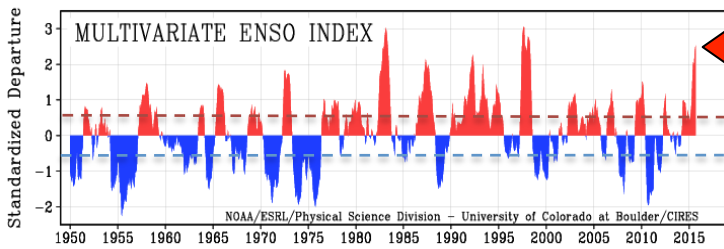


EL NIÑO IMPACTS FOR COLORADO Fall, Winter, Spring 2015-16

SUMMARY: The current El Niño event is very strong, and is expected to affect weather around the globe, and in Colorado, through next spring. The impacts of El Niño are more complex over Colorado than other parts of the West. Strong El Niño conditions improve the odds for wetter-than-normal conditions in most parts of Colorado, especially in fall and spring. However, strong El Niño conditions also tend to bring dry mid-winters to our North-Central mountains.



The Multivariate ENSO Index (MEI) shows warm El Niño events (red, above dashed line) and cool La Niña events (blue, below dashed line) since 1950. The current El Niño (red arrow) is now the 3rd strongest, after 1982-83 and 1997-98. (Figure: NOAA ESRL PSD)

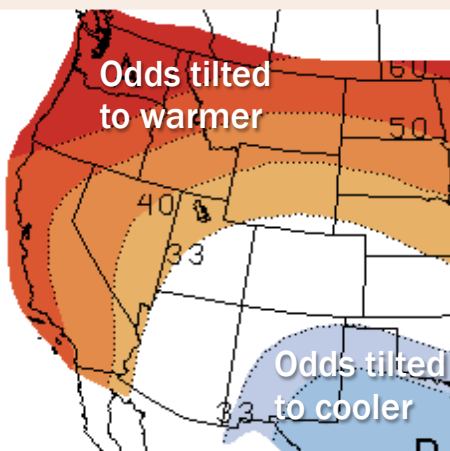
The El Niño-Southern Oscillation (ENSO) is an important influence on seasonal and annual climate variability in many parts of the globe.

It involves periodic changes in, and above, the tropical Pacific Ocean, see-sawing between its warm phase (El Niño) and its cool phase (La Niña) on a 2- to 7-year cycle (*left*). But what happens in the tropical Pacific doesn't stay in the tropical Pacific. The changes associated with ENSO affect the entire global climate system, as massive amounts of heat and water vapor are transferred between the ocean and atmosphere.

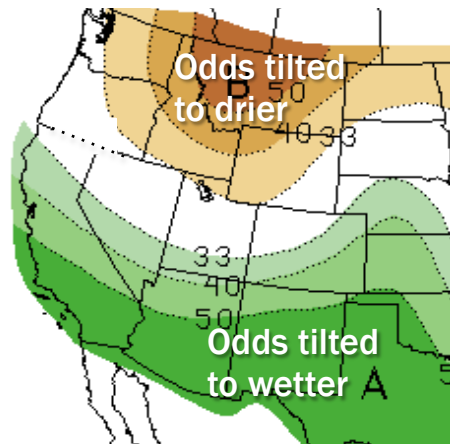
The current El Niño event is very strong, and may join 1982-83 and 1997-98 as a "super" El Niño event.

ENSO events are measured by the changes from normal sea-surface temperatures (SSTs) and by the Multivariate ENSO Index (MEI), which combines changes in SSTs, winds, and pressure in the tropical Pacific. According to all ENSO indices, the current El Niño event is particularly strong for this time of year, and the 3rd strongest since 1950. The consensus of ENSO model forecasts is that the event will strengthen slightly, peak in winter, then weaken rapidly in the spring, more similar to 1997-98 than 1982-83.

**NOAA CPC
Temperature
Outlook
Dec 2015-
Feb 2016**



**NOAA CPC
Precipitation
Outlook
Dec 2015-
Feb 2016**



Strong El Niño events have predictable effects on storm tracks that bring Pacific moisture into the western U.S.

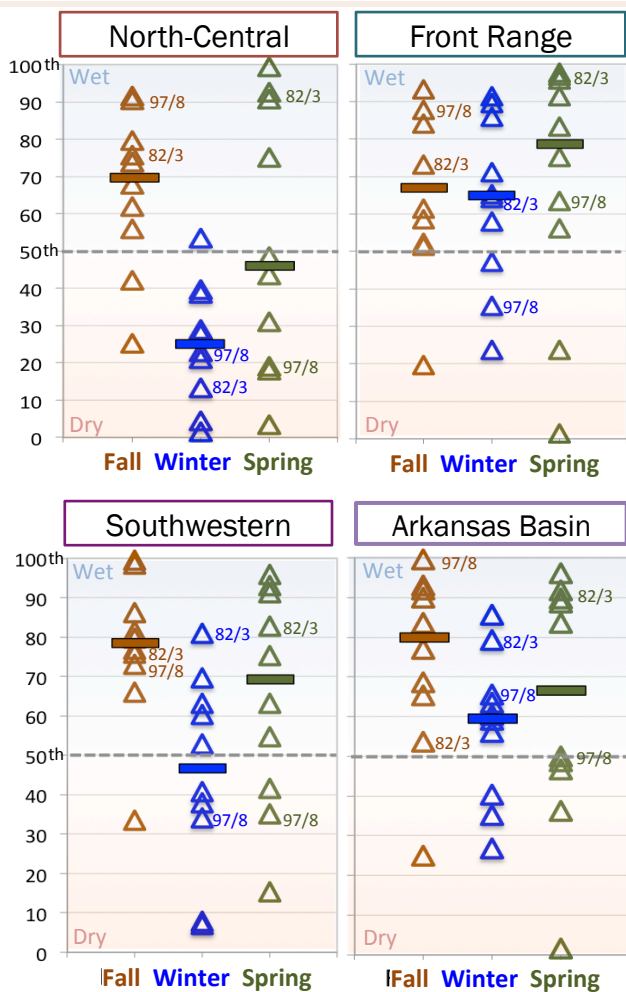
During fall, winter, and spring, the Southwest and southern California feel the brunt of an enhanced southerly storm track, while the interior Northwest tends to be dry as storms are shunted elsewhere. The northern tier of the U.S. also tends to be warmer than normal. The official seasonal forecasts for this winter (*left*) follow this general pattern. *Colorado's outlook is complicated by seasonal and topographic details that are not captured in this national perspective.*

