What's wrong with global climate models ?

By George E. Smith, 5 March 2008

I think this can be summed up with a question that one might ask of an 8th grade science class, or that I might have asked my first year freshman physics students 48 years ago at the University of Auckland.

"Do science theories describe how the universe behaves ?"

It's a trick question of course because the answer is, No they do not.

Science theories describe the behavior of completely fictitious models that we make up in our head out of whole cloth. Well that is all right because the mathematics that we use to analyse the behavior of those fictional models is also pure fiction; we made that all up too.

Geometers may talk about points and lines and surfaces; of circles and spheres; but NONE of those things actually exist anywhere in the universe.

The equation x^2 + y^2 + Z^2 = r^2 makes absolutely no provision for having 8,000 meter high mountains on its surface.

The beauty of our fictitious models and our equally fictitious mathematics is that we can describe the behavior of the model with great exactitude. Well some things like Heisenberg may add some fuzzy here and there, but most of the time we can predict exactly what our models do.

Now the experimental scientist of course makes his/her tests on the actual real universe and then compares the real observed behavior with that of the fictitious model.

We are surprisingly intolerant of any verified repeatable discrepancy between the observed real behavior of the universe and the exact predictions of our model behavior.

Planck's formula for the black body radiation provides correct results from near the absolute zero of the thermodynamic temperature scale to the highest billions of degrees known in the universe and replicates the spectral properties from down to but not including DC all the way out to cosmic rays and even the spatial distribution of the radiation is precisely specified. So that is a good model; not only is it quite simple mathematically, but we know of virtually no discrepancies between the behavior of the model and that of a real black body, which we can come very close to in the real universe.

The standard models of cosmology and particle physics also seem to give close agreement with what we believe the universe did even inside that 10^-34 seconds after the big bang, although the initial singularity is evidently an enigma.

So our rules are pretty strict. If the real universe always behaves demonstrably differently from our model, then we change the model. We add some bells and whistles and we try to abide by Einstein's admonition that scientific theories ought to be as simple as possible; BUT, no simpler !

So now compare what we observe (you experimental climatologists do) that this planet and indeed the whole earth/sun system appear to do in following the laws of physics and what our Computer Climate models (video games) claim is happening and will happen in the future.

Are they even vaguely the same? I think not; we gather temperature data from all over the world generally somewhere in the range from +60 °C down to -90 °C (and most of that range all at the same time), and then we boil it down to some single number average that we assign to the entire planet. And we religiously follow such numbers and claim that it is telling us something about what the planet is doing.

Absent the temperature differences between points on the earth, we have no knowledge of the expected heat flows from one region to another.

Without the absolute temperature at some location we have no knowledge of the expected radiation from that location, let alone heat transport by the other mechanisms of conduction, convection and phase changes like evaporation, freezing and melting.

So the unique thing about climate models is that they do not seem to make any effort to remove discrepancies between what we observe the planet to do in real time and what we mathematically compute the models to do.

Now I realize that in fact a lot of work is done to determine energy flow processes from one region to another the various circulations and decadal oscillations and the like; but our total picture for the planet as a whole seems to just throw away the detailed data that was gathered at great expense and we replace it with some purported average that really doesn't tell anybody anything particularly useful.

What good is a global average temperature if we are studying a radiation absorption and emission problem that we expect to be largely guided by black body, or at least grey or some other colored radiation laws, which we know are more a function of the fourth power of those detailed temperatures than they are of the temperature itself. And when we get to the actual emission spectra that will be subject to GHG absorption processes we simply ignore Wiens Displacement Law as if that doesn't matter. Well it does matter to planet earth, because I can assure you that the planet does not ignore Wiens Displacement Law in its dealings with the earth's Infra-red radiation.

The earths' interaction with a solar photon lasts a mere millisecond; that's how long it takes to propagate through 300 km of atmosphere and finally hit something. So in our models we gather them up in a bucket and then pour them over some model that isn't even vaguely like the real planet.

Am I the only one that doesn't see any commonality between what experimental climatologists tell us the real planet is doing and what the computer video games allege is the right way to model that?

So we go into endless minutiae about how CO_2 doubling might change the fringes of the 15 micron absorption band and as an aside we mention that we don't model water vapor or clouds too well, because they aren't that easy to model. Well if we believed that in fact the cloud cover completely swamps out any minor changes that CO_2 absorption might create, perhaps we would be mimicking the real behavior of the planet a lot more realistically. We might even find out that so long as we have those oceans out there, we can't change the temperature of this planet, either up or down, even if we wanted to.

Just a thought.

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BSc Physics and Mathematics (dual major) with strong emphasis on Radiophysics, and Electronics, from the University of Auckland (1957); taught Optics and Atomic Physics as a Junior lecturer at the University. In late 2000, received a Distinguished Alumni Award from the University of Auckland. Pioneer in the opto-electronic field and developer of the LED and IR optical computer mouse. No funding from any Government department or other institutional sources of research grants. Strongly believes that we need to get the science right before actual real damage is done to our planet, either environmentally or economically.