SOME CONVERGENCE OF GLOBAL WARMING ESTIMATES

New Studies May Contribute to the Reconciliation of Satellite, Radio Sonde, Surface Data Indicating Recent Temperature Changes the Lower End of IPPC Projections – read more here

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By Roy Spencer

In one of a trio of new global warming papers in Science, Mears & Wentz (2005) address what they consider to be a large source of uncertainty in our (University of Alabama in Huntsville, "UAH") satellite estimate for global lower tropospheric ("LT") temperature trends since 1979. The satellite measurements come from the Microwave Sounding Units (MSUs) and Advanced Microwave Sounding Units (AMSUs) flying on NOAA's polar orbiting weather satellites. The UAH estimate of the globally averaged trend since 1979 to the present has been +0.09 deg. C/decade, considerably below the surface thermometer estimate that has been hovering around +0.20 deg. C/decade for the same period of record.

This discrepancy between the UAH satellite LT trends and the surface thermometer trends has caused some consternation, since what we understand of atmospheric physics suggests that sustained warming at the surface should be amplified with height in the troposphere, not reduced.

Mears & Wentz, who are very capable remote sensing experts from Remote Sensing Systems ("RSS", Santa Rosa, California), found that the LT trend was particularly sensitive to the UAH method for removing the drift of the satellites through the local observing time. The satellites are launched into sun-synchronous orbits that are meant to cross over the same Earth locations at approximately the same time each day. But since the satellites do not have on-board propulsion, the satellites fall slowly back to Earth, which changes their orbital characteristics. In particular, what began as early afternoon observations from the daylight side of the "afternoon satellites" orbits drift to later in the day over the several years of each satellite's lifetime. This causes a spurious cooling trend as the Earth observations are made later in the afternoon to the evening.

The UAH method for removing this drift depended upon the spacecraft roll attitude (the accuracy with which it was pointing straight down, and not sideways) being almost exactly the same during the day side of the orbit as the night side. The new research paper presents Mears & Wentz's own estimate of LT trends using diurnal cycle corrections based upon a climate model estimate of the daily (diurnal) cycle of temperature at different levels in the atmosphere, on a global basis.

Their final estimate of the global lower tropospheric trend through 2004 is +0.19 deg. C/decade, very close to the surface thermometer estimate, and this constitutes the primary news value of their report.

While their criticism of the UAH diurnal cycle adjustment method is somewhat speculative, Mears & Wentz were additionally able to demonstrate to us, privately, that there is an error that arises from our implementation of the UAH technique. This very convincing demonstration, which is based upon simple algebra and was discovered too late to make it into their published report, made it obvious to us that the UAH diurnal correction method had a bias that needed to be corrected.

Since we (UAH) had already been working on a new diurnal adjustment technique, based upon the newer and more powerful AMSUs that have been flying since 1998, we rushed our new method to completion recently, and implemented new corrections. As a result, the UAH global temperature trends for the period 1979 to the present have increased from +0.09 to +0.12 deg. C/decade -- still below the RSS estimate of +0.19 deg. C/decade.

Our new AMSU-based (observed) diurnal cycle adjustments end up being very similar to RSS's climate model (theoretical) adjustments. So why the remaining difference between the trends produced by the two groups? While this needs to be studied further, it looks like the reason is the same as that determined for the discrepancy in deep-tropospheric satellite estimates between the two groups: the way in which successive satellites in the long satellite time series are intercalibrated. There has been a continuing, honest difference of opinion between UAH and RSS about how this should best be done.

In a paper accompanying the Mears and Wentz paper, a new analysis of radiosonde (weather balloon) data by Sherwood et al. also obtains larger levels of warming than have been previously reported. No other radiosonde dataset that has attempted to adjust for the calibration artifacts discussed therein has produced warming estimates as high as those obtained in this new study. As is always the case, it will take a while for the research community to form opinions about whether the new radiosonde adjustments advocated in this work are justified. At a minimum, the new work shows that at least one method for analysis of the weather balloon data (which have traditionally supported the much smaller satellite trends from UAH) results in trends much closer to the warmer surface thermometer trends.

The third paper (Santer et al, 2005) takes a more thorough look at the theoretical expectation that surface warming should be amplified with height in the troposphere. The authors restate what had already been known: that the UAH satellite warming estimates were at odds with theoretical expectations (as had been some radiosonde measures). Now, the convergence of these newly reported satellite and radiosonde estimates toward the surface warming estimates, if taken at face value, provides better agreement with climate models' explanation of how the climate system behaves.

What will all of this mean for the global warming debate? Probably less than the media spin will make of it. At a minimum, the new reports show that it is indeed possible to analyze different temperature datasets in such a way that they agree with current global warming theory. Nevertheless, all measurements systems have errors (especially for climate trends), and researchers differ in their views of what kinds of errors exist, and how they should be corrected. As pointed out by Santer et al., it is with great difficulty that our present weather measurement systems (thermometers, weather balloons, and satellites) are forced to measure miniscule climate trends. What isn't generally recognized is that the satellite-thermometer difference that has sparked debate in recent years has largely originated over the tropical oceans -- the trends over northern hemispheric land areas, where most people live, have been almost identical.

