El Niño: A focus on variability

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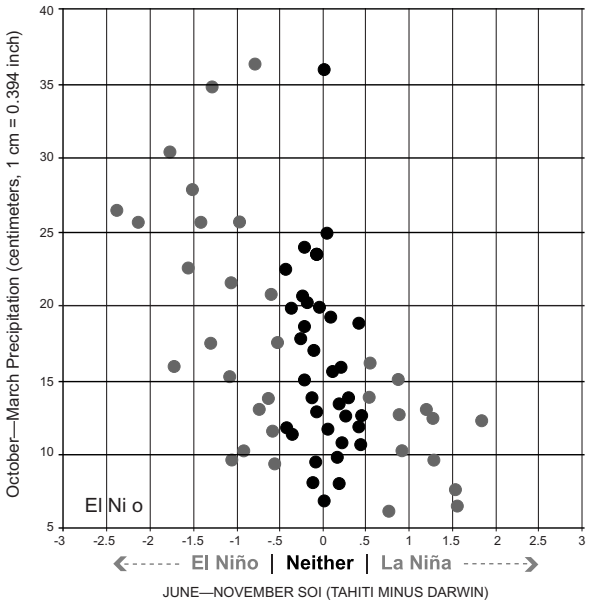
El Niño has a well-documented effect on precipitation fluctuations in the Southwest. Yet, like the snowflakes it helps bring to southwestern highlands, no two El Niños are identical. As a result, climatologists can use only a probability approach to describe expectations for a coming El Niño, even once they know that an event is almost certainly underway.

Scientists at NOAA's Climate Prediction Center could report with confidence on July 11 that an El Niño is developing, even though most of its impacts will not be felt until at least fall. In the Southwest, the probable end result is higher winter precipitation. But there's no guarantee. During the weak El Niño of 1969-70, for instance, total precipitation actually dropped below normal for much of Arizona and was no better than average throughout the Southwest.

A series of events in the tropical Pacific Ocean set the wheels of El Niño in motion. First, the usual westerly trade winds die down or even change direction, a phenomenon climatologists detect by comparing atmospheric pressure in Darwin, Australia, with that of Tahiti.

When the trade winds let up during an El Niño event, the warm surface waters of the western equatorial Pacific that typically pool east of Indonesia can expand into the eastern Pacific, butting up against the western coast of the Americas. Sea surface temperature measurements, then, allow scientists to detect reliably a pending El Niño months beforehand.

This sea change brings with it a variety of impacts, but the nature and intensity of those impacts can vary substantially from one El Niño event to another and from one place to another. In the Southwest, El Niño impacts often (but not always) produce more precipitation and lower temperatures during winter months, both of which can add up to increased soil moisture. It's good for plants, but from the human perspective, too much of a good thing can lead to damaging storms and floods.



Arizona statewide winter precipitation versus the Southern Oscillation Index (SOI) for 1933-1997. The SOI is a measure of El Niño-Southern Oscillation activity. The shade of the dots indicates whether conditions were classified as El Niño, La Niña, or neither. Note that the winters with the highest precipitation totals were nearly all El Niño years. La Niña winters are reliably dry and virtually never have above average precipitation. Southwest El Niño winters, however, display a great range of precipitation totals, from very low to the record high.

For instance, winter floods are more likely to occur during El Niño years. Snowpack from precipitation during an El Niño winter contributed to the January, 1993, flooding in the Tucson metropolitan area following a series of Pacific storms. Similarly, the spectacular October, 1983, flood in Tucson may have been indirectly related to the ongoing El Niño. Although most of the downpour again came from a tropical storm, the storm itself may have been driven deeper into Arizona by El Niño conditions, which have a strong influence on subtropical wind patterns.

During the El Niño years that occurred during the 1895-1996 period, December-March precipitation rates for Arizona's seven regional climate divisions averaged 170% of their 102-year mean, while the eight stations in New Mexico averaged 154% of their mean for the same period, according to information from NOAA's Climate Prediction Center.

In some ways El Niño's main effect is to increase the variability of precipitation, as shown in the illustration. To sum up, it seems El Niño provides no real safeguard against below-average precipitation. But if departures above the norm are going to occur, there will probably be an El Niño in the vicinity to take the credit—or the blame, as the case may be.