. and above-average heights over eastern Canada) contributed to below-average temperatures over much of the north-central and eastern U. S. and to above-average temperatures in eastern Canada. Anomalous ridging over western N. America during July contributed to above-average temperatures in the western U.S. Since the end of July, below-average heights have prevailed over much of Canada and the northern tier of the U.S. leading to near-to-below average temperatures in those regions.



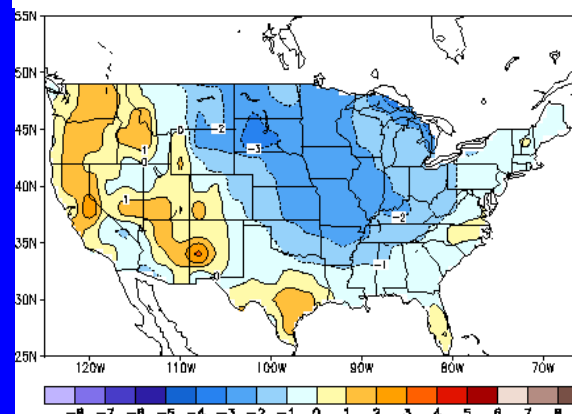
U.S. Temperature and Precipitation Departures During the Last 30 and 90 Days

Last 30 Days

30-day (ending 16 Aug 2009) % of average precipitation

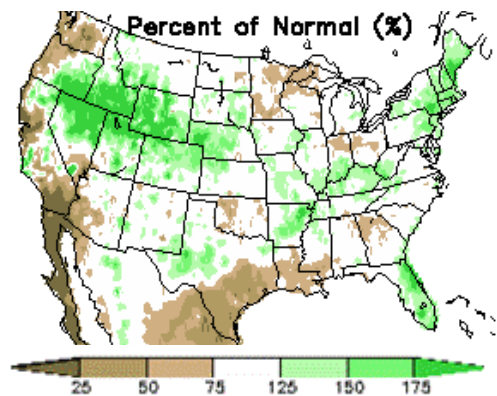


30-day (ending 15 Aug 2009) temperature departures (degree C)

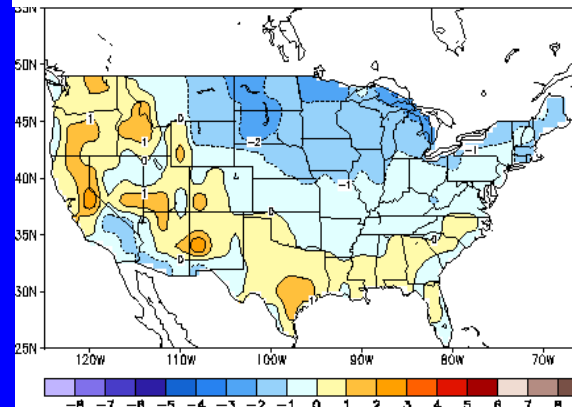


Last 90 Days

90-day (ending 16 Aug 2009) % of average precipitation



90-day (ending 15 Aug 2009) temperature departures (degree C)



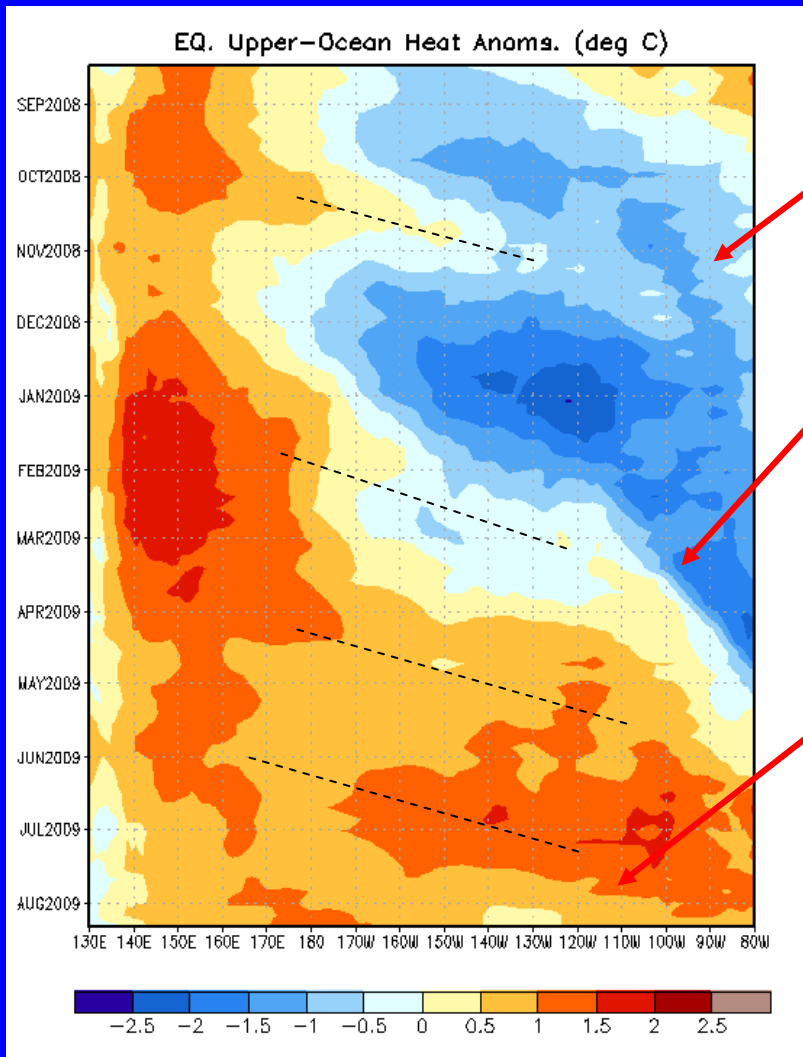


Intraseasonal Variability

- **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.**
 - **Several Kelvin waves have occurred during the last year (see next slide).**



