

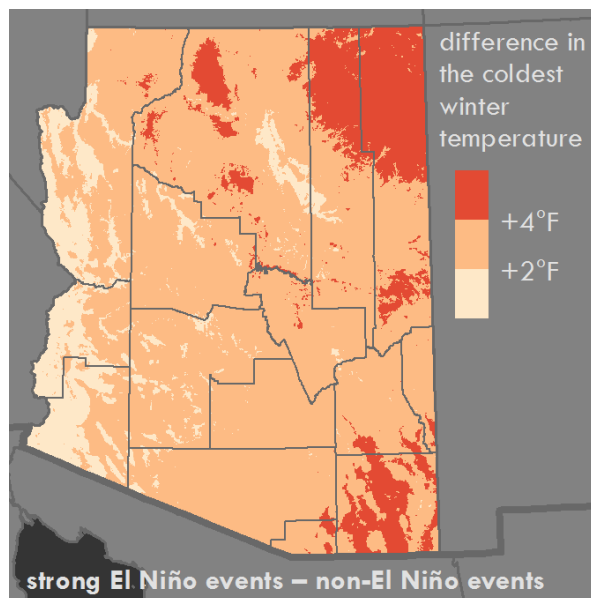
## El Niño 2015-2016 : Will It Affect Minimum Temperatures across Arizona?

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El Niño events increase the odds for cooler temperatures in Arizona, as the storm track shifts southward and potentially brings more storms to the region<sup>1,2</sup>. Such changes currently are reflected in seasonal temperature outlooks that show heightened chances for below-average temperatures in parts of the Southwest over the coming months<sup>3</sup>. What might these cooler temperatures mean for Arizona? Should we expect colder extreme minimum temperatures? Will we experience more nights with temperatures below freezing? In this third Extension Climate Fact Sheet about the 2015-2016 El Niño event, we address these issues and note their relevance to various activities in the state.

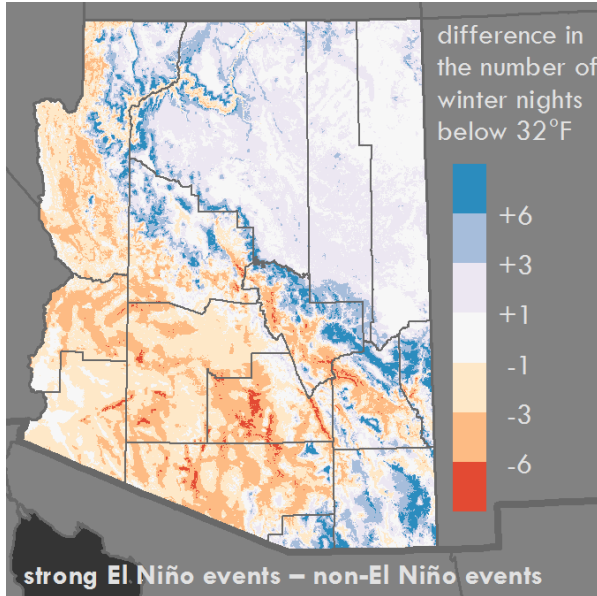
**Do strong El Niño events lead to colder extreme minimum temperatures?** Current forecasts are calling for the 2015-2016 El Niño event to reach a strength not seen since the winter of 1997-1998<sup>4,5</sup>. Between winters 1950-1951 and 2013-2014, seven such strong El Niño events occurred, whereas winters not influenced by an El Niño event happened 44 times<sup>6</sup>. A comparison between these two groups suggests that the coldest daily minimum temperature during December, January, and February is not as cold during strong El Niño events (Figure 1). As a result, we might expect this measure of minimum temperature during the coming months to be 2°F to 4°F warmer than most years across much of the state, with large areas in Coconino, Apache, Navajo, and Cochise counties more than 4°F warmer.



**Figure 1.** On average, the coldest daily minimum temperature from December through February during strong El Niño events is not as cold as the coldest daily minimum temperature during winters when there is no El Niño event<sup>7,8</sup>.

### Do strong El Niño events lead to more nights with temperatures below freezing?

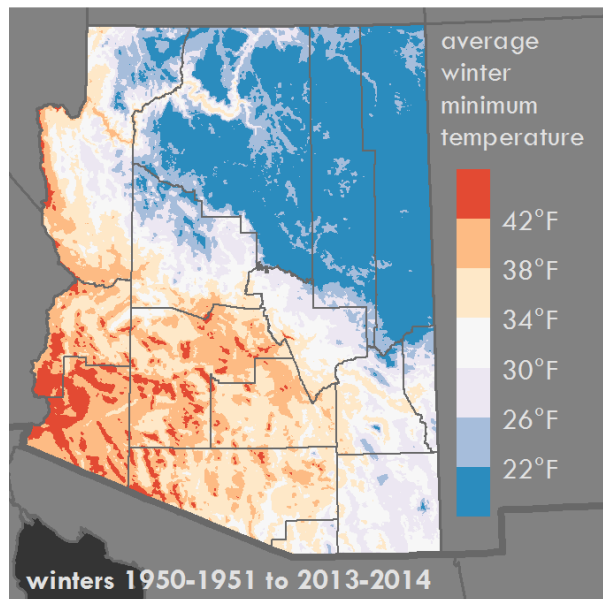
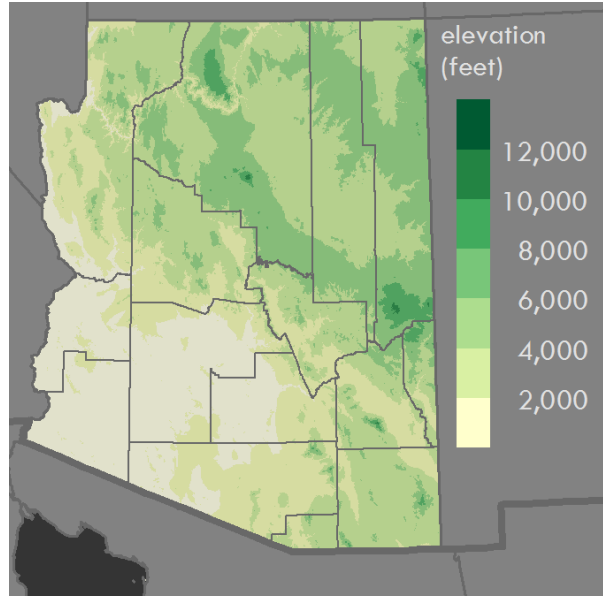
A comparison between these two groups also suggests that we might expect many areas of the state to experience a change this winter in the number of daily low temperatures below freezing. Such changes could be on the order of a few nights to a week or more (Figure 2). On average, a good part of southwestern Arizona had fewer daily minimum temperatures below 32°F during past strong El Niño events relative to winters with no El Niño event. In contrast, many areas in the far southeast corner of the state and a swath from Greenlee County to northern Mohave County recorded more daily minimum temperatures below 32°F. Most of northeastern Arizona experienced little to no change.



