

Future impacts of El Niño, La Niña likely to intensify

September 12 2018



During the July 2011 La Niña, a boat sits on dry land in a branch of Lake Travis in Texas. Credit: Erik A. Ellison, Wikimedia Commons

When an El Niño or its opposite, La Niña, forms in the future, it's likely to cause more intense impacts over many land regions—amplifying changes to temperature, precipitation and wildfire risk.

These are the findings of a new study funded by the National Science Foundation (NSF) and the U.S. Department of Energy and published in *Geophysical Research Letters*, a journal of the American Geophysical Union.

The researchers found, for example, that the increased wildfire danger in

the Southwest United States associated with La Niña events would become more acute.

Conversely, cooler and wetter weather in the same region, when associated with El Niño events, would likely become even cooler and even wetter in the future, enhancing flood risks.

"The cycling between El Niño and La Niña is responsible for some of the weather whiplash we get from year to year, particularly in the Western U.S.," said National Center for Atmospheric Research (NCAR) scientist John Fasullo, who led the study. "What we find when we look at model simulations of the future is that the whiplash is likely to get more severe."

NCAR, which is funded by NSF, is a research and development center in Boulder, Colorado, whose mission is to study the behavior of Earth's atmosphere and the geospace system. Study co-authors include Bette Otto-Bliesner, also of NCAR, and Samantha Stevenson of the University of California, Santa Barbara.



A result of projected changes in the El Niño-La Niña pattern, wildfire risk may increase. Credit: USGS

"These simulations show that the continuous rising of global mean temperature will leave regions of the U.S., including California, more vulnerable to severe droughts and widespread wildfires in the future, especially during La Niña years," said Ming Cai, a program officer in NSF's Division of Atmospheric and Geospace Sciences.

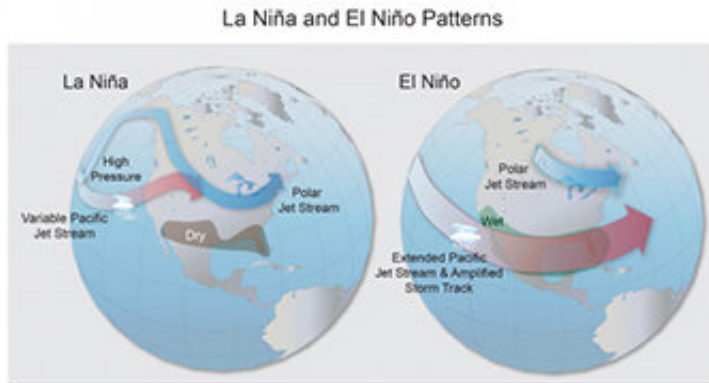
El Niño events are characterized by warmer-than-average sea surface temperatures in the eastern tropical Pacific Ocean. La Niña events, on the other hand, are defined by cooler-than-average waters in the same region.

The phenomena can influence weather patterns globally, with far-reaching consequences, including changes to crop yields, fire risk and the heating and cooling demands of homes, workplaces and other buildings.

The impacts of El Niño and La Niña are particularly pronounced over North America's southern tier, South America and Australia. El Niño tends to cause cooler, wetter weather over the southern U.S., but hotter, drier weather across most of Australia and South America.

Climate model simulations have been divided in their portrayal of how climate change will influence the sea surface temperature changes of El Niño and La Niña. For this study, the scientists were able to remove that effect and look at what the impact of these individual events would be.

The research team relied on two extensive sets of simulations, one created using the NCAR-based Community Earth System Model (CESM) and one created using the Geophysical Fluid Dynamics Laboratory Earth System Model.



El Niño and La Niña "alternate," but both have effects on extreme events such as flooding and fires. Credit: USGCRP

Each model was run dozens of times with slightly different starting conditions. Taken together, the large number of model simulations allowed the scientists to distinguish effects linked with El Niño and La Niña.

The scientists looked at how current impacts tied to, for example, a 1-degree Celsius sea surface temperature increase during an El Niño or similar decrease during La Niña, compared to the effects of that same variation at the end of this century.

In addition to temperature and precipitation, the researchers looked at changes in wildfire risk. This component took into account the biomass (area of trees and other vegetation) available for burning, along with the influences of temperature and moisture.

The result was that these impacts became more severe in several land regions.

For example, seasonal heat extremes in the southern half of the U.S. during a La Niña like the one that occurred in 2011 would be about 30 percent greater if they occurred at the end of the century.

"We can't say from this study whether more or fewer El Niños will form in the future, or whether the El Niños that do form will be stronger or weaker," Fasullo said. "But we can say that an El Niño that forms in the future is likely to have more influence over our weather than if the same El Niño formed today."

Provided by National Science Foundation

Citation: Future impacts of El Nino, La Nina likely to intensify (2018, September 12) retrieved 18 April 2024 from <https://phys.org/news/2018-09-future-impacts-el-nino-la.html>

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