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Stratosphere temperature data support scientists' proof for global warming

A new interpretation for temperature data from satellites, published earlier this year, raised controversy when its authors claimed it eliminated doubt that, on average, the lower atmosphere is getting warmer as fast as the Earth's surface.

Now, in another study headed by the same researcher to be published Dec. 15 in the Journal of Climate, direct temperature data from other scientists has validated the satellite interpretation.

A team headed by Qiang Fu, a University of Washington atmospheric sciences associate professor, earlier examined measurements collected from January 1979 through December 2001 by devices called microwave-sounding units on National Oceanic and Atmospheric Administration satellites. Different channels of the microwave-sounding units measure radiation at different frequencies, providing data for different layers of the atmosphere.

In the case of the troposphere, the layer from the surface to an altitude of about 7.5 miles, where most weather occurs, it was believed there had been less warming than what was recorded at the surface. However, Fu's team determined the satellite readings of the troposphere were imprecise because about one-fifth of the signal actually came from a higher atmosphere layer called the stratosphere, which for the last few decades has been cooling several times faster than the troposphere has been warming. The group devised a method to remove the stratosphere signal from the satellite data and was left with results that closely matched the warming at the surface. That work was published in May in the journal Nature.

However, critics contended the method overcompensated for the cooling effects of the stratosphere and thus overstated the amount of warming in the troposphere. The criticisms did not appear in peer-reviewed journals.

In the new study, Fu and Celeste Johnson, a UW atmospheric sciences graduate student, used direct stratosphere temperature measurements to examine the contamination from the stratosphere in

the satellite channel that measures troposphere temperatures. They also used the same data to evaluate their method for removing the stratosphere contamination. The data they used came from scientists at NOAA and the Hadley Centre for Climate Prediction and Research in England.

Using the direct stratosphere temperature trend profiles from 1979 through 2001, Fu's team found that the stratosphere contamination in the satellite channel measuring the troposphere amounted to about a minus one-tenth of a degree Celsius per decade. They used their new method to remove the contamination, leaving an influence from the stratosphere of less than one-hundredth of a degree on troposphere temperature trends. The results match closely with what would be expected from the Fu team's new interpretation of satellite data.

"These results are consistent with the results that the Nature paper gets," Fu said. "It is an independent check of the problem because we used completely independent data sets. The independent observations agree with our conclusions, and that's quite powerful evidence."

The Fu team's work indicates the troposphere has been warming at about two-tenths of a degree Celsius, or nearly one-third of a degree Fahrenheit, per decade. That closely resembles measurements of warming at the surface, something climate models have suggested would result if the warmer surface temperatures are the result of greenhouse gases.

The findings are important because, for years, satellite data inconsistent with warming at the surface have fueled the debate about whether climate change is actually occurring.

If contamination of troposphere signals by those from the stratosphere isn't taken into account for the last 25 years, Fu said, estimates of how much warming actually occurred in the troposphere during that time would be off by 40 percent to 70 percent.

Fu's work is supported in part by the U.S. Department of Energy, the National Aeronautics and Space Administration and NOAA.

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Reporters Note – Other experts willing to comment on this research include:

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