New research brings satellite measurements and global climate models closer

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The UW researchers are the first to come up with an adjustment for the way the Alabama scientists handled data from NOAA-9, a satellite that collected temperature data in the mid-1980s. Credit: NOAA

One popular climate record that shows a slower atmospheric warming trend than other studies contains a data calibration problem, and when the problem is corrected the results fall in line with other records and climate models, according to a new University of Washington study.

The finding is important because it helps confirm that models that simulate global warming agree with observations, said Stephen Po-Chedley, a UW graduate student in atmospheric sciences who wrote the paper with Qiang Fu, a UW professor of atmospheric sciences.

They identified a problem with the satellite temperature record put

together by the University of Alabama in Huntsville. Researchers there were the first to release such a record, in 1989, and it has often been cited by climate change skeptics to cast doubt on models that show the impact of greenhouse gases on global warming.

In their paper, appearing this month in the American Meteorological Society's *Journal of Atmospheric and Oceanic Technology*, Po-Chedley and Fu examined the record from the researchers in Alabama along with satellite temperature records that were subsequently developed by the National Oceanic and Atmospheric Administration and Remote Sensing Systems.

Scientists like Po-Chedley and Fu have been studying the three records because each comes to a different conclusion.

"There's been a debate for many, many years about the different results but we didn't know which had a problem," Fu said. "This discovery reduces uncertainty, which is very important."

When they applied their correction to the Alabama-Huntsville climate record for a UW-derived tropospheric temperature measurement, it effectively eliminated differences with the other studies.

Scientists already had noticed that there were issues with the way the Alabama researchers handled data from NOAA-9, one satellite that collected temperature data for a short time in the mid-1980s. But Po-Chedley and Fu are the first to offer a calculation related to the NOAA-9 data for adjusting the Alabama findings, said Kevin Trenberth, a distinguished senior scientist at the National Center for Atmospheric Research.

"It should therefore make for a better record, as long as UAH accepts it," he said.

To come up with the correction, Po-Chedley and Fu closely examined the way the three teams interpreted readings from NOAA-9 and compared it to data collected from weather balloons about the temperature of the troposphere.

They found that the Alabama research incorrectly factors in the changing temperature of the NOAA-9 satellite itself and devised a method to estimate the impact on the Alabama trend.

Like how a baker might use an oven thermometer to gauge the true temperature of an oven and then adjust the oven dial accordingly, the researchers must adjust the temperature data collected by the satellites.

That's because the calibration of the instruments used to measure the Earth's temperature is different after the satellites are launched, and because the satellite readings are calibrated by the temperature of the satellite itself. The groups have each separately made their adjustments in part by comparing the satellite's data to that of other satellites in service at the same time.

Once Po-Chedley and Fu apply the correction, the Alabama-Huntsville record shows 0.21 F warming per decade in the tropics since 1979, instead of its previous finding of 0.13 F warming. Surface measurements show the temperature of Earth in the tropics has increased by about 0.21 F per decade.

The Remote Sensing Systems and NOAA reports continue to reflect warming of the troposphere that's close to the surface measurements, with warming of 0.26 F per decade and 0.33 F respectively.

The discrepancy among the records stems from challenges climate researchers face when using weather satellites to measure the temperature of the atmosphere. The records are a composite of over a

dozen satellites launched since late 1978 that use microwaves to determine atmospheric temperature.

However, stitching together data collected by those satellites to discover how the climate has changed over time is a complicated matter. Other factors scientists must take into account include the satellite's drift over time and differences in the instruments used to measure atmospheric temperature on board each satellite.

The temperature reports look largely at the troposphere, which stretches from the surface of the earth to around 10 miles above it, where most weather occurs. Climate models show that this region of the atmosphere will warm considerably due to greenhouse gas emissions. In fact, scientists expect that in some areas, such as over the tropics, the troposphere will warm faster than the surface of the Earth.

The paper does not resolve all the discrepancies among the records, and researchers will continue to look at ways to reconcile those conflicts.

"It will be interesting to see how these differences are resolved in the coming years," Po-Chedley said.

Provided by University of Washington

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