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THE *Current*

October 13, 2005

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Link Between Tropical Warming and Greenhouse Gases Stronger Than Ever, Say Scientists

New evidence from climate records of the past provides some of the strongest indications yet of a direct link between tropical warmth and higher greenhouse gas levels, say scientists at the University of California, Santa Barbara. The present steady rise in tropical temperatures due to global warming will have a major impact on global climate and could intensify destructive hurricanes like Katrina and Rita.

The new evidence linking past tropical ocean temperatures to levels of atmospheric greenhouse gases is published in this week's Science Express, the on-line publication of the journal Science. The authors are Martin Medina-Elizalde, graduate student in the Department of Earth Science and the Interdepartmental Program in Marine Science at UC Santa Barbara, and David Lea, professor in UCSB's Department of Earth Science and the Marine Science Institute.

The link between increased atmospheric greenhouse gas and global temperatures underlies the theory of global warming, explained the authors. This link can be established by computer climate models or modern observations. Another way to study the link is through paleoclimate observations where past climate is reconstructed through natural archives. This latest study is based on such paleoclimate observations; the scientists analyzed the chemical composition of fossil plankton shells from a deep sea core in the equatorial Pacific.

"The relationship between tropical climate and greenhouse gases is particularly critical because tropical regions receive the highest proportion of solar output and act as a heat engine for the rest of the earth," said Lea.

Modern observations of tropical sea surface temperature indicate a rise of one to two degrees Fahrenheit over the last 50 years, a trend consistent with rising carbon dioxide in the atmosphere due to fossil fuel combustion, according to the authors. The paleoclimate evidence from this new study supports the attribution of the tropical temperature trend to the ever-increasing greenhouse gas burden in the atmosphere.

The research described in this week's article demonstrates that over the last 1.3 million years, sea surface temperatures in the heart of the western tropical Pacific were controlled by the waxing and waning of the atmospheric greenhouse effect. The largest climate mode shift over this time interval, occurring ~950,000 years before the present (the mid-Pleistocene transition), has previously been attributed to changes in the pattern and frequency of ice sheets.

The new research suggests instead that this shift is due to a change in the oscillation frequency of atmospheric carbon dioxide abundances, a hypothesis that can be directly tested by deep drilling on the Antarctic Ice Cap. If proved correct, this theory would suggest that relatively small, naturally occurring fluctuations in greenhouse gases are the master variable that has driven global climate change on time scales of ten thousand to one million years.

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† About the Illustration

This live plankton, called foraminifera, can indicate ocean temperature through analysis of its chemical composition. The paleoclimate observations in the Science Express paper come from analysis of foraminifera fossils, from a deep sea core in the equatorial Pacific. Photo credit: H. Spero, UC Davis and D. Lea, UC Santa Barbara.

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