El Niño Impacts and Outlook

Western Region

November 2018

What is El Niño and how does it impact the West?

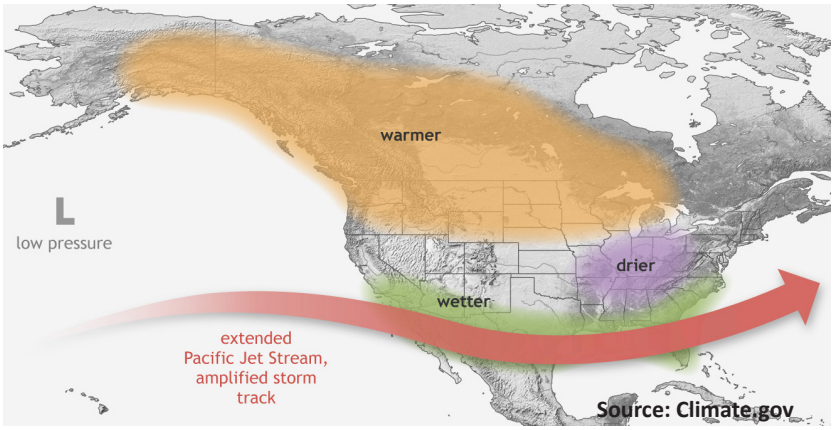

Fig. 1: Most common US wintertime impacts during El Niño. There is an 80% chance of El Niño conditions developing and persisting through winter.

El Niño Impacts

The common teleconnection pattern observed in the western US during an El Niño winter is drier and warmer than normal conditions in the Pacific Northwest and wetter than normal conditions across the far Southwest (Fig. 1). There is no reliable influence in northern California, the Great Basin, or the Upper Colorado River Basin. However, a strong El Niño event may further tilt the odds towards a larger region of above normal precipitation across the Southwest.

What is El Niño?

An El Niño is a wholesale rearrangement of winds, sea surface temperatures (SSTs), and the location of thunderstorms in the tropical Pacific Ocean. These changes have global impacts, since the location of powerful tropical storms affects atmospheric high and low pressure patterns across the planet. These pressure patterns can move the jet stream and alter storm tracks, so an El Niño can affect temperature and precipitation in distant locations, such as the western U.S., as well as in the Southeastern U.S., upper Midwest, Central and South America, Indonesia, and Australia. The remote influence of the tropical Pacific on other locations via movement of pressure patterns and the jet stream is called a teleconnection. El Niño is just one phase of what is termed the *El Niño-Southern Oscillation (ENSO)*, and is characterized by warmer than normal SSTs and enhanced tropical thunderstorm activity in the central and eastern equatorial Pacific. The other phases are La Niña (cooler than normal SSTs) and Neutral.

Why can't we count on El Niño teleconnections?

Even if El Niño conditions are present, the teleconnected effects on the western U.S. are not guaranteed. Every El Niño event has different characteristics – how warm the SST anomalies are, the location of the tropical Pacific thunderstorms, when and how the jet stream is deflected – resulting in a spread of western U.S. impacts, even though the average result across many events is as seen in Fig. 1. This problem of natural variability leading to varied outcomes is compounded by the relatively short historic record, <70 years. Since 1950, there have been only 24 years with El Niño conditions. Of these, six have been classified as strong, six as moderate, and twelve as weak (Fig. 2). Thus, we are basing our observation of teleconnections on just a handful of events. Any one individual El Niño year can have western U.S. impacts that differ considerably from the average seen across all events.

