

## **New View of Data Supports Human Link to Global Warming**

By Andrew C. Revkin

The New York Times – Science Times

Tuesday 18 November 2003

One of the last gaps in the evidence pointing to a human cause for global warming appears to be closing.

A re-examination of 24 years of data from weather satellites has found that temperatures are rising in the lower layer of the atmosphere, called the troposphere, at a rate that is consistent with what has been measured at the earth's surface.

The finding is subtle but significant, experts say, particularly because previous studies of the same data, showing no warming, have been highlighted by opponents of curbs on heat-trapping smokestack and tailpipe emissions linked to recent warming.

The difference between the two analyses also now has a clear explanation, with most of the divergence resulting from the way data were adjusted to account for a transition from one weather satellite to a successor in the mid-1980's.

The result is more consensus than ever that emissions of carbon dioxide and other heat-trapping greenhouse gases are noticeably altering climate.

But at the same time, the new research is showing that, at least so far, the influence of greenhouse gases appears to have been more modest than some climate experts once predicted.

The findings, after a year of review and debate at workshops, appear in the current issue of *The Journal of Climate*.

Dr. Thomas R. Karl, the director of the National Climatic Data Center in Asheville, N.C., called the new work "a significant step forward," but stressed that more work would be necessary to reconcile the persistent differences between computer models of the climate and the real thing.

The new study, done by private satellite experts at Remote Sensing Systems for the National Aeronautics and Space Administration and the Commerce Department, has not quelled doubters. But several experts not associated with the work said it had pushed the satellite record of recent warming more in line with what computer simulations had projected.

Dr. Frank J. Wentz, an author of the study and the director of the research firm, said continuing refinements in climate models had also brought the computer projections more in line with what the measurements were showing.

"The controversy is somewhat going away," Dr. Wentz said. "As time has gone on, the disconnect between the satellites and the models has gotten smaller and smaller."

Dr. John R. Christy, a University of Alabama at Huntsville scientist whose group was the first to analyze the satellite data for climate clues, agreed that the gap between models and measurements was closing somewhat.

But he added that the evidence was pointing more firmly toward a modest impact from rising greenhouse gases.

Dr. Christy, who has long been an outspoken critic of catastrophic climate predictions, said, "We've had enough years of this human-induced forcing to get some boundaries on it, and it's just not going in the dramatic and catastrophic direction."

Other scientists who have assessed the satellite findings, old and new, cautioned that no one should draw any conclusion about the prospect for significant climate shifts from subtle trends in surface or air temperature trends over a few decades.

Dr. Roger A. Pielke Sr., a climatologist at Colorado State who participated in a workshop last month assessing the new paper and other work assessing temperature trends, said the climate system had a tendency to jump from one steady state to another.

"It is characterized by rapid shifts, rather than smooth changes," he said.

Dr. Christy and Dr. Roy W. Spencer, at NASA's Marshall Space Flight Center in Huntsville, pioneered efforts to sift weather-satellite data for clues to longer-term temperature trends.

The data are notoriously difficult to deal with because they were gathered by a dozen satellites launched over several decades with different kinds of instruments. In a number of cases, one satellite sometimes overlapped with its predecessor for only a short time, preventing adequate cross-checking of their readings.

Adjustments to calculations had to be made for all manner of variables, including the tendency of the satellites to tip and drift up and down and east and west, distorting readings.

Initially, Dr. Christy and his group found that the lower troposphere was actually cooling, and not warming, drawing strong interest in their work from companies and elected officials questioning whether global warming was happening.

More recently, as Dr. Christy and his team took into account factors that could distort the readings, they concluded that there had been a slight, but inconsequential warming.

The new analysis was begun several years ago by Remote Sensing Systems and the two groups have increasingly shared data over the past year. The rate of warming calculated by the new group is higher than the old analysis by just a sixth of a degree per decade.

But that adds up over time to a trend that is consistent with what some computer simulations say would occur under the influence of building greenhouse-gas concentrations, Dr. Wentz said.

Dr. Christy says his work matches up much better with readings taken by an independent method, instrument-laden balloons launched from hundreds of weather stations.

But other scientists said the balloon-gathered data were spotty and inconsistent as well, and did not provide a useful yardstick.

Some scientists said the most valuable result of the new analysis of the satellite record was to take it out of the realm of politicized science.

Now, they said, it is simply one more data set in the broader body of evidence pointing in a generally warmer direction in years to come.

The only way to improve understanding of the causes and consequences of warming, Dr. Karl said, will be to look for clues in many places at once — melting glaciers, ocean temperatures and satellites, among others — and not rely on a lone line of evidence.

"The whole issue of global climate change is weighing evidence," he said. "Any conclusion will ultimately have to look like the results of a 100-question test. If you get a 90, you're probably on track."