

Global Temperatures Spark Hot Debate

For skeptics of global warming, satellite-borne thermometers have long served as a powerful ally. Although ground-based thermometers indicate that Earth's surface has warmed in recent decades, satellite readings show just the opposite for the atmosphere, which has seemed to cool since records began in 1979. A new study now charges that the satellite data contain significant errors.

Cleansed of these inaccuracies, the satellite record would probably show a slight rise in atmospheric temperatures over the last 17 years, according to James W. Hurrell and Kevin E. Trenberth of the National Center for Atmospheric Research in Boulder, Colo. They report their analysis in the March 13 *NATURE*.

"We believe that there are two downward jumps in the data which contribute to the spurious cooling," says Hurrell.

Hurrell and Trenberth's study has prompted climate scientists to take a close look at the much-publicized satellite record, although few are willing to reach any firm conclusions without more study.

The debate centers on an instrument called the Microwave Sounder Unit (MSU), which flies on polar-orbiting satellites operated by the National Oceanic and Atmospheric Administration (NOAA). Channel 2R of the MSU instruments gauges air temperature by measuring microwave radiation coming from oxygen in the lower atmosphere.

Analysis of the MSU 2R data since 1979 suggests that the temperature of the lower atmosphere has dropped at a rate of 0.05°C per decade. Earth's surface has warmed by 0.13°C per decade, according to ground-based measurements.

Researchers skeptical of global warming have used the satellite measurements to bolster their argument that greenhouse gases are not significantly altering Earth's climate.

NOAA keeps two polar-orbiting satellites in the sky at all times and replaces each spacecraft every 3 to 5 years. For that reason, scientists must weave together MSU data from different satellites.

Therein lies the problem, according to Hurrell and Trenberth. When patching

together the records from nine satellites, researchers have failed to account fully for differences among the MSU instruments. Evidence of this comes from temperatures in the tropics, they say.

To assess the validity of the satellite data, the two scientists decided to produce an independent record of atmospheric temperatures. Because the tropical ocean plays a strong role in controlling the atmosphere, Hurrell and Trenberth used records of sea-surface conditions to estimate atmospheric temperatures. They then compared their calculations with the MSU 2R measurements.

For the period 1982 through 1991, the simulated record closely matched the satellite data. Hurrell and Trenberth take this as evidence that the MSU record is accurate for this decade.

The two records fail to agree prior to 1982 and after 1991, however. Hurrell and Trenberth argue that these discrepancies represent errors in the MSU record introduced by weaving together the satellite data. They note that new satellites went online in 1981 and 1991, the same times that changes appeared in the satellite record relative to the sea-surface data.

This conclusion does not sit well with the scientists who produce the satellite record. John Christy of the University of Alabama in Huntsville counters that he has checked the satellite data against balloon measurements of atmospheric temperature and found excellent agreement.

Christy argues that Hurrell and Trenberth have discovered a real change in the atmosphere, not an error. For unknown reasons, air over the tropics follows the sea surface for some periods but not for others. He suspects the answer involves volcanoes and oceanic warmings called El Niños. Major eruptions occurred in 1982 and 1991, and a spate of El Niños has brewed since 1991.

"The lesson is that the tropical atmosphere has a level of complexity that we have not yet grasped," says Christy.

That possibility intrigues Alan Basist of the National Climatic Data Center in Asheville, N.C. Either the satellite record is wrong, he says, "or the atmosphere is responding differently to the surface than everyone expects it should, which would be a really significant finding."

Scientists who work closely with the MSU data say that they are not surprised by news of potential errors. "I think the MSU 2R record, at present, is a bit questionable," says meteorologist John Bates of NOAA. Bates adds, though, that he has no more confidence in the temperature trends derived from surface records.

—R. Monastersky

Picture of world forests pieced together

Eight thousand years ago, all the shaded areas on this map were forested. Today, only the areas in green—one-fifth of the original—remain as large, intact forest ecosystems, according to a report released last week by the World Resources Institute in Washington, D.C. The light brown areas include forest patches, degraded and second-growth forests, and tree plantations, all of which lack the biological diversity and ecological functions of large forests. Almost half of the large forest today is boreal, consisting of northern conifers. Another 44 percent is in the tropics. Only 3 percent is in temperate regions, where most of the original forest has been cleared for farms, pastures, or development.

The map is based on information gathered from 90 regional specialists. It is "a very useful synthesis" of regional assessments of forest quality that haven't been pulled together before, says Ken Andrasko, a forest analyst with the Environmental Protection Agency in Washington, D.C. It pinpoints the countries with the most remaining original forest, to lose or to conserve: Russia, Canada, and Brazil.

—C. Mlot

