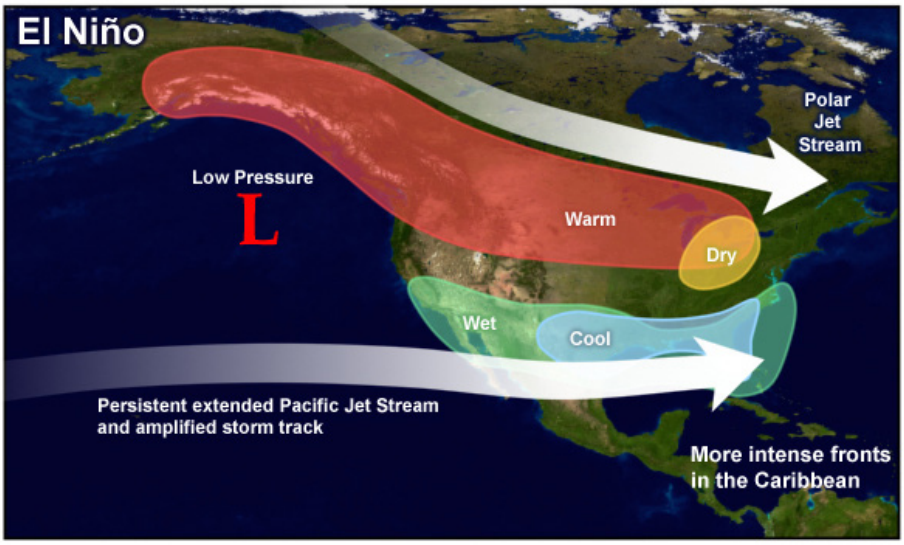
El Niño Impacts and Outlook

Western Region October 2014

Typical El Niño Weather Pattern

Typical Weather Pattern for the U.S. During El Niño



Typical El Niño jet stream patterns across the U.S. include a stronger than usual storm track across the southern U.S., leaving the northern US removed from the average storm track. Image courtesy of NOAA.

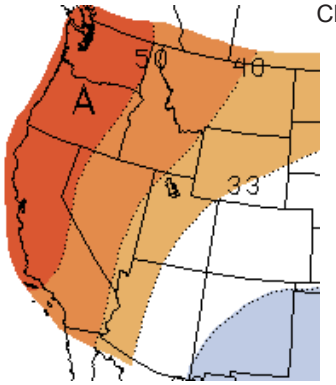
El Niño and the West

- A weak to moderate El Niño is forecast to develop during winter 2014-15
- Wetter than normal conditions anticipated for southern third of California eastward along the U.S.-Mexico border
- Drier than normal conditions anticipated for the Pacific Northwest and Inland Northwest
- El Niño is not a useful predictor of winter precipitation for an east-west zone that roughly follows the Interstate-80 corridor

El Niño is a warming of Pacific Ocean waters that occurs along the equator between South America and the Date Line. The main effects to the U.S. are seen in the cold season (Oct-Mar). Patterns of western climate vary considerably from one El Niño to the next and depend on the location, magnitude, and month of the ocean temperature departures from average.

Climate Outlook and El Niño Connections

Winter Temperature and Precipitation Outlook



Temperature

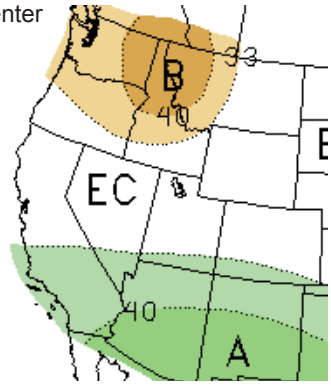
Climate Prediction Center Official Outlooks

Produced Oct 16, 2014

A indicates above normal
B indicates below normal
N indicates normal
EC means equal chances for A, N or B

