La Niña Impacts and Outlook

Western Region

December 2020

What is La Niña and how does it impact the West?

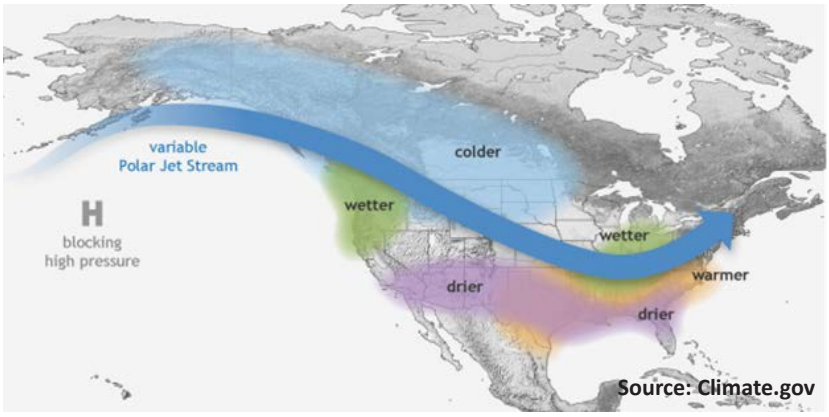

Fig. 1: Most common US wintertime impacts during La Niña. Currently, there are La Niña conditions present and those conditions are likely to persist through winter. While no two La Niña events are alike, there are some general tendencies that emerge. For instance, the polar jet stream is typically displaced farther north than usual. This pattern brings enhanced chances for below-normal precipitation to the southern tier of the Southwest and above-normal precipitation to the Pacific Northwest. Below-normal temperatures are also favored in the Pacific Northwest.

What is La Niña?

La Niña 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 a La Niña 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. La Niña is just one phase of what is termed the *El Niño-Southern Oscillation (ENSO)*, and is characterized by cooler than normal SSTs and decreased tropical thunderstorm activity in the central equatorial Pacific. The other phases are El Niño (warmer than normal SSTs) and Neutral.

What can La Niña teleconnections reveal about winter precipitation?

Even if La Niña conditions are present, the teleconnected effects on the western U.S. are not guaranteed. Every La Niña event has different characteristics – how cold the SST anomalies are, the location of the tropical Pacific thunderstorms, when and how the jet stream is deflected – resulting in a variable range 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 23 years with La Niña conditions. Of these, seven have been classified as strong, four 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 La Niña year can have western U.S. impacts that differ considerably from the average seen across all events.

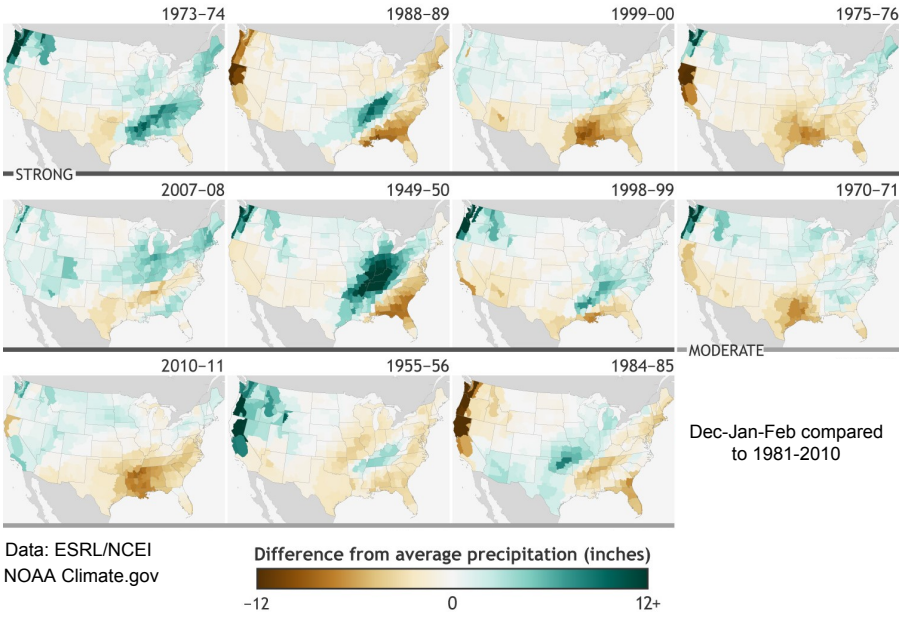

Fig. 2: December-January-February difference from average precipitation for the seven strong and four moderate La Niña events that have occurred since 1950. A moderate-to-strong La Niña is anticipated this winter.