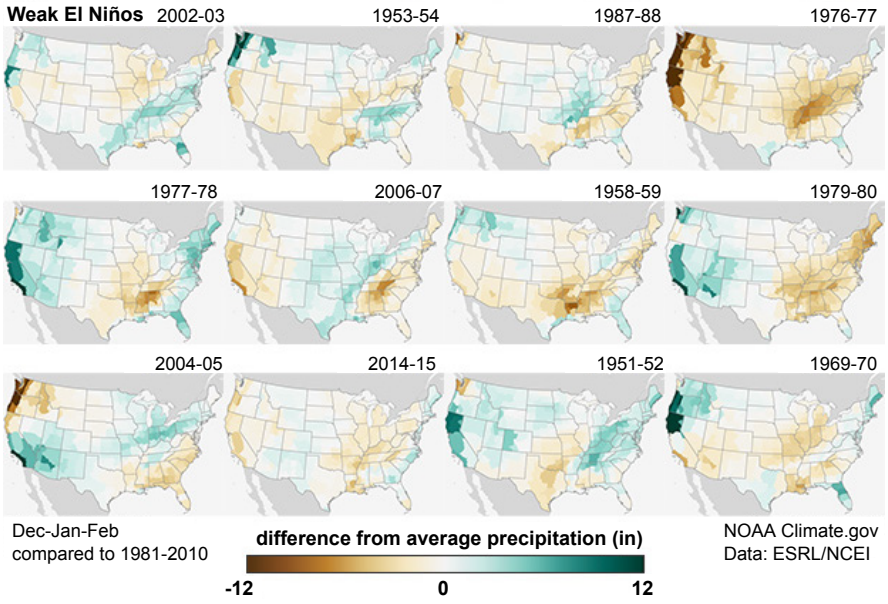

Fig. 2: December-January-February difference from average precipitation for the twelve weak El Niño events that have occurred since 1950. A weak El Niño is anticipated this winter.

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ENSO and Seasonal Prediction

Temperature Outlook

Precipitation Outlook

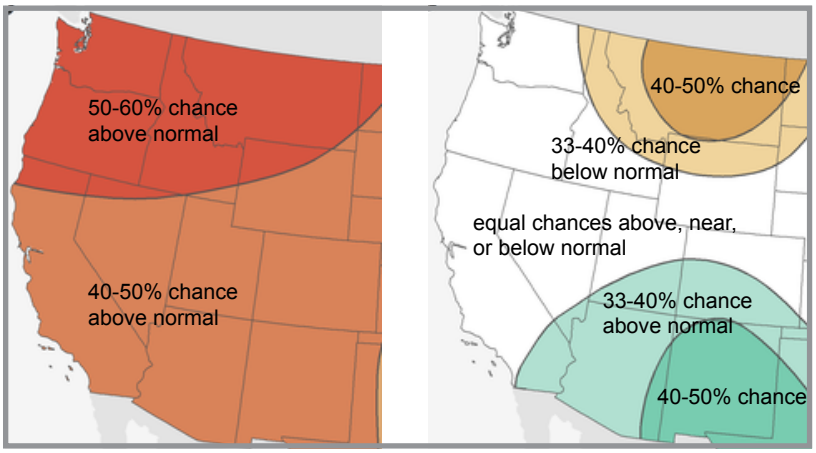

Fig. 3: Outlooks for Dec 2018-Feb 2019 indicate the most likely outcome for temperature or precipitation. While one outcome may be favored, there is still a significant chance that the less likely outcome will occur. Data: NWS Climate Prediction Center Oct. 2018; maps produced by Climate.gov.

While ENSO phase and strength tilt the odds of various cool season temperature and precipitation outcomes, ENSO alone is not enough for useful prediction. Seasonal forecasts are produced using complex computer models that simulate ENSO as well as SST, sea ice, land surface, and other conditions that may also contribute to western weather. Additionally, researchers are studying the influence of other oscillations such as the Pacific decadal oscillation (PDO), the quasi-biennial oscillation (QBO) and the Madden-Julian oscillation (MJO) to evaluate their influence western US precipitation at sub-seasonal to seasonal timescales.

Research is also underway to understand how teleconnection patterns influencing the western US may evolve in a warming climate. Scientists postulate that the characteristics of El Niño conditions in the tropical Pacific may change, causing historic temperature and precipitation teleconnections to change in magnitude or even sign. There is a potential for other signals that emerge in a warming climate, such as polar amplified warming, to dominate over the ENSO signal, though the long-term impacts of such signals are still unknown.