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/

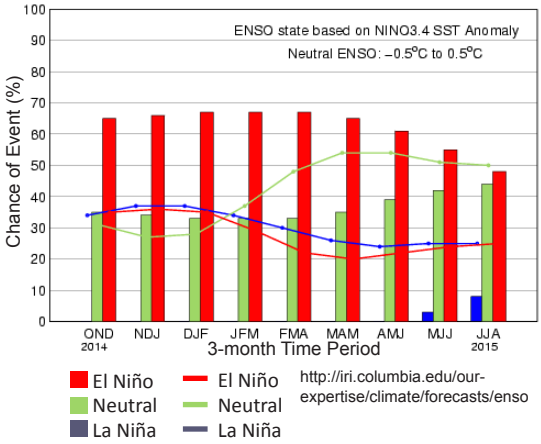


Precipitation

The official outlooks for Dec-Jan-Feb temperature and precipitation for the West reflect the development of a weak to moderate El Niño during this period. Historical statistical pattern relationships (ocean pattern A has been preferentially followed by climate pattern B) have played a major role in the development of climate forecasts; newer methods solve the dynamic equations directly. Above normal temperatures are forecast for much of the West, though cooler than normal temperatures are anticipated in the far southern portion of the region across much of New Mexico. Above normal precipitation is favored across the southern portion of the West. El Niño does not have a strong signal in areas important for water resources or facing persistent drought such as northern California, the Great Basin, and the central Rockies. These areas have equal chances of above or below normal precipitation. The Dec-Jan-Feb period accounts for 50 percent of annual Sierra Nevada precipitation.

Likelihood of El Niño

CPC/IRI Plume-Based Probabilistic ENSO Forecast
Generated mid-Oct 2014



http://iri.columbia.edu/our-expertise/climate/forecasts/enso

Currently, the odds favor a weak-to-moderate El Niño developing during the Nov-Feb 2014-15 time frame (67% probability).The three phases, El Niño (warm), La Niña (cool), and Neutral are all parts of a collective process called ENSO (El Niño/Southern Oscillation). Ocean experts first predict the state of ENSO and then atmospheric experts use these ocean forecasts to drive atmospheric forecasts.

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Western Regional Climate Center

NOAA

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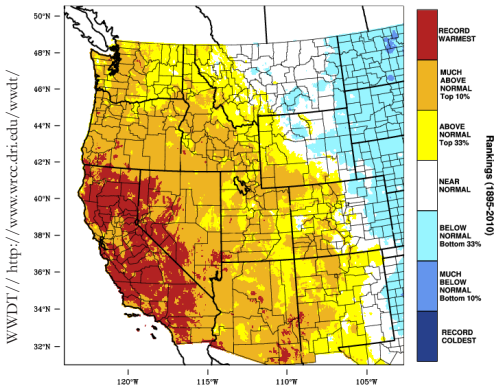
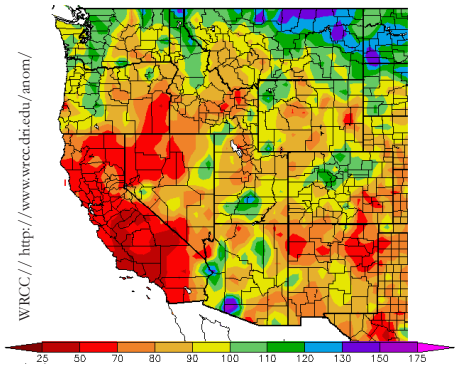
Current Conditions and Observed Impacts

Jan-Sept 2014 Mean Temperature

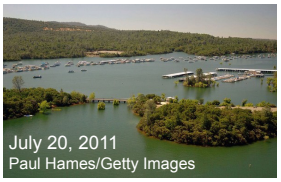


36-Month Precipitation Percent of Normal (10/18/2011-10/17/2014)



The backdrop for El Niño this winter is major drought affecting much of the West, especially the Colorado River (15 years) and the Sierra Nevada (3 years). High temperatures exacerbate drought conditions, and so far through September of this year, every month in California has been warmer than average. This year to-date has been the warmest by far in a 120-year record. The average precipitation deficit is such that about a year's worth of precipitation is "missing" over the past three years.