Weekly Heat Content Evolution in the Equatorial Pacific

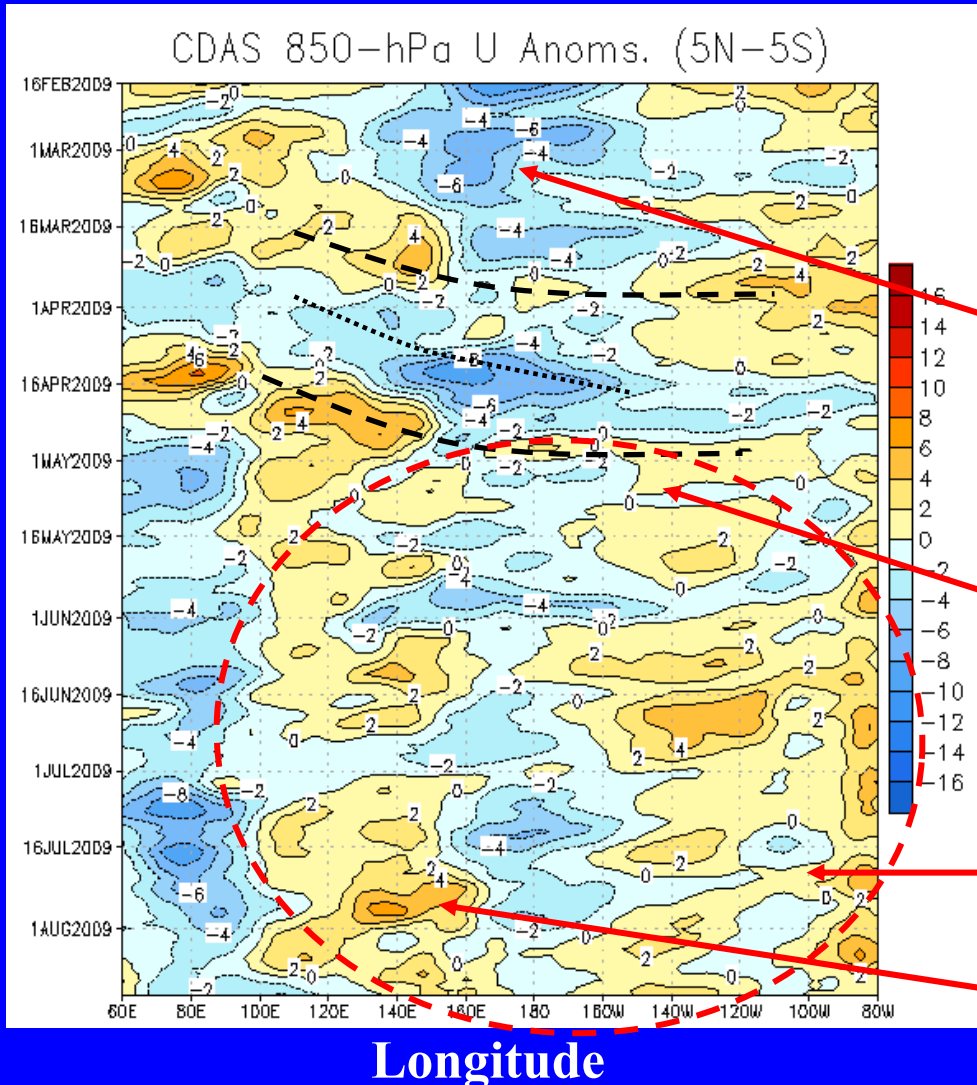


- During September 2008 – January 2009, negative heat content anomalies returned and then strengthened in the central and eastern equatorial Pacific as La Niña conditions redeveloped.
- The negative anomalies weakened during January–March 2009, with anomalies becoming positive since late March.
- In April 2009, the combined effects of an oceanic Kelvin wave and weaker easterly trade winds contributed to an increase in the upper-ocean heat content anomalies across the Pacific Ocean.
- Since April 2009, heat content anomalies have remained above-average.

• 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).

Low-level (850-hPa) easterly wind anomalies persisted from January 2007- March 2009 over the equatorial Pacific between 150°E and 150°W.

