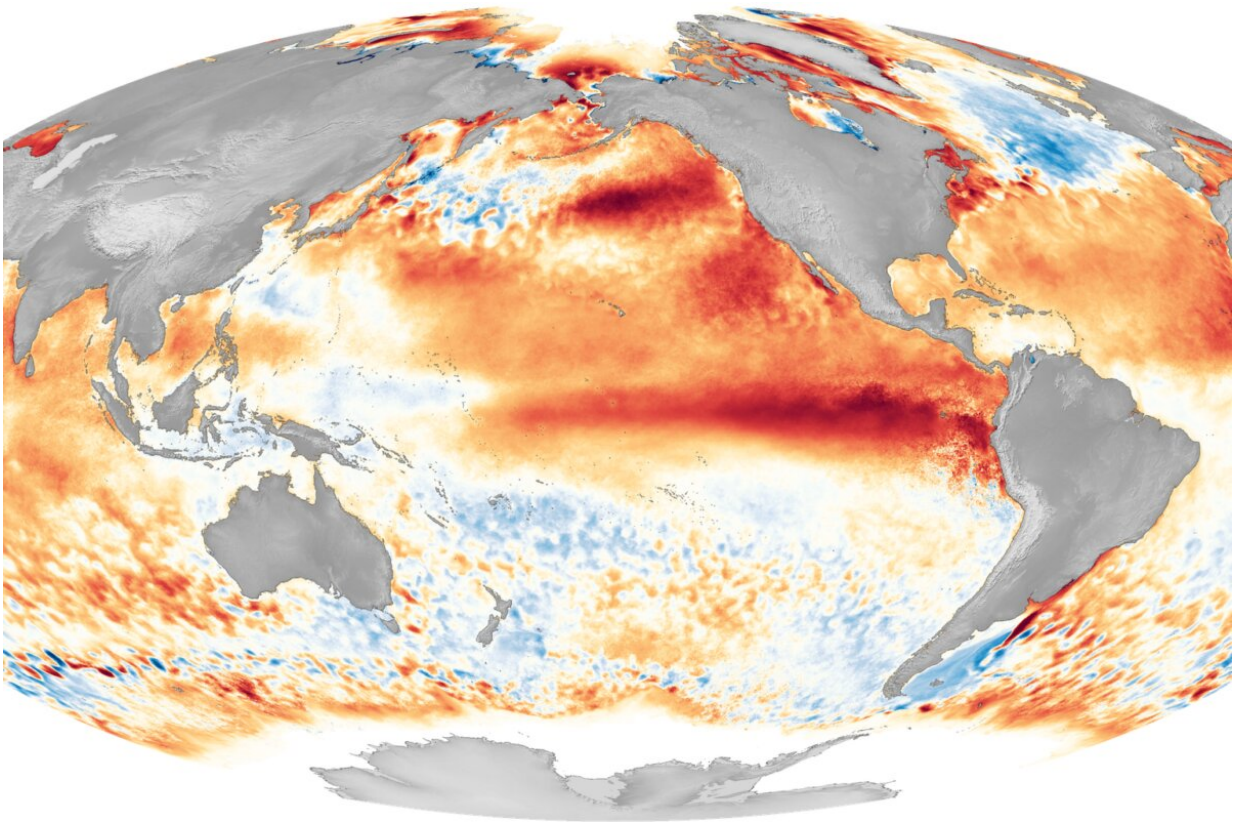# Ancient El Niños reveals limits to future climate projections

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A map of the strongest El Niño on record in 2016, showing sea surface temperature. Red is higher and blue lower than normal. Credit: NOAA.

The climate pattern El Niño varies over time to such a degree that scientists will have difficulty detecting signs that it is getting stronger

with global warming.

That's the conclusion of a study led by scientists at The University of Texas at Austin that analyzed 9,000 years of Earth's history. The scientists drew on climate data contained within ancient corals and used one of the world's most powerful supercomputers to conduct their research.

The study of the past, which was recently published in *Science Advances*, was motivated by the need to get a clearer picture of how climate change may affect El Niño in the future.

El Niño is the warm phase of the El Niño Southern Oscillation, a climate phenomenon that sets the stage every few years for weather patterns worldwide. Strong El Niño events, such as the ones in 1997 and 2015 that brought wildfires to the rainforests of Borneo in Asia and caused widespread bleaching to the world's coral reefs, happened about once a decade.

Computer models, however, are unclear about whether El Niño events will become weaker or stronger as the world warms due to climate change.

"Much of the world's temperature and rainfall are influenced by what happens in the tropical Pacific Ocean where El Niño starts," said the study's lead author, Allison Lawman, who began the research as a Ph.D. project at the UT Jackson School of Geosciences and is now a postdoctoral researcher at the University of Colorado Boulder. "The difference in rainfall between greater or fewer strong El Niño events is going to be a critical question for infrastructure and resource planners."
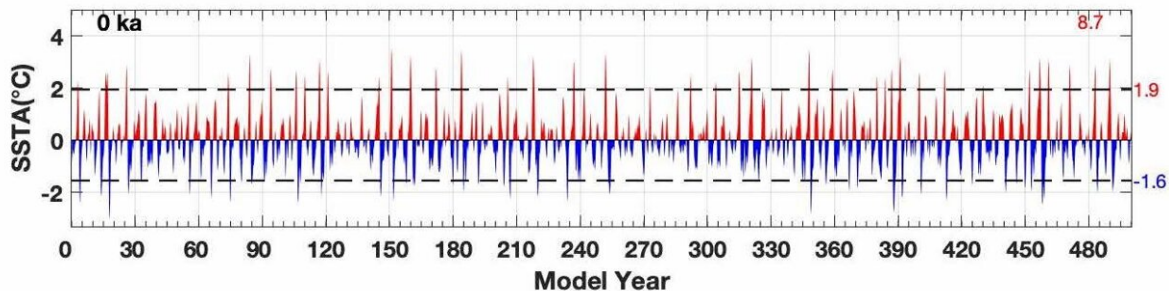
A 500-year simulation of El Niño intensity from the study period. Although the data appears chaotic, finding how these patterns change during periods of past climate change could hold the key to future climate projections, according to climate researchers at University of Texas Institute for Geophysics. Credit: Allison Lawman

Lawman and her collaborators used the Lonestar5 supercomputer at UT's Texas Advanced Computing Center to run a series of climate simulations of a period in Earth's history before human influences, when the main source of climate change came from a tilt in the planet's orbit. The simulations were verified using a coral emulator Lawman had previously developed to compare them with climate records from ancient corals.

They found that although the occurrence of strong El Niño events intensified over time, the change was small compared with El Niño's highly variable nature.

"It's like trying to listen to soft music next to a jackhammer," said study co-author Jud Partin, a research scientist at the University of Texas Institute for Geophysics.

To achieve this, Partin, Lawman and the study's other authors call for

further investigations into even earlier times in Earth's history, such as the last ice age, to see how El Niño responded to more intense changes in climate forces.

"Scientists need to keep pushing the limits of models and look at geological intervals deeper in time that could offer clues on how sensitive El Niño is to changes in climate," said co-author Pedro DiNezio, an associate professor at University of Colorado Boulder. "Because if there's another big El Niño, it's going to be very hard to attribute it to a warming climate or to El Niño's own internal variations."

Provided by University of Texas at Austin