Drought Impacts to Date

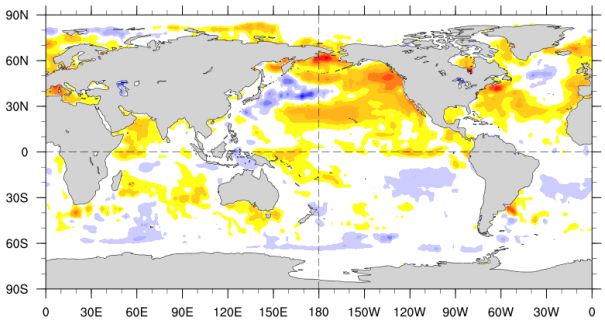


Lake Oroville, California in 2011 (top) and after 3+ years of drought in 2014 (bottom).

The most dramatic effects are the loss of water storage, including carryover, from large California and Colorado River reservoirs. Small cities and towns are digging deeper wells, at great expense, to avoid loss of supply. Salt intrusion and increased pollutant loads from restricted flow are being reported. Loss of agricultural production has been about $2B thus far.

There is More to Climate than El Niño

Sea Surface Temperature (SST) Anomalies



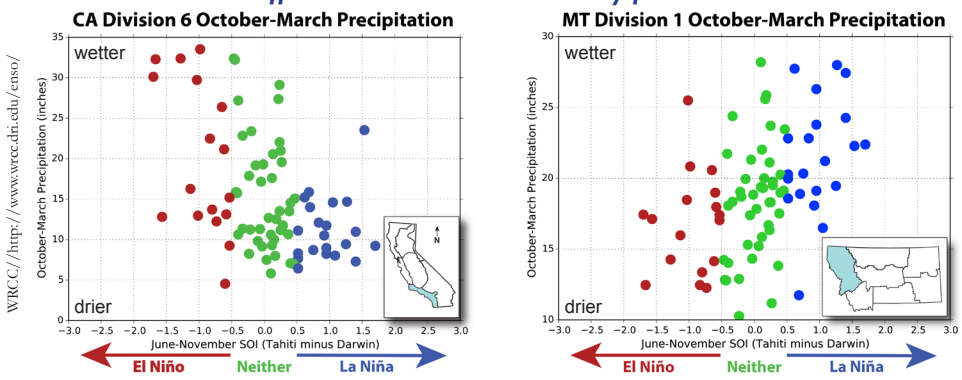
Shown: 10/5/2014-10/11/2014. This fall, much above normal SSTs have been observed across the northeastern Pacific and along the U.S. West Coast.

Source: NOAA/ESRL/PSD

Base Period: 1981-2010

We do not expect El Niño to account for everything, but rather to act on occasion as a minor or moderate contributor to the weather we experience over a winter. For example, the above normal temperatures in most of the North Pacific this year should have some influence on the climate of western North America, though we cannot specify how much, where or when, a clear priority for climate research.

El Niño Effects on Western Climate Vary from Year-to-Year



In the above figures, each marker represents Oct-Mar precipitation total for a year between 1933-34 and 2013-14. El Niño years (red, left side of each diagram) can be among the wettest or driest, showing the variable nature of El Niño's effects. In general, El Niño winters tend to be inconsistently wet in the Southwest (left figure) or inconsistently dry in the northern tier (right figure). At most, El Niño can account for no more than a quarter to a third of the year-to-year precipitation variability experienced in the western states. There are always other factors at work, of which El Niño is just one.

Western Region Partners

Western Regional Climate Center
wrcc.dri.edu
National Integrated Drought Information System (NIDIS) - drought.gov
Western Governors' Association
westgov.org
Western States Water Council
westgov.org/wswc
NOAA/ESRL Physical Sciences Division
esrl.noaa.gov/psd
NOAA Climate Prediction Center
www.cpc.ncep.noaa.gov
National Climate Data Center (NCDC)
www.ncdc.noaa.gov
USDA/NRCS National Water and Climate Center - www.wcc.nrcs.usda.gov
National Interagency Fire Center
www.nifc.gov
DOI WaterSMART
www.usbr.gov/WaterSMART
NOAA's Western Regional Collaboration Team
www.regions.noaa.gov/western/western_region_team.html
Western Water Assessment
wwa.colorado.edu
Climate Assessment for the Southwest
climas.arizona.edu
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 - stateclimate.org

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