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THE UNCERTAINTIES OF AVERAGES

Those who provide us with the supposed Mean Annual Global Temperature Anomaly (attached) treat the annual points in their graph as if they were constants. The points on the graph do not represent actual observations. They are processed versions of actual observations and they are subject to statistical uncertainties.

The latest CRU paper to calculate these uncertainties is:

Brohan, P., J J Kennedy, I. Harris, S. F, B, Tett, and P. D. Jones. 2006, Uncertainty estimates in regional and global observed temperature changes: A new data set from 1850. J. Geophys. Res. 111, D12106.doi:1020/2005JD006546.

This paper combinemany sources of uncertainties and the final figures very from year to year, but are typically about plus/minus 0.2C on a 95% confidence basis. Some versions of their graph include these figures as "error bars" attached to the data points.

Brohan et al even admit that they do not include "Unknown unknowns", even referring to the internationally recognized expert on this subject, Donald Rumsfeld.

The monthly uncertainties by location in 1969 according the Brohan etal paper.

It is surpising that they have left out of their discussions the most important source of uncertainty in their figures, one which is "known" to every person who has studied stratistics. It is the uncertainty which arises every time you take an average.

The actual experimental observations upon which the final figures on the graph are based are the daily measurements of the maximum and the minimum temperature at weather stations all over the world. In order to obtain the annual mean maximum or minimum it is necessary to average 365 daily measurements (366 in a leap year).

According to every one of the several textbooks on statistics that I possess. the equation for obtaining the uncertainty of a single mean is as follows uncertainty is plus/minus txSD/Sqrt of number of observations.

The value for t is obtained form the tables of the t distribution given in the textbooks. For 95% confidence limits and numbers of observations above 50 it is close to 2. The square root of 365 is 19.1.

Kerkin (personal communication) recently downloaded a large number of daily maximum and minimum measurements from the NIWA database and calculated the standard deviation, for two weather stations, Albert Park, Auckland and Te Aroha in the North Island of New Zealand. For Albert Park the SD for the maximum was 3.8C and for the mimimum 3.7C. For Te Aroha the SD for the maximum was 4.8C and for the minimum 5.1C.

I do not know how typical of the whole world these might be, but I expect that for countries with a continental climate the SD figures would be much higher. But, anyway, let us take an SD of 4.3C for he maximum and 4.4C for the minimum and try it in the formula.

The 95% confidence limits for the average are therefore plus/minus 2x 4.3/19.1 = 0.45C for the maximum and 2x 4.4/19.1 = 0.46C.

These figures are about double the uncertainties calculated by Brohan et al from all the other possible sources of error.

It is assumed that the average temperature is the mean of the maximum and the minimum. So you have to add up the individual uncertainties to give those for the mean as plus/minus 0.91C.

But that isn't all. There is an addtional uncertainty from choosing such a bad method for calculation the average. There are no published figures as far as I am aware of attempts to calculate the error of doing this, or its uncertainty. However, NIWA have published a set of hourly temperature figures from 24 New Zealand weather stations for a typical summer's day and a typical winter's day at NIWA 2010 "Meteorologist for a Day".

I have calculated, from the 48 figures supplied, the averege difference between the Maximum/Minimum mean and the 24 Hour Mean as 0.2C with a standard deviation of 0.8C.

The 95% incertainty can again be calculated as plus/minus 2 x 0.8/sqrt of 48 which gives plus/minus 0.23C. This is an amount about the same as all the uncertainties calculated by Brohan et all.

If the 95% confidence limits are all added together you get 0.2+0.45+0.46+0.23 They come to a total of plus/minus 1.34C on each data point. This is well above the 0.9C claimed to be the global, or the New Zealand temperature rise over the last 100 years, which means that this figure has a very low probability of being correct.

Cheers
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"To kill an error is as good a service as, and sometimes better than, the establishing of a new truth or fact" Charles Darwin