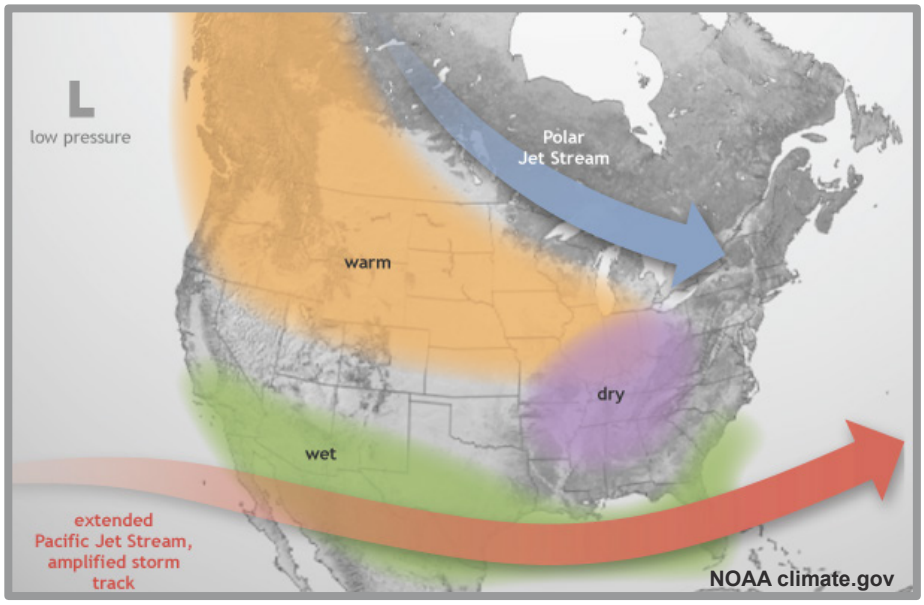
El Niño Impacts and Outlook

Western Region September 2015

Typical El Niño Winter Weather Pattern



Typical El Niño jet stream patterns across the U.S. during the winter include a more persistent than usual storm track entering the Southwest U.S. bringing wetter than normal conditions. The Northwest U.S. is then removed from the storm track, resulting in a drier than normal winter season.

El Niño and the West

A strong El Niño is predicted during winter 2015/16.

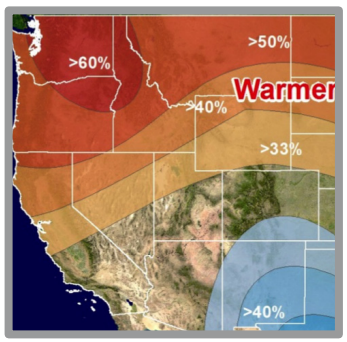
El Niño is a warming of the Pacific Ocean that occurs along the equator between South America and the Date Line and can influence the storm track over the West. El Niño conditions do not "cause" individual storms but rather influence their frequency and characteristics.

El Niño is typically associated with wetter than normal conditions along the southern third of California eastward following the U.S.-Mexico border and drier than normal conditions in the Inland Northwest and northern Rockies.

El Niño is not usually a good predictor of winter precipitation for northern California and the northern Great Basin, though model simulations suggest a very strong El Niño may drive above normal precipitation in this area and further north.

Climate Outlook and El Niño Connections

Winter Temperature and Precipitation Outlook



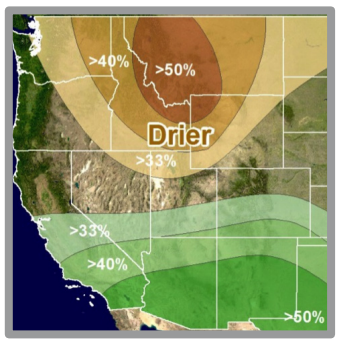
Temperature

Climate Prediction Center Outlooks

Produced August 20, 2015 for Dec-Jan-Feb 2015/16

Numbers indicate percent chance of temperature in warmest one-third and of precipitation in wettest one-third