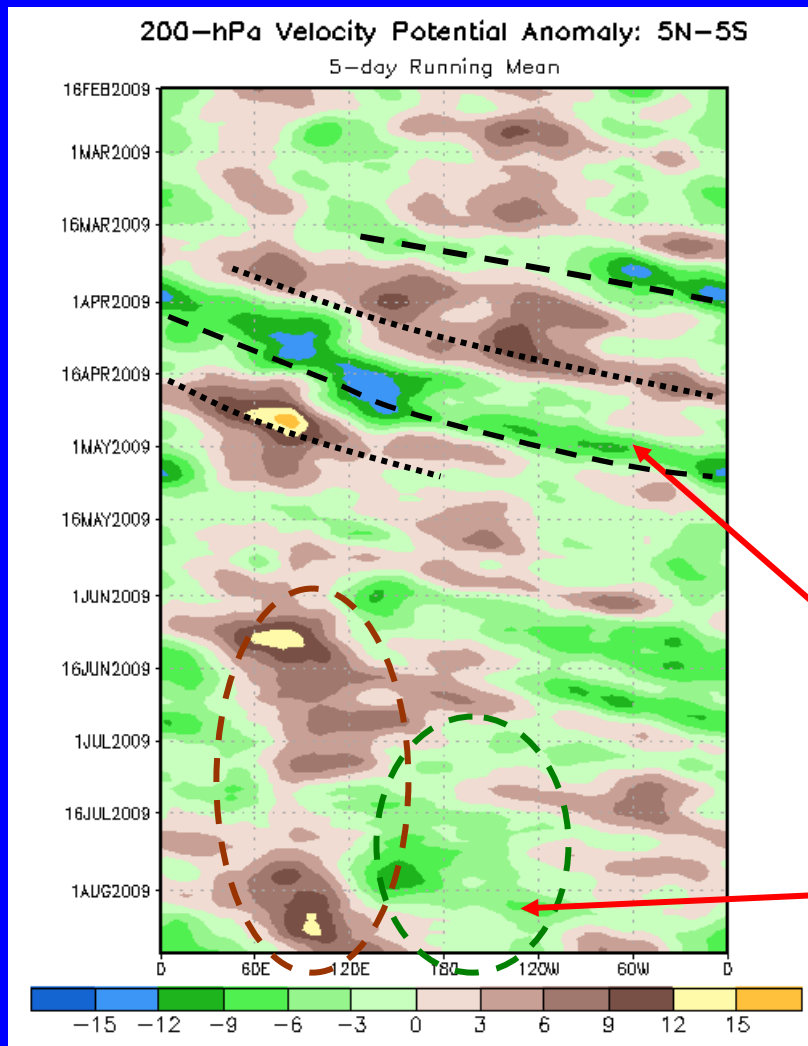
During March and April 2009, a pattern of alternating anomalous westerlies and easterlies was evident, associated with the MJO. Since then, the MJO has been weak.

Since May 2009, westerly wind anomalies have covered large portions of the equatorial Pacific, except near the Date Line.

In late July, a strong westerly wind burst was evident in the western Pacific.



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



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

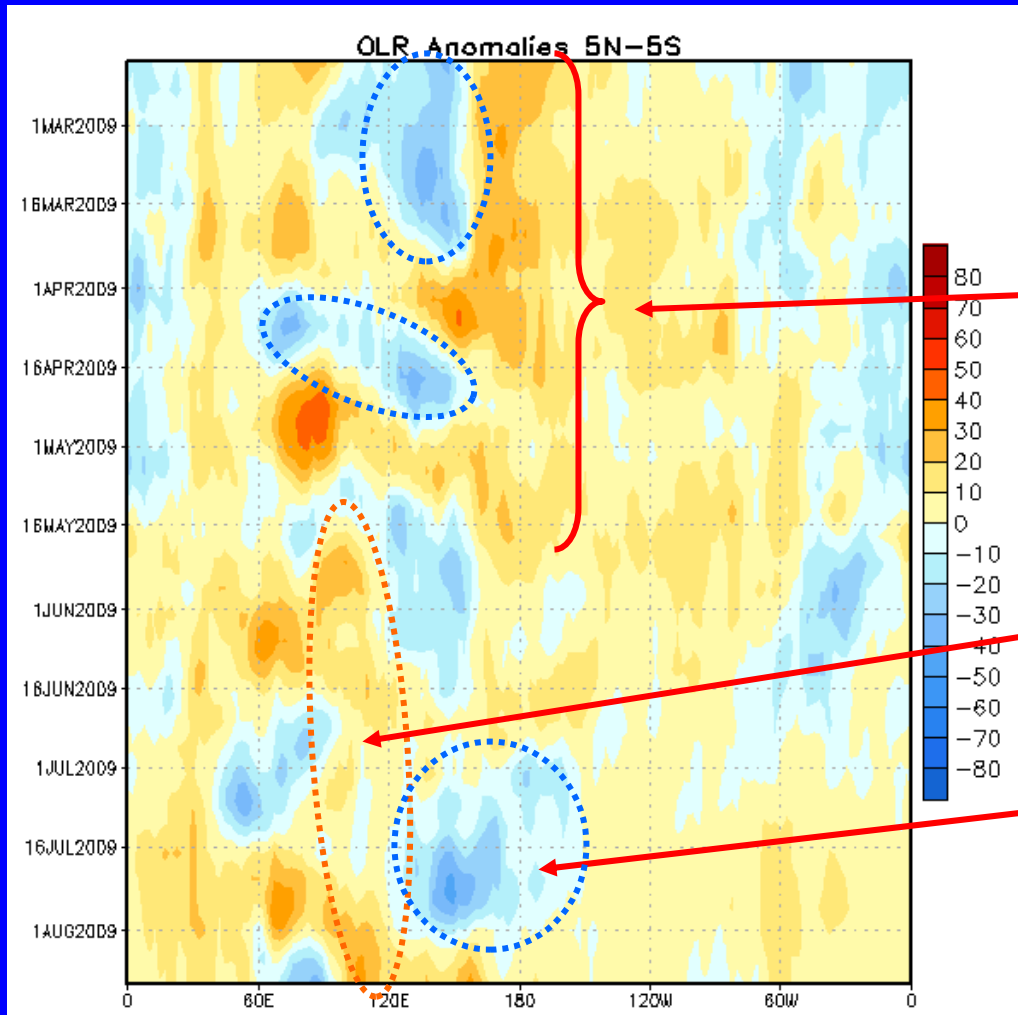
Negative anomalies (green shading) indicate favorable conditions for precipitation.

The MJO was active from mid-March through early May 2009.

The velocity potential pattern indicates anomalous upper-level divergence over the west-central Pacific, and anomalous upper-level convergence over the Indian Ocean and Maritime Continent.



Outgoing Longwave Radiation (OLR) Anomalies



Time



Longitude

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

Wetter-than-average conditions (blue shading)

From February 2007- May 2009, convection has been suppressed across the central equatorial Pacific Ocean.