Past ENSO Impacts and Outcomes

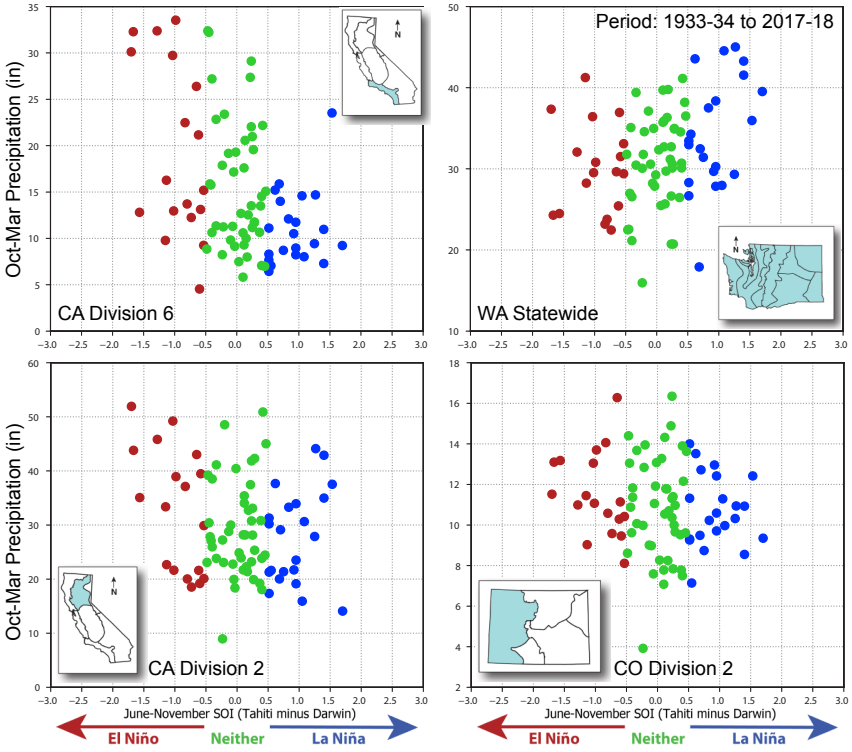

Fig. 4: Southern Oscillation Index (SOI, a measure of the atmospheric part of ENSO conditions) versus October-March precipitation. Even in places with a stronger relationship (e.g. CA division 6 and WA), there is a range of precipitation outcomes in any phase. More plots may be viewed at https://bit.ly/2RJVwwF.

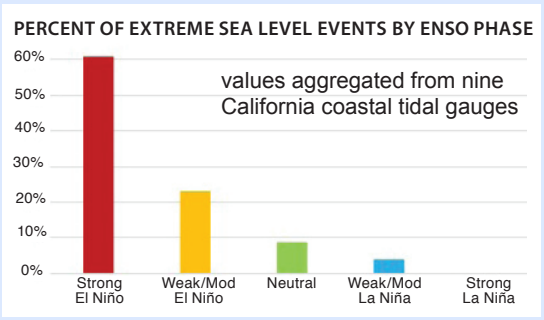

Fig. 5: Weak-to-moderate El Niño conditions, as forecasted for this winter, have historically been associated with roughly 22% of extreme (top 0.01% highest water) sea levels. Extreme sea levels favor coastal flooding during high tides and storm surges as well as increased coastal erosion.

For More Information

Climate.gov ENSO Blog: climate.gov/enso
WRCC ENSO Page: bit.ly/2T18Qy3
CPC ENSO Outlooks: bit.ly/1NU1faV
CW3E Seasonal Outlooks: bit.ly/2RONqTJ
IRI Seasonal Forecasts: bit.ly/2xl63WO
California-Nevada Applications Program: scripps.ucsd.edu/programs/cnap/

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