On the positive side, at least some portion of the disagreement between satellite and thermometer estimates of global temperature trends has now been removed. This helps to further shift the global warming debate out of the realm of "is warming happening?" to "how much has it warmed, and how much will it warm in the future?". (Equally valid questions to debate are "how much of the warmth is man-made?", "is warming necessarily a bad thing?", and "what can we do about it anyway?"). And this is where the debate should be.

REFERENCES

Mears, C.A., and F.J. Wentz, 2005: The effect of diurnal correction on satellite-derived
lower tropospheric temperature. August 11, online at http://www.scienceexpress.org.

Santer, B.D., et al., 2005: Amplification of surface temperature trends and variability in
the tropical atmosphere. August 11, online at http://www.scienceexpress.org.

Sherwood, S., J. Lanzante, and C. Meyer, 2005: Radiosonde daytime biases and late 20th
century warming. August 11, online at http://www.scienceexpress.org.

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WE'RE ALL GLOBAL WARMERS NOW

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http://www.reason.com/links/links081105.shtml

Reconciling temperature trends that are all over the place

Ronald Bailey

People who have doubted predictions of catastrophic global warming (and that includes me) have long cited the satellite data series derived by climatologists John Christy and Roy Spencer at the University of Alabama Huntsville (UAH). That data set showed a positive trend of 0.088 degrees centigrade per decade until recently. On a straight line extrapolation that trend implied warming of less than 1.0 degree centigrade by 2100.

A new article in Science by researchers Carl Mears and Frank Wentz from Remote Sensing Systems (RSS) identified a problem with how the satellites drifted over time, so that a slight but spurious cooling trend was introduced into the data. When this drift is taken into account, the temperature trend increases by an additional 0.035 degrees per decade, raising the UAH per-decade increase to 0.123 degrees centigrade. Christy points out that this adjustment is still within his and Spencer's +/- 0.5 margin of error. What's the upshot? Although reluctant to make straight-line extrapolations, Christy notes in an e-mail, "The previous linear extrapolation indicated a temperature of +0.9 C +/- 0.5 C in 2100, the new data indicate a temperature of +1.2 +/- 0.5 C."

However, the Remote Sensing Systems team has made some additional adjustments, such that their global trend is 0.193 degrees per decade. Christy and Spencer disagree with those additional RSS adjustments, but acknowledge that it's an open scientific question which team is correct. If RSS is right, a straight-line extrapolation of future temperature trends implies that global average temperatures in 2100 will be about 2.0 degrees centigrade (3.6 degrees Fahrenheit) warmer than they are today-more than double the original Christy and Spencer trend. The RSS trend is more in accord with the higher projections of future temperature increases generated by climate computer models.

Is there a way to tell which data set is more accurate? Long term weather balloon data provide an independent measure of temperature trends; however, they also have some problems. Another of the Science articles looks at daytime biases in the radiosonde balloon data sets. A team led by Yale University climate researcher Steven Sherwood, suggests that researchers overcorrected for temperature increases caused by daytime solar heating of the instruments, and thus projected a spurious cooling trend. The researchers acknowledge that there are also nighttime biases, but do not correct for those in this article, coming to the not very robust conclusion that "the uncertainty in the late 20th century radiosonde trends is large enough to accommodate the reported surface warming."

The UAH temperature data set differs from a set of six different recent analyses of weather balloon radiosonde data by range from a low of 0.002 degrees centigrade to a high of 0.023 degrees centigrade. All are well within the +/-0.5 degree margin of error for the adjusted UAH data and lower than the adjusted RSS temperature trend. In other words, the balloon data suggest the global temperature trends are closer to the UAH number than they are to the RSS number. In its article, the RSS team agrees, "Trends from temporally homogenized radiosonde data sets show less warming than our results and are in better agreement with the Christy et al. results."

But what about the future? As the U.S. National Oceanic and Atmospheric Administration notes, "taking into account uncertainty in climate model performance, the IPCC [UN Intergovernmental Panel on Climate Change] projects a global temperature increase of anywhere from 1.4-5.8°C" by 2100.

So what's the bottom line? The UAH team finds warming of 0.123 degrees per decade. The balloon data tend to support the UAH team's findings. The RSS team finds warming of 0.193 degrees per decade. And the surface measurements show a warming trend of 0.15 degrees per decade.

Christy notes, "If you want to say model trends are bolstered, you must remember model trends are all over the map. Which trend is bolstered? Perhaps you want to say those model trends less than 0.2 C per decade are bolstered." Right now the available data sets appear to strengthen the case for arguing that the lower-end model projections for future temperature increases are more likely ones. Christy concludes, "The new warming trend is still well below ideas of dramatic or catastrophic warming."