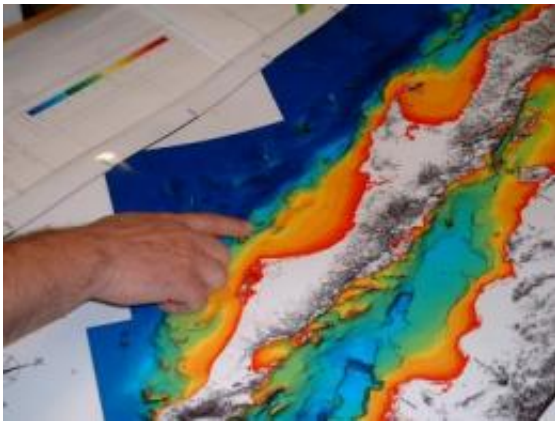


# Research provides better understanding of long-term changes in the climate system

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A researcher points in the vicinity of Soledad Basin on a high-resolution bathymetric map off the coast of Baja California. Credit: Photo courtesy of Dr. Joseph Ortiz/Kent State University

For more than a decade, Dr. Joseph Ortiz, associate professor of geology at Kent State University and part of an international team of National Science Foundation (NSF)-funded researchers, has been studying long-term climate variability associated with El Niño. The researchers' goal is to help climatologists better understand this global climate phenomenon that happens every two to eight years, impacting much of the world.

El Niño is the periodic warming of central and eastern tropical Pacific waters. The last El Niño occurred in 2009, Ortiz said, and its impact was felt in the United States with flooding in the south and wildfires in

California. The research team looked at El Niño-Southern Oscillation (which is often just called "El Niño"), reconstructing sea surface temperature of the equatorial Pacific over the past 14,000 years.

"If we understand how El Niño changes over thousands of years, we can better predict climate changes on societal time-scales of years to decades," Ortiz explained. "El Niño variations lead to drought, famine, landslides, fires and other natural disasters, depending on where in the world you happen to be. Our findings can help lead to better ways to predict El Niño-Southern Oscillations, mitigating the natural disasters associated with it."

In addition to Ortiz, the research team includes the lead author on the paper, Thomas Marchitto (University of Colorado); Raimund Muscheler (Lund University in Sweden); Jose Carriquiry (Universidad Autónoma de Baja California, Ensenada in Mexico); and Alexander van Geen (Lamont-Doherty Earth Observatory of Columbia University).

Their findings will appear in the Dec. 3 issue of *Science*. Their paper, "Dynamical Response of the Tropical Pacific Ocean to Solar Forcing During the Early Holocene," helps to establish the linkage between changes in solar intensity and the strength of El Niño on millennial time scales. Their work was funded by the Marine [Geology](#) Subdivision of the National Science Foundation's Ocean Sciences Division.

"The climate system is very sensitive to subtle external forcing," Ortiz said. "We determined that the sun has an impact but is not the sole factor driving changes on these millennial time scales. Other studies have tried to show a solar linkage to El Niño-related [climate variability](#), but our study indicates a convincing linkage due to the continuity of our record. This paper confirms the 'ocean dynamical thermostat' theory, showing that solar-forced changes in ocean circulation have an impact on El Niño."



Scientists on the Marion Dufresne process core that has been recovered from off the coast of Baja California. Credit: Photo courtesy of Dr. Joseph Ortiz/Kent State University

Ortiz began working with the international team of scientists when he was a post-doctoral scientist at Lamont-Doherty Earth Observatory, a research branch of Columbia University. Over the last 11 years, his contributions to the team include assisting with measurements and in the statistical analysis of the data sets. As a researcher in the Kent State geology department, Ortiz has involved Kent State graduates and undergraduates in his NSF-funded research, providing his students with real-world experience on an international level. His students have participated in research projects as close to home as here in Ohio, and as far away as the South Pacific, North Atlantic, Arctic, Pacific Northwest, and off Baja California.

"With my involvement in this project, Kent State geology students have studied core samples collected off of Baja California," Ortiz said. "The

students can take what they learn in the classroom out into the field and back to the lab. I feel very fortunate to be able to provide our students with this type of experience and bring international-level research to Kent State."

Provided by Kent State University

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