COLLEGE OF AGRICULTURE & LIFE SCIENCES
Cooperative Extension

El Niño 2015-2016 : Will It Influence Tropical Cyclones that Affect Arizona?

Jeremy Weiss, Michael Crimmins, Gregg Garfin, Paul Brown
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Arizona is not immune to tropical cyclones. Although most such storms that form off of the western and southern coasts of Mexico move westward to open waters, some of them travel towards the north and bring considerable precipitation to the Southwest. In fact, tropical cyclones originating in the eastern north Pacific Ocean have led to significant flooding events in the state[1]. Does an El Niño event influence the ability of these storms to form and later affect Arizona weather? If so, what might be some relevant related hazards or favorable circumstances? In this second Extension Climate Fact Sheet about the 2015-2016 El Niño event, we address these questions and note how current conditions in the Pacific Ocean could be changing the odds that tropical cyclones bring moisture to the state.

How do tropical cyclones affect Arizona?

Tropical cyclones form over warm tropical waters and have an organized circulation with bands of showers and thunderstorms accompanied by strong winds[2]. Depending on the relative strength of the storm and its wind speed, tropical cyclones are classified as tropical disturbances, tropical depressions, tropical storms, or hurricanes. More often than not, only remnants of tropical cyclones make it to Arizona, steered into the region by winds in upper levels of the atmosphere. This is most likely to occur in September and October, even though tropical cyclones develop in the eastern north Pacific Ocean from May through November[3]. On average, three tropical cyclones or their remnants affect Arizona each year, providing cloud cover and precipitation.

How does an El Niño event influence tropical cyclones in the eastern north Pacific Ocean?

During an El Niño event, there is less vertical wind shear, or fewer changes in wind direction, in the atmosphere above the eastern north Pacific Ocean that allows for more tropical cyclones to form[4]. This is sometimes accompanied by warmer-than-average water in the region that further fuels tropical cyclones. Both of these conditions contribute to greater odds of tropical cyclone activity during El Niño events than in other years (Figure 1).

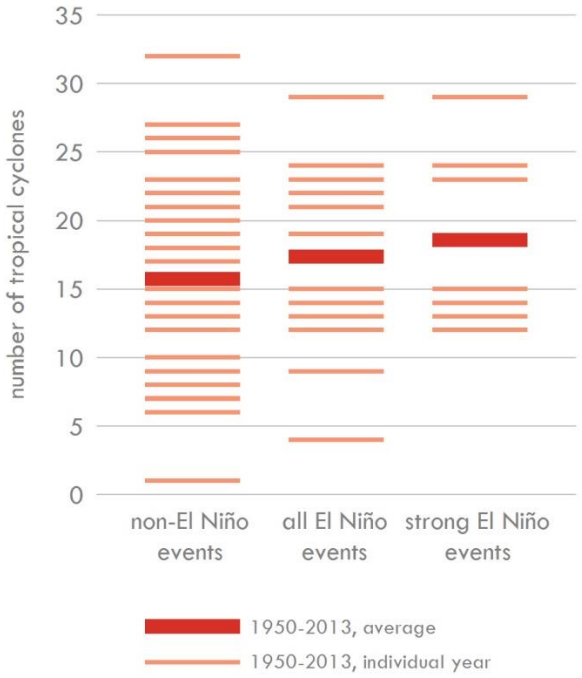

Figure 1. The number of tropical cyclones in the eastern north Pacific Ocean during September and October is more likely to be higher during El Niño events[5].

In order to make this information available to Arizona counties as quickly as possible, we are publishing this Extension Climate Fact Sheet only with review by University of Arizona faculty.

Do current conditions in the Pacific Ocean further raise the odds for tropical cyclones?

Current forecasts are calling for the 2015-2016 El Niño event to reach a strength not seen since the winter of 1997-1998 when one of the strongest El Niño events on record occurred[6,7]. Since 1950, more tropical cyclones tend to occur on average in the eastern north Pacific Ocean during strong El Niño events (Figure 1). Also, record-warm water has been present this year in this ocean basin, helping to make for a very active tropical cyclone season[8].

What could be some of the related relevant impacts in Arizona?

Although the influence of strong El Niño events on the number of tropical cyclones or their remnants affecting Arizona is not clear, there is no doubt that these storms can impact the state. For example, remnants of hurricane Nora affected western Arizona in September 1997 with record rainfall and strong winds that lead to flooding and power outages[9]. Impacts on agriculture alone possibly surpassed $100 million. Most recently, remnants of tropical depression 16-E crossed southeastern Arizona on September 21, 2015, delivering heavy rainfall and flash flooding. When not causing floods, precipitation from tropical cyclones can benefit the state by improving drought conditions. In June of this year, for instance, moisture from hurricanes Blanca and Carlos contributed to rainfall in several parts of the state during a month that is typically dry. Despite the importance, anticipating such impacts remains challenging as forecasting local rain amounts and wind speeds from tropical cyclones is difficult, particularly with storms that make landfall.

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). Please contact us for further information, data, and analysis that could be applied to stakeholder needs in your county.

References

[1] www.wrh.noaa.gov/psr/tropics/hurricanes.htm
[2] Geer IW (1996) Glossary of Weather and Climate with Related Oceanic and Hydrologic Terms. American Meteorological Society, Boston MA, 272pp
[3] Ritchie EA, Wood KM, Gutzler DS, White SR (2011) The influence of eastern Pacific tropical cyclone remnants on the southwestern United States. *Monthly Weather Review*, 139, 192-210
[4] www.elnino.noaa.gov/index.html
[5] tropical cyclone track data are from www.ncdc.noaa.gov/ibtracs
[6] iri.columbia.edu/our-expertise/climate/forecasts/enso/current/
[7] www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html
[8] www.ncdc.noaa.gov/sotc/global/201508
[9] www.nhc.noaa.gov/1997nora.html

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Authors
Jeremy Weiss, Climate and Geospatial Extension Scientist
School of Natural Resources and the Environment, University of Arizona
520-626-8063, jlweiss@email.arizona.edu

Michael Crimmins, Climate Science Extension Specialist
Department of Soil, Water, and Environmental Science, University of Arizona
520-626-4244, crimmins@email.arizona.edu

Gregg Garfin, Climate Science, Policy, and Natural Resources Extension Specialist
School of Natural Resources and the Environment, University of Arizona
520-626-4372, gmgarfin@email.arizona.edu

Paul Brown, Biometeorology Extension Specialist
Department of Soil, Water, and Environmental Science, University of Arizona
520-621-1319, pbrown@ag.arizona.edu

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