Getting warmer? Prehistoric climate can help forecast future changes

November 24 2008

The first comprehensive reconstruction of an extreme warm period shows the sensitivity of the climate system to changes in carbon dioxide (CO_2) levels as well as the strong influence of ocean temperatures, heat transport from equatorial regions, and greenhouse gases on Earth's temperature.

New data allow for more accurate predictions of future climate and improved understanding of today's warming. Past warm periods provide real data on climate change and are natural laboratories for understanding the global climate system.

Scientists examined fossils from 3.3 to 3.0 million years ago, known as the mid-Pliocene warm period. Research was conducted by the Pliocene Research, Interpretation and Synoptic Mapping (PRISM) group, led by the U.S. Geological Survey.

"PRISM's research provides objective, unbiased data for climate modelers to better understand the environment in which we live and for decision makers to make informed adaptation and mitigation strategies that yield the greatest benefits to society and the environment," said Senior Advisor to USGS Global Change Programs Thomas Armstrong. "This is the most comprehensive global reconstruction for any warm period and emphasizes the importance of examining the past state of Earth's climate system to understand the future."

The mid-Pliocene experienced the most extreme warming over the past

3.3 million years. Global average temperatures were 2.5°C (4.5°F) greater than today and within the range projected for the 21st century by the Intergovernmental Panel on Climate Change.

"Exploring the mid-Pliocene will further understanding on the role of ocean circulation in a warming world, the impacts of altered storm tracks, polar versus tropical sensitivity, and the impacts of altered atmospheric CO_2 and oceanic energy transport systems," said USGS scientist Harry Dowsett, also lead scientist for PRISM. "We used fossils dated to the mid-Pliocene to reconstruct sea surface and deepwater ocean temperatures, and will continue research by studying specific geographic areas, vegetation, sea ice extent and other environmental characteristics during the Pliocene."

Since CO_2 levels during the mid-Pliocene were only slightly higher than today's levels, PRISM research suggests that a slight increase in our current CO_2 level could have a large impact on temperature change. Research also shows warming of as much as 18°C, bringing temperatures from -2°C to 16°C, in the high latitudes of the North Atlantic and Arctic Oceans during the mid-Pliocene. Warming in the Pacific, similar to a present day El Niño, was a characteristic of the mid-Pliocene. Global sea surface and deep water temperatures were found to be warmer than those of today, impacting the ocean's circulation system and climate. Data suggest the likely cause of mid-Pliocene warmth was a combination of several factors, including increased heat transport from equatorial regions to the poles and increased greenhouse gases.

PRISM has been chosen by the Pliocene Model Intercomparison Project of Paleoclimate Modelling Intercomparison Project Phase II as the dataset against which to run and test the performance of climate models for the Pliocene.

Source: United States Geological Survey