Convection has occasionally been enhanced over the western equatorial Pacific and central Indian Ocean.

Since mid-May 2009, convection has remained mostly suppressed over the eastern Indian Ocean and Maritime Continent.

During July 2009, convection was enhanced near the Date Line and over the western Pacific.



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 .

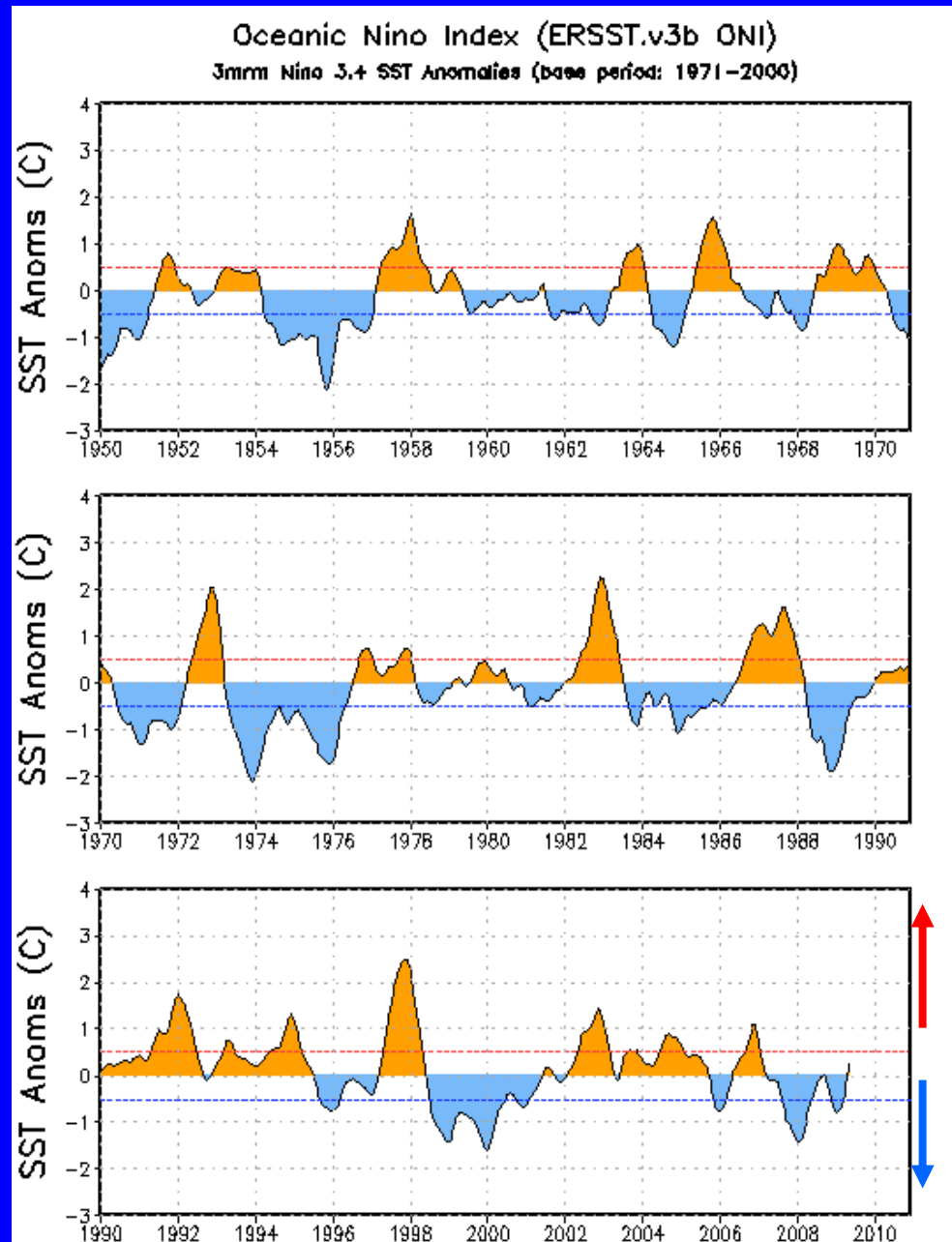
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 SST 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 (May – July 2009) is $+0.6^{\circ}\text{C}$.



El Niño
neutral
La Niña



Historical El Niño and La Niña Episodes

Based on the ONI computed using ERSST.v3b

| | Highest | | Lowest |
|------------------------|------------------|------------------------|------------------|
| <u>El Niño</u> | <u>ONI Value</u> | <u>La Nina</u> | <u>ONI Value</u> |
| JAS 1951 - NDJ 1951/52 | 0.8 | ASO 1949 – FMA 1951 | -1.7 |
| MAM 1957 – MJJ 1958 | 1.7 | MAM 1954 – DJF 1956/57 | -2.1 |
| JJA 1963 – DJF 1963/64 | 1.0 | ASO 1962 – DJF 1962/63 | -0.8 |
| MJJ 1965 – MAM 1966 | 1.6 | MAM 1964 – DJF 1964/65 | -1.1 |
| OND 1968 – MJJ 1969 | 1.0 | NDJ 1967/68 – MAM 1968 | -0.9 |
| ASO 1969 – DJF 1969/70 | 0.8 | JJA 1970 – DJF 1971/72 | -1.3 |
| AMJ 1972 – FMA 1973 | 2.1 | AMJ 1973 – MAM 1976 | -2.0 |
| ASO 1976 – JFM 1977 | 0.8 | SON 1984 – ASO 1985 | -1.0 |
| ASO 1977 - DJF 1977/78 | 0.8 | AMJ 1988 – AMJ 1989 | -1.9 |
| AMJ 1982 – MJJ 1983 | 2.3 | ASO 1995 – FMA 1996 | -0.7 |
| JAS 1986 – JFM 1988 | 1.6 | JJA 1998 – MJJ 2000 | -1.6 |
| AMJ 1991 – JJA 1992 | 1.8 | SON 2000 – JFM 2001 | -0.7 |
| AMJ 1994 – FMA 1995 | 1.3 | ASO 2007 – AMJ 2008 | -1.4 |
| AMJ 1997 – AMJ 1998 | 2.5 | | |
| AMJ 2002 – FMA 2003 | 1.5 | | |
| MJJ 2004 – JFM 2005 | 0.9 | | |
| JAS 2006 - DJF 2006/07 | 1.1 | | |