CPC // http://www.cpc.ncep.noaa.gov/products/predictions/long_range/



Precipitation

The official NOAA outlooks for Dec-Jan-Feb temperature and precipitation for the West reflect the development of a strong El Niño during this period. Above normal temperatures and below normal precipitation are anticipated in the Pacific Northwest and northern Rockies. There is a 50% chance that winter precipitation totals will be in the top 33% of historic values across far southern California, Arizona, and New Mexico. The forecast is less confident moving northward. These outlooks are likely to change as we track the progress of El Niño and other climate variables in the coming months. This El Niño event is forecast to rival previous strong El Niño events, such as 1982/83 and 1997/98. During those events, above normal precipitation extended northward into northern California, the Great Basin, and the coastal Pacific Northwest. However, no two years are identical even when a strong El Nino is present. There are other sources of variability and uncertainty that can impact this winter's weather. These include background warming of the ocean and atmosphere, unique ocean temperature patterns, and other atmospheric patterns besides El Niño.

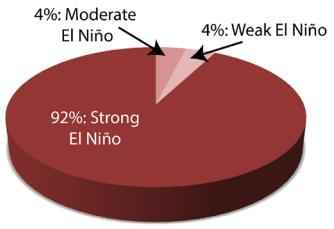
Past Strong El Niño Events

Event since 1950	Year (Oct-Mar)	Maximum ONI Value
1	1957/1958	1.7
2	1965/1966	1.8
3	1972/1973	2.0
4	1982/1983	2.1
5	1991/1992	1.6
6	1997/1998	2.3
7 (TBD)	2015/2016	2.3 (predicted)

Above: El Niño events with an Oceanic Niño Index (ONI), an indicator based on equatorial SSTs, peaking at >=1.5. *Below:* 92% of 26 dynamical and statistical climate models favor a strong El Niño, with most peaking during the late fall or early winter of 2015/16.

El Niño Strength 2015/16

Potential El Niño Event Intensity



Data Source: CPC/IRI Aug 20 2015
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/

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Highlight: El Niño and California

California Precipitation During Prior "Strong" El Niño Events

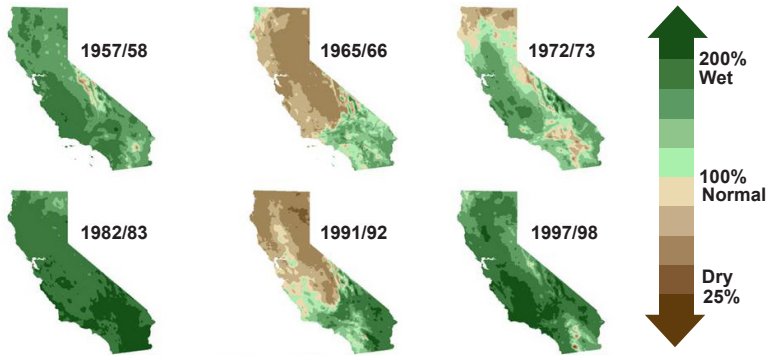


Image courtesy of NWS Sacramento Data: PRISM, OSU

Above: Precipitation total by Water Year (Oct 1- Sep 30). Of the 6 strong El Niños on record, only half produced statewide above normal precipitation: 1957/58, 1982/83, and 1997/98. Flooding in California can occur in both El Niño and non-El Niño years. Most of the state's largest floods occured during non-El Niño conditions, such as in the winter of 1996/97, a neutral year. Extreme rainfall and flooding in CA is often associated with surges of subtropical moisture into the region that are known as *atmospheric rivers* (ARs). Research suggests ARs are less frequent in the eastern Pacific during El Niño, though the relationship between El Niño and ARs is the subject of active investigation.