From past experience, strong El Niño events in fall shift the odds towards above-normal September-May precipitation for many parts of Colorado.

However, there are important differences between different seasons and different parts of the state. Most of our mountains tend towards a dry winter (Dec-Feb) during El Niño events. (**See next page.**) *History is not destiny:* Even where the past shows a clear pattern, the coming season may still diverge from that pattern.

The official NOAA Climate Prediction Center seasonal outlooks issued in October for the 3-month winter (Dec 2015-Feb 2016) period follow the pattern typical of strong El Niño events: the Pacific jet stream (storm track) strengthens and brings more moisture to the southwestern U.S. The Polar jet stream shifts north, leading to warmer and drier conditions in the northern U.S. (Figure: NOAA CPC)

EL NIÑO IMPACTS FOR COLORADO 1997 2015 Fall, Winter, Spring 2015-16

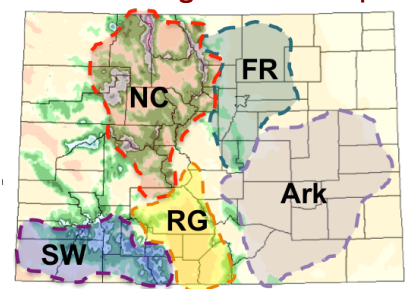


Across Colorado, past strong El Niño events have often brought above-normal precipitation in the fall (Sep–Nov) and spring (Mar–May), but less so in winter (Dec–Feb).

- In the **North-Central** mountains—the headwaters of the Colorado, Gunnison, Yampa, White, North Platte, and South Platte—fall is more often wet than dry, spring is split evenly, but winter is drier than normal in 9 of 10 cases.
- For the **Front Range**, there is a tendency towards wetter conditions in all seasons, especially in spring. Major (>18”) snowstorms are also much likely during El Niño.
- In the **Arkansas Basin**, the wet tendencies are similar to the Front Range, though strongest in fall.
- In **Southwestern** Colorado, fall is consistently wetter than normal; spring slightly less so; winter is split between wet and dry. (The **Rio Grande Basin** follows a similar pattern.)
- *There has been a wide range of outcomes in all seasons.*

The open triangles show the percentile ranks (100th=wettest; 50th=median, 1st=driest) for seasonal precipitation during and after the 10 strongest fall El Niño conditions since 1915, relative to all years in the record. The bars show the median outcome of the 10 years. 82/3 = 1982–83 El Niño; 97/8 = 1997–98 El Niño (Figure: WWA & NOAA PSD)

Colorado Region Locator Map



Colorado's spring snowpack and annual runoff also have tended to be above normal in past strong El Niño events.

Overall, the pronounced wet tendency in fall and spring precipitation has balanced out the dry tendency for winter in the North-Central and Southwestern regions. In most of the strongest past El Niño events, May 1 snow-water equivalent (SWE) and water-year runoff (**below**) have both been above normal in Colorado's major river basins. However, if fall 2015 were to remain on the dry side, through November, it would be hard to recover by late spring.

Stream Gage	Colorado - Lees Ferry	South Platte - S. Platte	Arkansas - Salida	Rio Grande - Del Norte
Above-normal runoff	7/10 El Niño events	8/10 events	7/10 events	6/10 events

What else can we expect during El Niño events?

Average winter temperatures in Colorado show no clear tendency during an El Niño event; a mild or cold winter is equally likely. El Niño years tend to be less windy overall, with fewer downslope windstorms on the Front Range. This reduces the likelihood of extreme warm spells associated with Chinook winds.

Resources for monitoring ENSO and its impacts for Colorado

NOAA - ENSO Blog

www.climate.gov/news-features/department/enso-blog

PSD - MEI Homepage

www.esrl.noaa.gov/psd/enso/mei/

WWA Intermountain West Climate Dashboard

www.colorado.edu/climate/dashboard.html

NIDIS - Upper Colorado Drought Assessment

climate.colostate.edu/~drought/

Partners

Western Water Assessment and CIRES

[www.colorado.edu - cires.colorado.edu](http://www.colorado.edu/~cires.colorado.edu)

NOAA ESRL Physical Sciences Division

<http://www.esrl.noaa.gov/psd/>

NOAA National Weather Service - Denver/Boulder

www.weather.gov/bou/

Colorado Climate Center

climate.colostate.edu

National Integrated Drought Information System

www.drought.gov

North Central Climate Science Center

www.revampclimate.colostate.edu

Layout: Ami Nacu-Schmidt and Jeff Lukas