NOTE:

After updating the ocean analysis to ERSST.v3b, a new La Niña episode was classified (ASO 1962-DJF 1962/63) and two previous La Niña episodes were combined into one single episode (AMJ 1973- MAM 1976).



Historical 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)], calculated with respect to the 1971-2000 base period. 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.

| Year | DJF | JFM | FMA | MAM | AMJ | MJJ | JJA | JAS | ASO | SON | OND | NDJ |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1950 | -1.7 | -1.5 | -1.3 | -1.4 | -1.3 | -1.1 | -0.8 | -0.8 | -0.8 | -0.9 | -0.9 | -1.0 |
| 1951 | -1.0 | -0.9 | -0.6 | -0.3 | -0.2 | 0.2 | 0.4 | 0.7 | 0.7 | 0.8 | 0.7 | 0.6 |
| 1952 | 0.3 | 0.1 | 0.1 | 0.2 | 0.1 | -0.1 | -0.3 | -0.3 | -0.2 | -0.2 | -0.1 | 0.0 |
| 1953 | 0.2 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 1954 | 0.5 | 0.3 | -0.1 | -0.5 | -0.7 | -0.7 | -0.8 | -1.0 | -1.2 | -1.1 | -1.1 | -1.1 |
| 1955 | -1.0 | -0.9 | -0.9 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.4 | -1.8 | -2.0 | -1.9 |
| 1956 | -1.3 | -0.9 | -0.7 | -0.6 | -0.6 | -0.6 | -0.7 | -0.8 | -0.8 | -0.9 | -0.9 | -0.8 |
| 1957 | -0.5 | -0.1 | 0.3 | 0.6 | 0.7 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 1.2 | 1.5 |
| 1958 | 1.7 | 1.5 | 1.2 | 0.8 | 0.6 | 0.5 | 0.3 | 0.1 | 0.0 | 0.0 | 0.2 | 0.4 |
| 1959 | 0.4 | 0.5 | 0.4 | 0.2 | 0.0 | -0.2 | -0.4 | -0.5 | -0.4 | -0.3 | -0.2 | -0.2 |
| 1960 | -0.3 | -0.3 | -0.3 | -0.2 | -0.2 | -0.2 | -0.1 | 0.0 | -0.1 | -0.2 | -0.2 | -0.2 |
| 1961 | -0.2 | -0.2 | -0.2 | -0.1 | 0.1 | 0.2 | 0.0 | -0.3 | -0.6 | -0.6 | -0.5 | -0.4 |
| 1962 | -0.4 | -0.4 | -0.4 | -0.5 | -0.4 | -0.4 | -0.3 | -0.3 | -0.5 | -0.6 | -0.7 | -0.7 |
| 1963 | -0.6 | -0.3 | 0.0 | 0.1 | 0.1 | 0.3 | 0.6 | 0.8 | 0.9 | 0.9 | 1.0 | 1.0 |
| 1964 | 0.8 | 0.4 | -0.1 | -0.5 | -0.8 | -0.8 | -0.9 | -1.0 | -1.1 | -1.2 | -1.2 | -1.0 |
| 1965 | -0.8 | -0.4 | -0.2 | 0.0 | 0.3 | 0.6 | 1.0 | 1.2 | 1.4 | 1.5 | 1.6 | 1.5 |
| 1966 | 1.2 | 1.0 | 0.8 | 0.5 | 0.2 | 0.2 | 0.2 | 0.0 | -0.2 | -0.2 | -0.3 | -0.3 |
| 1967 | -0.4 | -0.4 | -0.6 | -0.5 | -0.3 | 0.0 | 0.0 | -0.2 | -0.4 | -0.5 | -0.4 | -0.5 |
| 1968 | -0.7 | -0.9 | -0.8 | -0.7 | -0.3 | 0.0 | 0.3 | 0.4 | 0.3 | 0.4 | 0.7 | 0.9 |
| 1969 | 1.0 | 1.0 | 0.9 | 0.7 | 0.6 | 0.5 | 0.4 | 0.4 | 0.6 | 0.7 | 0.8 | 0.7 |
| 1970 | 0.5 | 0.3 | 0.2 | 0.1 | 0.0 | -0.3 | -0.6 | -0.8 | -0.9 | -0.8 | -0.9 | -1.1 |
| 1971 | -1.3 | -1.3 | -1.1 | -0.9 | -0.8 | -0.8 | -0.8 | -0.8 | -0.8 | -0.9 | -1.0 | -0.9 |
| 1972 | -0.7 | -0.4 | 0.0 | 0.2 | 0.5 | 0.8 | 1.0 | 1.3 | 1.5 | 1.8 | 2.0 | 2.1 |
| 1973 | 1.8 | 1.2 | 0.5 | -0.1 | -0.6 | -0.9 | -1.1 | -1.3 | -1.4 | -1.7 | -2.0 | -2.1 |
| 1974 | -1.9 | -1.7 | -1.3 | -1.1 | -0.9 | -0.8 | -0.6 | -0.5 | -0.5 | -0.7 | -0.9 | -0.7 |
| 1975 | -0.6 | -0.6 | -0.7 | -0.8 | -0.9 | -1.1 | -1.2 | -1.3 | -1.5 | -1.6 | -1.7 | -1.7 |



