INSTRUMENTATION ACCURACY AND GLOBAL WARMING

Global Warming adherents come in many forms. There are politicians, journalists, youths who hunger to do battle - any battle - against the established order and naïve supporters of all ages who have this burning desire to do “good” in their lifetime. As well, there are scientists, some of better training, some who think for themselves, others who don’t.

The man made global warming theories all rest on commonly used instruments that were not designed for that task.

These GW proponents first stated, in no uncertain terms, that over the last 100 years the Earth’s average temperature has increased by one degree. This was the point that caught my attention. In my 35 years in the industrial measurement and control discipline, I came across no cost effective, generally-used temperature measuring system accurate enough to be certain of a global change of one degree (Celsius or Fahrenheit). If we can’t accomplish this task today, we certainly cannot believe any claims on the temperature measurements of 100 years ago.

The Equipment

Any measurement is only as accurate as the tools employed. The tools employed are a function of need and cost. Please note, determining accuracy is an inexact science and is determined by numerous factors such as impurities and manufacturing techniques as well as how well and how often, or even if, the devices are maintained and calibrated.

There are two types of accuracy -

1. Absolute Accuracy – how accurate the measurement is compared to a standard or to other similar devices.

2. Repeatability Accuracy – how accurately one device repeats the measurement of a previously recorded temperature on the same device.

Traditionally, both industry and government weather services rely on the repetitive accuracy of temperature measuring devices. Global Warmers used the information from these devices incorrectly. Typically, the Resistance Temperature Device (RTD) has a very high repeatability accuracy in the order of 0.01 to 0.2 degrees, depending on manufacturer and cost.

The absolute accuracy of these devices is quoted, by the manufacturers, as either a flat plus or minus 0.5 degrees or related to the full range of the device resulting in accuracy guarantees of plus or minus multiple degrees. The first, the best of the two claims, still results in a one degree temperature spread – that same one degree upon which the global warming proponents are relying.

Other factors that affect device accuracy -

- Two wire temperature devices are much less costly and less accurate than a three or four wire device. The third and fourth wires are used to balance the extra resistance of wiring runs between the RTD and the electronics that turn the measurement into human terms.

- The translation of resistance to temperature is a non-linear function. Algorithms are included in the electronics package to compensate for this curve. Calibration at boiling and freezing points provide some accuracy at those points. However, mid-scale calibration, if and when done, requires an expensive instrument bearing much greater accuracy. Midpoint calibrations make economic sense only if the prime requirement is for absolute accuracy.
- The electronics and to lesser extent, the RTD, drifts and changes over time. Lack of regular maintenance and calibration, a fact of life in many remote sites, negatively affects accuracy of reading.

There are many challenges with today's technology to ensure certainty of temperature readings. What about a century ago?

RTDs didn't come into general usage until the latter half of the 20th century. Prior to the 1950s, temperature measurement was a mechanical action (differing expansion of two metals and expansion of liquids such as mercury, alcohol and other low freezing, or high boiling point materials). All had their own unique challenges for certainty of reading.

The Human Element

Temperature monitoring stations of the early 20th century were manned by humans. Humans are fallible – often quite fallible.

The Measurement

Measuring temperature is a curious business. In a fluid, temperature can vary by many degrees depending on distance from the heat source. Adjacent points, even in the relatively higher viscosity of an oil bath, can vary be a degree or two. Within the lower viscosity, hence greater turbulence, of earth's atmosphere, these variations are magnified.

The highest density of atmosphere, within one mile of sea level, is the strip that is most monitored for temperature. But, even within this band, there are vast regions that have few if any temperature monitoring systems.

The Counter Argument

Global Warming proponents often discount device accuracy by claiming that averaging uncertain measurements will magically dispel the uncertainty. What they forget is that averaging the readings is simply averaging readings - not the actual temperature. The argument continues that, theoretically there are two types of measuring systems –

1. All measuring devices are inaccurate by the same direction and by the same amount. In that case only a mathematical offset need be applied for accuracy.
2. If the above is not the case, which it isn't, then the devices are random; therefore by averaging readings the actual temperature will be known.

A compelling argument. however, by extension, if the scientific community wanted accurate readings – on anything – why then even consider accuracy of individual devices? Why not just employ numerous devices regardless of quality or calibration and average the results?

The reason is simple. There is no such thing as true randomness. Neither averaging nor other statistical manipulation will turn uncertainty into certainty. If one is uncertain of a fact and more facts of lesser or greater uncertainty are added, averaged or otherwise manipulated, the result is an uncertainty that is, at least, equal to the fact of least accuracy.

Take, for instance, Les and Sid who have trouble counting objects. Les and Sid are assigned the task of counting people streaming through two doorways. By experience, it is well known that their counting is within plus or minus one, out of every hundred (1%). At the first door Les counts 100 people so we are certain - only - that there are between 99 and 101 people. At the second door Sid counts 200 people allowing a certainty of between 198 and 202. We are uncertain by a factor of two people at Les's door and four people at Sid's door. Averaging these results turns the uncertainty of the total number of people from 300 to between 297 to 303. The uncertainty factor is now six persons out of 300 (2%). Average the result and the uncertainty factor is back to 1% - just where we started.

Summary

Low cost, widely used temperature measuring instruments are ideal for monitoring local trends. Comparing the results of two or multiple temperature monitors in different locales requires careful consideration of the uncertainty factors of each monitor and each of its components. Uncertainty is not divisible.

Extrapolating global results from samples of less than 1%, improper installation, scarce calibration or repair and maintenance leads directly to even greater uncertainty.

The rule-of-thumb for calibrating temperature systems is to measure against a standard device that is ten times more accurate than that which is being calibrated. The most commonly used standard for global temperature readings is accurate only to within plus or minus 0.5 degrees. Science is supposed to be exact. Science is supposed to discriminate between fact and supposition. Extrapolating a global temperature from these commonly used RTDs leads to a certainty of only plus or minus 5.0 degrees. The rest is speculation.

Adding to that uncertainty is the scarcity of monitoring 99% of the Earth's atmosphere.

Global Warming proponents enjoy pointing to indirect evidence as proof of warming. Melting icebergs, tree rings, hurricanes and other differing weather phenomena make for a compelling argument. However, using indirect evidence is invariably self serving as many other contributing factors and localized conditions are always present.

Comparing modern "global" temperature readings with ancient "global" readings is comparing bad apples with even worse oranges.

Conclusion

Earth may indeed be warming, however the instruments upon which any proof resides are simply not up to that particular job. The range of observed global warming frequently claimed by the proponents is often within the range of typical instrumentation error, and thus is anything but absolute.