El Niño and California Drought

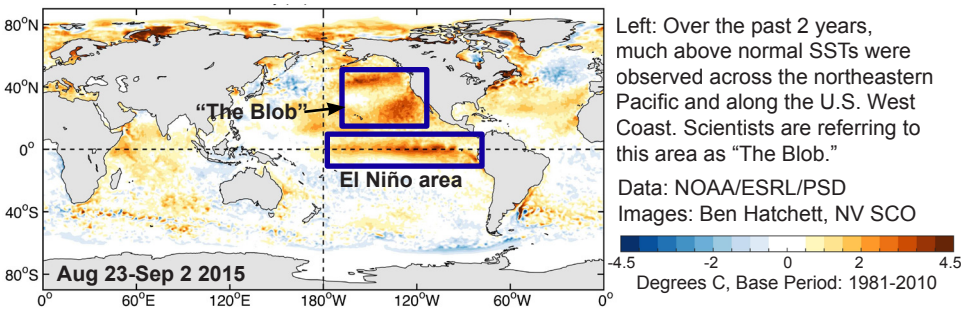
California just experienced 4 years of drought. Recovery from drought in California is a multi-faceted issue. Storm location is important as most of California's major reservoirs are located in the northern part of the state where the relationship between El Niño and precipitation is generally weak. A healthy Sierra Nevada snowpack is important for drought recovery as well. Intensity of precipitation also affects groundwater replenishment and runoff into reservoirs; El Niño does not provide insight to this.

Looking towards Red Slate Peak and the upper Convict Creek watershed in the High Sierra. Runoff from this area provides water resources to eastern Sierra communities and to Los Angeles via the Los Angeles Aqueduct.

Photo: Ben Hatchett March 2010

El Niños Past and Present

Current Sea Surface Temperature (SST) Anomalies

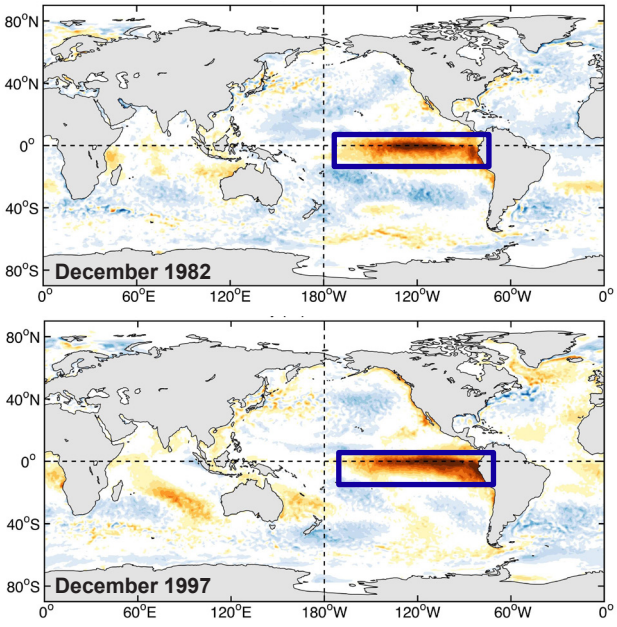


Left: Over the past 2 years, much above normal SSTs were observed across the northeastern Pacific and along the U.S. West Coast. Scientists are referring to this area as "The Blob."

Data: NOAA/ESRL/PSD
Images: Ben Hatchett, NV SCO

The Blob (above) formed under the persistent upper level ridge that has been present over the eastern Pacific during much of the last 4 winters. Under the ridge, ocean waters were warmed by the sun, reduced upwelling, and less wave mixing. The Blob's influence on winter 2015/16 is not well understood, though it is expected to play some role.

Past Strong El Niño SST Anomalies



Each El Niño event has different characteristics that can affect the way it impacts the western US. Both the 1982/83 (left, top) and 1997/98 (left, bottom) had SST anomalies peak offshore of South America, but other El Niño events (2004/05, not shown) have peaked towards the central equatorial Pacific. Past very strong El Niño events shown to left did not have a "blob"-like feature, so there is not a good analog for this scenario. Timing and characteristics of precipitation during El Niño events may vary as well; CA's 8-Station Index saw well above normal precipitation in Oct/Feb/Mar of 1982/83, but only during Jan-Feb of 1997/98.

Western Region Partners

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USDA/NRCS National Water and Climate Center - www.wcc.nrcs.usda.gov
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www.nifc.gov
DOI WaterSMART
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Western Water Assessment
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Climate Assessment for the Southwest
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California Nevada Applications Program
meteora.ucsd.edu/cnap
Climate Impacts Research Consortium
pnwclimate.org/resources
NWS River Forecast Centers
water.weather.gov/ahps/rfc/rfc.php
NOAA Fisheries Service
www.nmfs.noaa.gov/
NWS Western Region Forecast Offices
www.wrh.noaa.gov/
State Climatologists
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