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|------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1976 | -1.6 | -1.2 | -0.8 | -0.6 | -0.5 | -0.2 | 0.1 | 0.3 | 0.5 | 0.7 | 0.8 | 0.7 |
| 1977 | 0.6 | 0.5 | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 |
| 1978 | 0.7 | 0.4 | 0.0 | -0.3 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.3 | -0.2 | -0.1 |
| 1979 | -0.1 | 0.0 | 0.1 | 0.1 | 0.1 | -0.1 | 0.0 | 0.1 | 0.3 | 0.4 | 0.5 | 0.5 |
| 1980 | 0.5 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.0 | -0.1 | -0.1 | 0.0 | -0.1 |
| 1981 | -0.3 | -0.5 | -0.5 | -0.4 | -0.3 | -0.3 | -0.4 | -0.4 | -0.3 | -0.2 | -0.1 | -0.1 |
| 1982 | 0.0 | 0.1 | 0.1 | 0.3 | 0.6 | 0.7 | 0.7 | 1.0 | 1.5 | 1.9 | 2.2 | 2.3 |
| 1983 | 2.3 | 2.0 | 1.5 | 1.2 | 1.0 | 0.6 | 0.2 | -0.2 | -0.6 | -0.8 | -0.9 | -0.7 |
| 1984 | -0.4 | -0.2 | -0.2 | -0.3 | -0.5 | -0.4 | -0.3 | -0.2 | -0.3 | -0.6 | -0.9 | -1.1 |
| 1985 | -0.9 | -0.8 | -0.7 | -0.7 | -0.7 | -0.6 | -0.5 | -0.5 | -0.5 | -0.4 | -0.3 | -0.4 |
| 1986 | -0.5 | -0.4 | -0.2 | -0.2 | -0.1 | 0.0 | 0.3 | 0.5 | 0.7 | 0.9 | 1.1 | 1.2 |
| 1987 | 1.2 | 1.3 | 1.2 | 1.1 | 1.0 | 1.2 | 1.4 | 1.6 | 1.6 | 1.5 | 1.3 | 1.1 |
| 1988 | 0.7 | 0.5 | 0.1 | -0.2 | -0.7 | -1.2 | -1.3 | -1.2 | -1.3 | -1.6 | -1.9 | -1.9 |
| 1989 | -1.7 | -1.5 | -1.1 | -0.8 | -0.6 | -0.4 | -0.3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.1 |
| 1990 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 |
| 1991 | 0.4 | 0.3 | 0.3 | 0.4 | 0.6 | 0.8 | 1.0 | 0.9 | 0.9 | 1.0 | 1.4 | 1.6 |
| 1992 | 1.8 | 1.6 | 1.5 | 1.4 | 1.2 | 0.8 | 0.5 | 0.2 | 0.0 | -0.1 | 0.0 | 0.2 |
| 1993 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 0.7 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.2 |
| 1994 | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 | 0.9 | 1.2 | 1.3 |
| 1995 | 1.2 | 0.9 | 0.7 | 0.4 | 0.3 | 0.2 | 0.0 | -0.2 | -0.5 | -0.6 | -0.7 | -0.7 |
| 1996 | -0.7 | -0.7 | -0.5 | -0.3 | -0.1 | -0.1 | 0.0 | -0.1 | -0.1 | -0.2 | -0.3 | -0.4 |
| 1997 | -0.4 | -0.3 | 0.0 | 0.4 | 0.8 | 1.3 | 1.7 | 2.0 | 2.2 | 2.4 | 2.5 | 2.5 |
| 1998 | 2.3 | 1.9 | 1.5 | 1.0 | 0.5 | 0.0 | -0.5 | -0.8 | -1.0 | -1.1 | -1.3 | -1.4 |
| 1999 | -1.4 | -1.2 | -0.9 | -0.8 | -0.8 | -0.8 | -0.9 | -0.9 | -1.0 | -1.1 | -1.3 | -1.6 |
| 2000 | -1.6 | -1.4 | -1.0 | -0.8 | -0.6 | -0.5 | -0.4 | -0.4 | -0.4 | -0.5 | -0.6 | -0.7 |
| 2001 | -0.6 | -0.5 | -0.4 | -0.2 | -0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.0 | -0.1 | -0.1 |



Pacific Niño 3.4 SST Outlook

- A majority of ENSO models indicate El Niño (SST anomalies greater than $+0.5^{\circ}\text{C}$) will continue to intensify during Northern Hemisphere summer and last through Northern Hemisphere winter 2009-10.
- The models disagree on the eventual strength of El Niño ($+0.5^{\circ}\text{C}$ to $+2.0^{\circ}\text{C}$), but nearly all of the dynamical models predict a moderate-to-strong episode.

