A cooler Pacific may have severely affected medieval Europe, North America

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In the time before Columbus sailed the ocean blue, a cooler central Pacific Ocean has been connected with drought conditions in Europe and North America that may be responsible for famines and the disappearance of cliff dwelling people in the American West.

A new study from the University of Miami (UM) has found a connection between La Niña-like sea surface temperatures in the central Pacific and droughts in western Europe and in what later became the southwestern United States and Mexico, as published in a recent issue of Geophysical Research Letters.

"We've known for some time the connection between El Niño and La Niña and the weather conditions in North America and Europe," said Robert Burgman, a climate scientist at UM's Rosenstiel School of Marine & Atmospheric Science. "La Niña-like conditions, such as those we found, can cause persistent drought, and as we know warm conditions cause increased precipitation."

Using cores of fossil coral from the Palmyra Atoll in the central Pacific Ocean, Burgman and a team used reconstructed sea surface temperatures from the period 1320 to 1462 to simulate medieval climate conditions with a state-of-the-art climate model. When the differences between medieval and modern climate simulations were compared with paleo-records like tree-rings and sediment cores from around the globe, the authors found remarkable agreement.

During the 142-year study period, the sea surface temperature dropped only one-tenth of one degree, but it was enough to cause arid conditions in North America and Europe.

The Anastazi people—who lived in dramatic cliff dwellings near what later became known as the "Four Corners" area at the intersection of the state of Utah, Colorado, New Mexico, and Arizona—left their settlements at Mesa Verde and other locations some 600 years ago without explanation. A prolonged drought is thought to be one of the contributing factors to their departure.

In Europe, the study period was preceded by three years of torrential rains, which led to the Great Famine from 1315 to 1320, and marked the transition from the Medieval Warm Period to the Little Ice Age, which began in the mid 1500s. During that time, extreme weather conditions were thought to be responsible for continued localized crop failures and famines throughout Europe during the remainder of the 14th Century.

"The marriage of complex climate models with paleo-records of sea surface temperature and other climate variables provide valuable insight to climate scientists who wish to understand climate variability and change before the instrumental record," said Burgman.

Warning that the Palmyra Atoll data only represents one data point, Burgman emphasized that he would like to test his thesis with data from other oceans. "If we can fill in the gaps with data from corals and other records from the Atlantic, Pacific, and Indian oceans, we'll have a better idea of what has happened to the global climate over time," he added.

In the study, Burgman and his colleagues used the reconstructed tropical Pacific sea surface temperatures to create a 16-member ensemble of atmospheric general circulation model (ACGM) simulations, coupled with a one-layer ocean model outside of the tropical Pacific. When the

ACGM simulations were compared with the modern climate simulations, they were able to reproduce many aspects of the medieval climate found in observational records for much of the Western Hemisphere, northern Eurasia, and the northern tropics. These results suggest that many features of global medieval hydroclimate changes can be explained by tropical Pacific sea surface temperatures.

Provided by University of Miami