Contacts: Dan McEvoy (mcevoyd@dri.edu)
Andrea Bair (andrea.bair@noaa.gov)

ENSO and Seasonal Prediction

Temperature Outlook

Precipitation Outlook

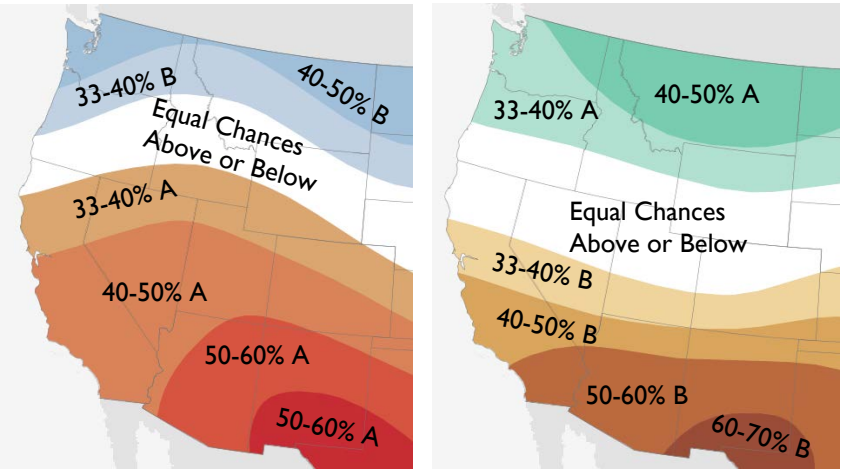

Fig. 3: Outlooks for Dec 2020-Feb 2021 indicate the most likely outcome for temperature or precipitation. A = Above Normal. B = Below Normal. Data: NWS Climate Prediction Center Nov. 2020; maps produced by Climate.gov.

While ENSO phase and strength tilt the odds of various cool season temperature and precipitation outcomes, many other factors contribute to western US winter weather variability and prediction. Sea ice, antecedent land surface conditions, and other ocean-atmosphere oscillations are all important factors.

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 on 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 ENSO 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

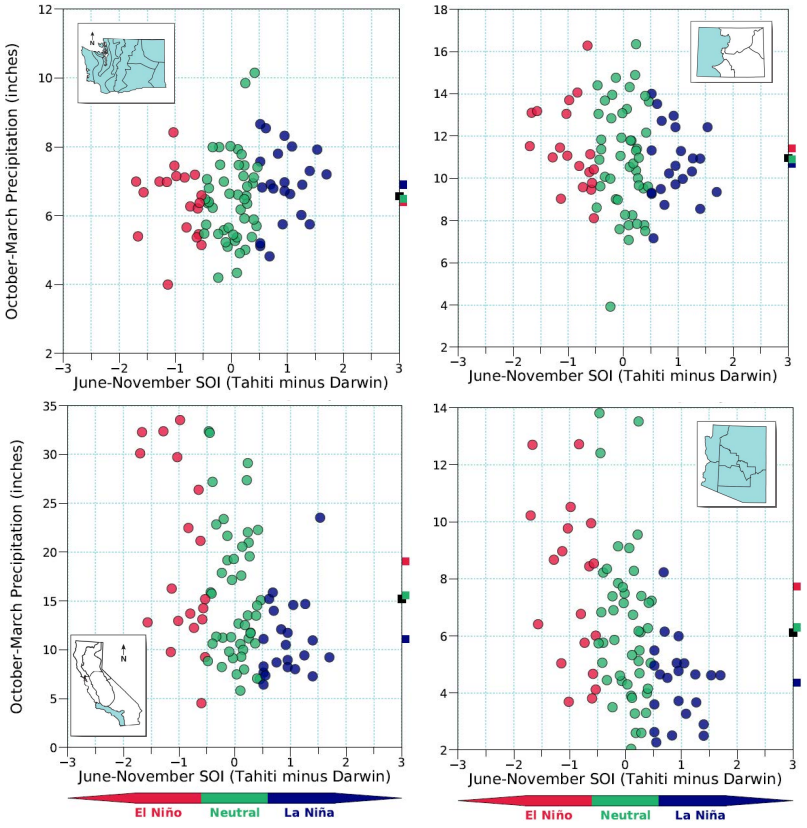

Fig. 4: Southern Oscillation Index (SOI, a measure of the atmospheric part of ENSO conditions) versus October-March precipitation for Washington, Western Colorado, South Coast California, and Arizona. https://wrcc.dri.edu/.

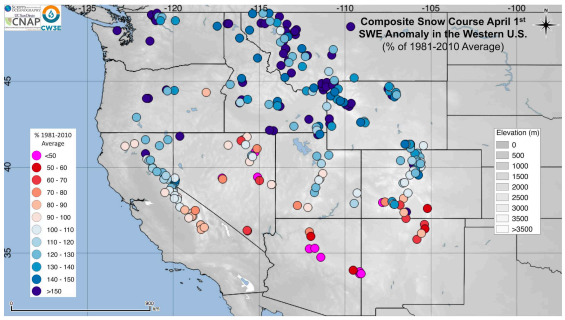

Fig. 5: Mean April 1 snow water equivalent percent of average based on moderate and strong La Niña years. Blues indicate more snowpack and reds less. Note that variability exists for each indivdiual La Niña years similar to precipitation in Figure 2. Data: NRCS Snow Survey.

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
Western Regional Climate Center: wrcc.dri.edu