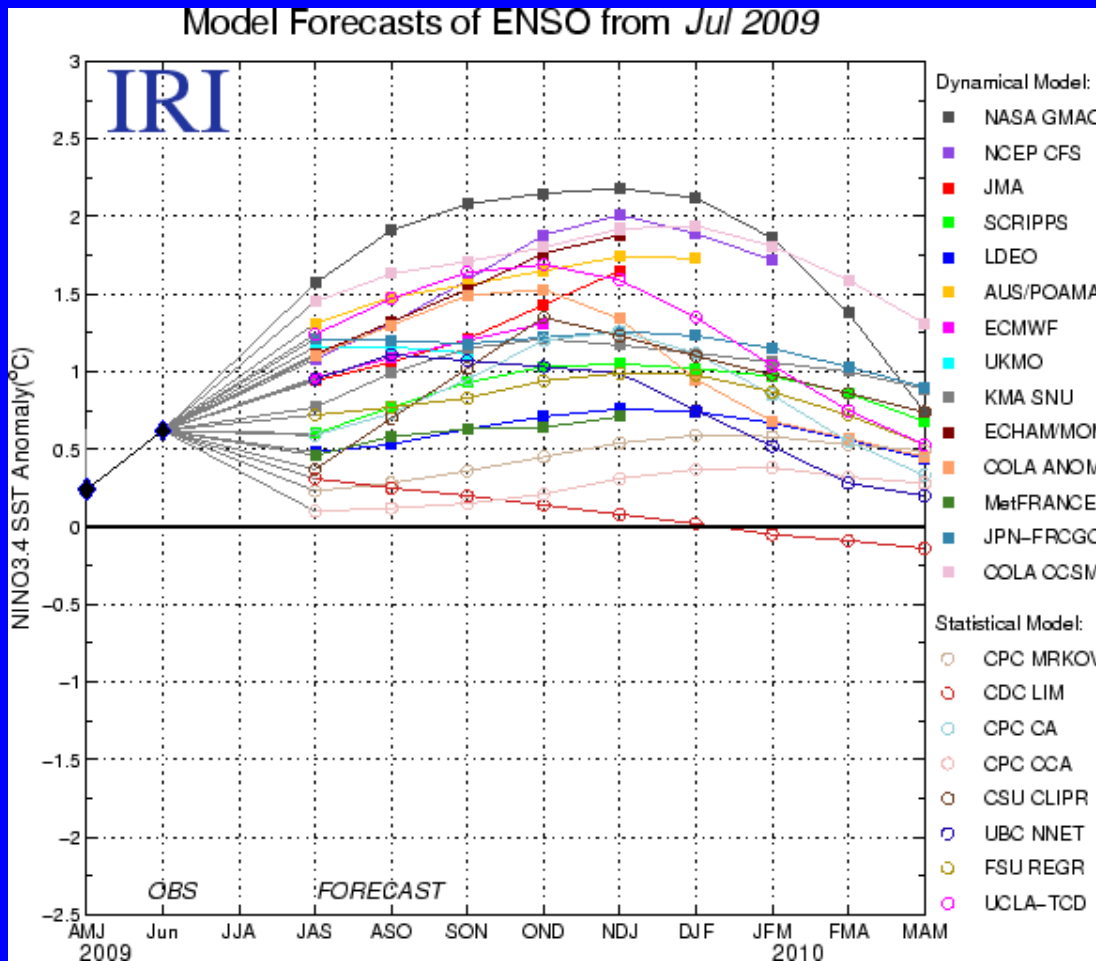
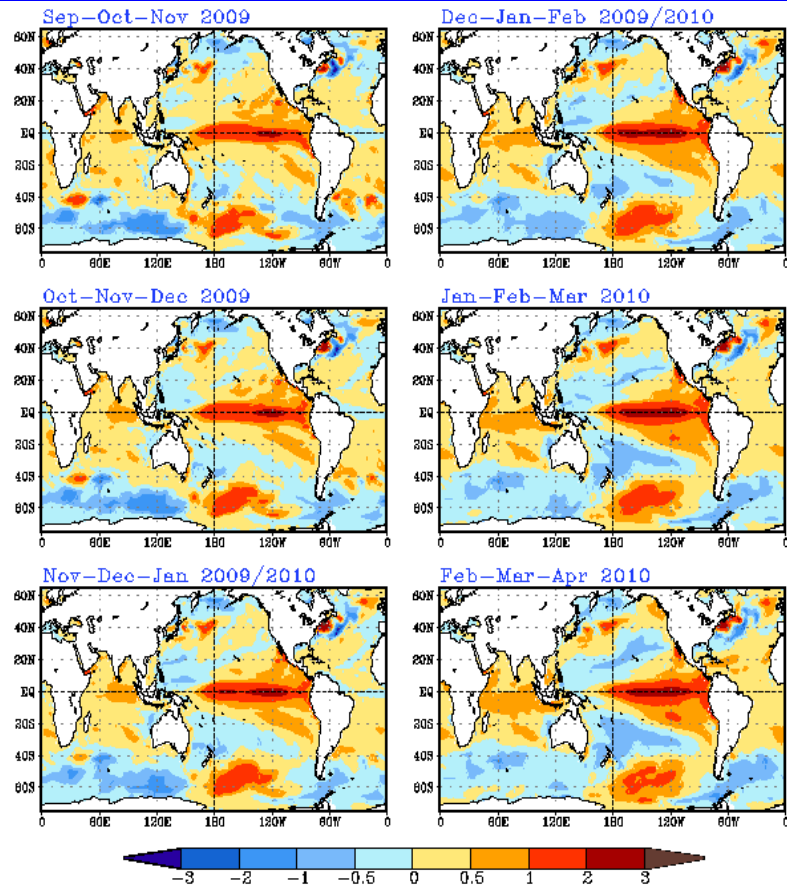


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 16 July 2009).