**Figure 2.** On average, many areas in Arizona appear to have a change in the number of daily low temperatures below freezing from December through February during strong El Niño events relative to winters when there is no El Niño event<sup>7,8</sup>. Blue colors indicate more daily minimum temperatures below 32°F during strong El Niño events, whereas orange colors indicate fewer.

**Why is there such a complex pattern of changes in the number of low temperatures below freezing?** The highly variable terrain in Arizona strongly influences minimum temperatures through a number of factors<sup>8</sup>. For example, higher elevations generally have cooler temperatures (Figure 3). Elevation in Arizona ranges from near sea level to over 12,000 feet across a landscape that includes mountains, valleys, and plateaus. About half of the state has an average minimum temperature during winter that is below freezing, with the other half above freezing. The combination of weather, climate, and complex terrain thus leads to a wide variation of minimum temperatures across the state.

Areas that had fewer daily minimum temperatures below 32°F during past strong El Niño events relative to non-El Niño years



**Figure 3.** In combination with a broad range of elevations across the state, weather and climate lead to a wide variation of average minimum temperatures during winter in Arizona<sup>7,8</sup>.

(Figure 2) are largely at lower elevations below 4,000 feet and have an average daily minimum temperature during all winters from 1950-1951 through 2013-2014 that is above freezing (Figure 3). In contrast, areas that recorded more daily low temperatures below



32°F during past strong El Niño events mostly are at middle elevations between 4,000 and 8,000 feet, and have an average low temperature during winter that is near freezing. Locations with little to no change in the number of nights below 32°F between past strong El Niño events and non-El Niño years are predominantly at elevations above 4,000 feet and have average winter low temperatures well below freezing.

### **How then can we interpret seasonal forecasts for cooler temperatures in Arizona?**

In the context of minimum temperatures during winter over Arizona, the potential for the 2015-2016 El Niño event to bring more storms to the region apparently does not correspond to colder extreme minimum temperatures. This is due at least in part to an increase in damp and cloudy weather that makes minimum temperatures warmer than on dry and cloudless nights, such as those that occurred over the state in late November and early December. A series of dry and cold storms moving through the region in early December also led to these latter conditions. For the remainder of this winter, the current El Niño event should increase the occurrence of wet weather and reduce the number of dry and cloudless nights.

The potential for more storms this winter does, however, appear to correspond to more nights below 32°F for areas in the state where the average low temperature during winter is near freezing, as storms during this part of the year nonetheless steer cooler air into the region. It also appears to represent fewer night-time freezing temperatures during winter for areas where average daily low temperatures are well above freezing, such as in the deserts of southwestern Arizona. In these areas, daily minimum

temperatures below 32°F are tied to extreme cold events, which occur less often during strong El Niño events. For areas with average winter minimum temperatures well below freezing, such as on the Colorado Plateau in northeastern Arizona, the potential increase in the number of storms traversing the region in the coming months does not appear to change the frequency of night-time temperatures below 32°F, which typically occur for most if not all nights from December through February.

Seasonal forecasts for cooler temperatures in the Southwest this winter thus reflect expectations for the 2015-2016 El Niño event to lead to an increase in damp and cloudy weather that lowers daily high temperatures, but also keeps minimum temperatures warmer than what they otherwise would be on dry and cloudless nights.

**What could be some of the related relevant impacts in Arizona?** Minimum temperatures during winter – particularly those below 32°F or related to extreme cold – are important across Arizona for several activities, including those in agriculture, ecosystem management, urban horticulture, and water resources. For instance, warmer extreme minimum temperatures over the coming months could benefit those growing cold-sensitive ornamental plants or crops such as citrus and lettuce during this part of the year. On the other hand, it could end up indirectly harming both cultivated and natural vegetation by allowing disease and pests to survive the winter. A greater frequency of daily minimum temperatures below freezing could affect whether precipitation falls as rain or snow over middle elevations in the state between 4,000 and 8,000 feet.



**How can I get more information?** In addition to periodic Extension Climate Fact Sheets like this one, climate specialists and scientists of Cooperative Extension are working with the Climate Assessment for the Southwest (CLIMAS) to produce a full suite of information related to the 2015-2016 El Niño event ([www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation](http://www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation)). Please contact us for further information, data, and analysis that could be applied to stakeholder needs in your county.

## References

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