

# Global temps highest in 4,000 years

By Justin Gillis, New York Times

Global temperatures are warmer than at any time in at least 4,000 years, scientists reported Thursday, and over the coming decades are likely to surpass levels not seen on the planet since before the last ice age.

Previous research had extended back roughly 1,500 years, and suggested that the rapid temperature spike of the past century, believed to be a consequence of human activity, exceeded any warming episode during those years. The new work confirms that result while suggesting the modern warming is unique over a longer period.



Lake Tahoe has had record highs this winter. Photo/LTN file

Even if the temperature increase from human activity that is projected for later this century comes out on the low end of estimates, scientists said, the planet will be at least as warm as it was during the warmest periods of the modern geological era, known as the Holocene, and probably warmer than that.

That epoch began about 12,000 years ago, after changes in incoming sunshine caused vast ice sheets to melt across the Northern Hemisphere. Scientists believe the moderate climate of the Holocene set the stage for the rise of human civilization roughly 8,000 years ago and continues to sustain it by, for example, permitting a high level of food production.

In the new research, scheduled for publication on Friday in the journal *Science*, Shaun Marcott, an earth scientist at Oregon State University, and his colleagues compiled the most meticulous reconstruction yet of global temperatures over the past 11,300 years, virtually the entire Holocene. They used indicators like the distribution of microscopic, temperature-sensitive ocean creatures to determine past climate.

Like previous such efforts, the method gives only an approximation. Michael E. Mann, a researcher at Pennsylvania State University who is an expert in the relevant techniques but was not involved in the new research, said the authors had made conservative data choices in their analysis.

“It’s another important achievement and significant result as we continue to refine our knowledge and understanding of climate change,” Mann said.

Though the paper is the most complete reconstruction of global temperature, it is roughly consistent with previous work on a regional scale. It suggests that changes in the amount and distribution of incoming sunlight, caused by wobbles in the earth’s orbit, contributed to a sharp temperature rise in the early Holocene.

The climate then stabilized at relatively warm temperatures about 10,000 years ago, hitting a plateau that lasted for roughly 5,000 years, the paper shows. After that, shifts of incoming sunshine prompted a long, slow cooling trend.

The cooling was interrupted, at least in the Northern

Hemisphere, by a fairly brief spike during the Middle Ages, known as the Medieval Warm Period. (It was then that the Vikings settled Greenland, dying out there when the climate cooled again.)

Scientists say that if natural factors were still governing the climate, the Northern Hemisphere would probably be destined to freeze over again in several thousand years. "We were on this downward slope, presumably going back toward another ice age," Marcott said.

Instead, scientists believe the enormous increase in greenhouse gases caused by industrialization will almost certainly prevent that.

During the long climatic plateau of the early Holocene, global temperatures were roughly the same as those of today, at least within the uncertainty of the estimates, the new paper shows. This is consistent with a large body of past research focused on the Northern Hemisphere, which showed a distribution of ice and vegetation suggestive of a relatively warm climate.

The modern rise that has recreated the temperatures of 5,000 years ago is occurring at an exceedingly rapid clip on a geological time scale, appearing in graphs in the new paper as a sharp vertical spike. If the rise continues apace, early Holocene temperatures are likely to be surpassed within this century, Marcott said.

Mann pointed out that the early Holocene temperature increase was almost certainly slow, giving plants and creatures time to adjust. But he said the modern spike would probably threaten the survival of many species, in addition to putting severe stresses on human civilization.

"We and other living things can adapt to slower changes," Mann said. "It's the unprecedented speed with which we're changing the climate that is so worrisome."