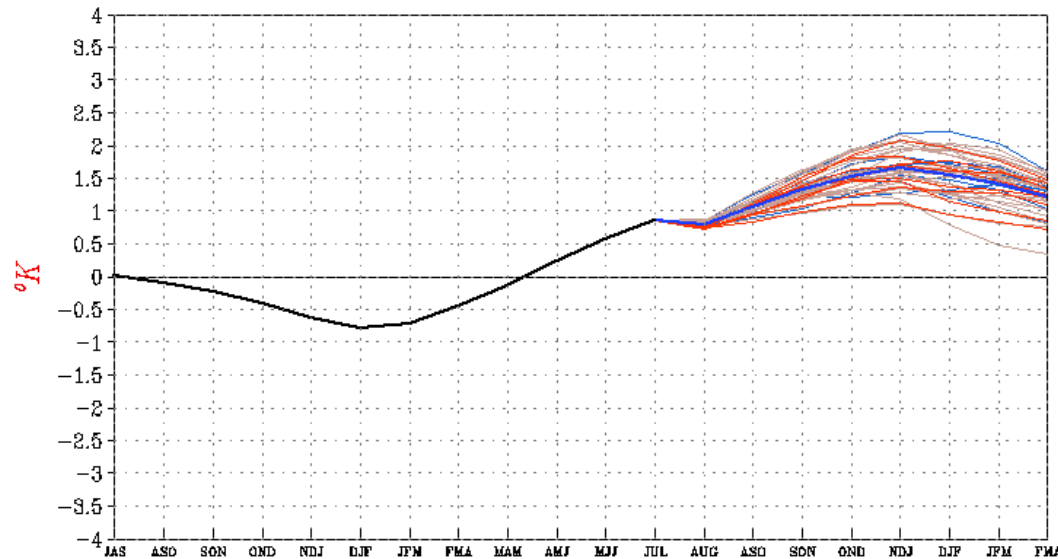


SST Outlook: NCEP CFS Forecast

Issued 16 August 2009

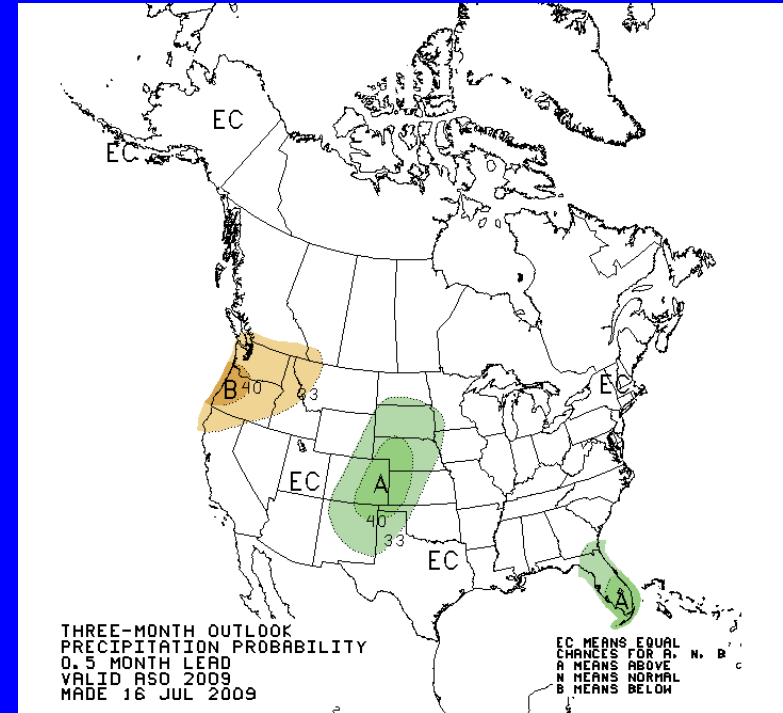
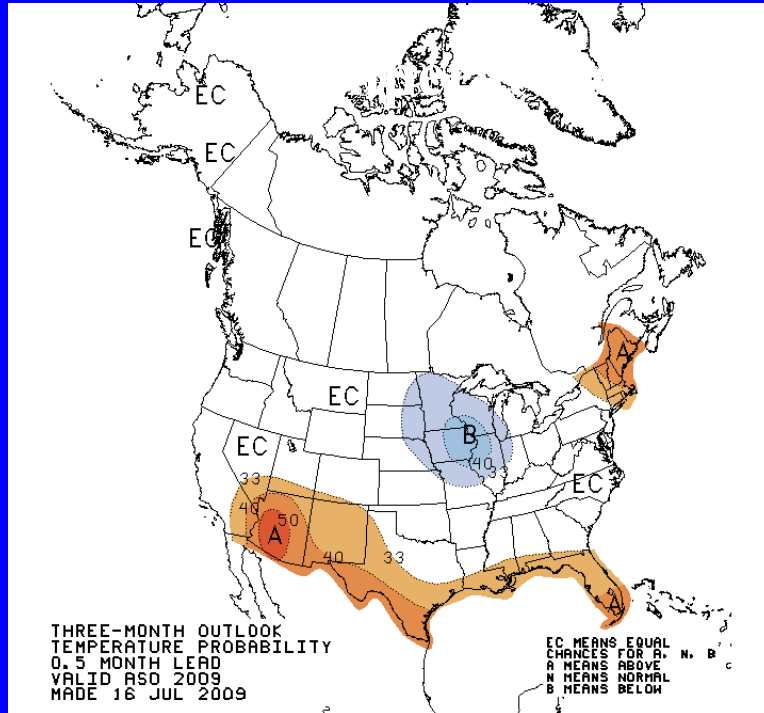


The CFS ensemble mean (heavy blue line) predicts El Niño to last through Northern Hemisphere winter 2009-10.





U. S. Seasonal Outlooks August – October 2009



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



Summary

- **El Niño is present across the equatorial Pacific Ocean.**
- **Sea surface temperatures (SST) remain +0.5 to +1.5 above-average across much of the equatorial Pacific Ocean.**
- **Current observations and dynamical model forecasts indicate El Niño is expected to strengthen and last through Northern Hemisphere winter 2009-10.**