

Science and Ideology: A Response

Rick Baartman

Introduction

I am writing concerning the 29 January 2010 editorial in *Clarion* by Prof. Van Dam entitled "Science and Ideology." Prof. Van Dam begins by applauding scientific achievements but then casts doubt on scientists' abilities by stating that they "can be driven by ideological presuppositions that colour and influence the way they interpret the evidence." But my experience is that scientists are more thoroughly trained in objectivity than people in other fields. I recall as a graduate student omitting three data sets that were anomalous in some regard. My supervisor asked why I had omitted them. I told him I was pretty sure that the Hall probe had been miscalibrated. He told me that "pretty sure" was not good enough. If I did not have proof of a reason to reject the data, it was simply "not legal" to omit them. So I included them in my thesis even though they seemed to weaken the case I was making. Lesson learned, and a humiliation: my atheist supervisor was more honest than I. More on this type of "cherry-picking" below.

Prof. Van Dam concentrates on two examples. Anthropogenic global warming (AGW), and dinosaur dating. I know very little about dinosaurs, but I am writing on the topic of AGW.

I agree that there is an incorrect ideology involved, but I think this charge can be better leveled against the denialist side than against those who worry that the planet is warming. Science historian Dr. Naomi Oreskes points out¹ that some of the same influential people who claim that the science of global warming is 'not settled,' denied the truth of studies linking smoking to lung cancer, coal smoke to acid rain, and CFCs to the ozone hole. What connects these issues? In all of these cases, they were worried that the US government would impose regulations limiting citizens' freedoms. I believe this ideology of laissez-faire government lies behind much of the denialism.

Prof. Van Dam states without equivocation: "The earth has actually been cooling for the last number of years," thereby declaring "the reigning consensus among scientific experts" that planet earth is "getting warmer and warmer" is not true.

At first, I wondered how he obtained this information. He gave no reference to any data. Did he personally take a thermometer in hand? No, and it would have been useless if he had, since "global" warming is meant to be an average over the "globe;" a very large network of thermometers is needed. Moreover, the raw data is very "noisy;" to iron out seasonal fluctuations, one must average over at least a year, taking many measurements regularly throughout the year. This is a very data- and computationally-intensive process. Who is doing this

¹ Naomi Oreskes, "Merchants of Doubt: How a Handful of Scientists Obscure the Truth about Climate Change", lecture for the University of Rhode Island's Vetlesen Lecture Series, 2 March 2010; online at http://www.uri.edu/vetlesen/lectures_online_Oreskes.shtml or http://www.uri.edu/hc/2008/2010302_Oreskes.shtml or <http://www.youtube.com/watch?v=XXyTpY0NCp0> .

calculation? The “Friends of Science”? No. So it must be climate scientists. But why does Prof. Van Dam disbelieve what climate scientists are saying about their own data, namely that the earth is warming due to human activity?

Prof. Phil Jones (climatologist) in an interview with the BBC was asked:² “How confident are you that warming has taken place and that humans are mainly responsible?” He answered: “I’m 100% confident that the climate has warmed. As to the second question, I would go along with IPCC Chapter 9 - there’s evidence that most of the warming since the 1950s is due to human activity.”

How not to analyze noisy data

In response to my request for sources, Professor Van Dam listed “Thirty years of warmer temperatures go poof,” by Lorne Gunter.³ At the bottom of that article, you will find an interesting graph, duplicated here:

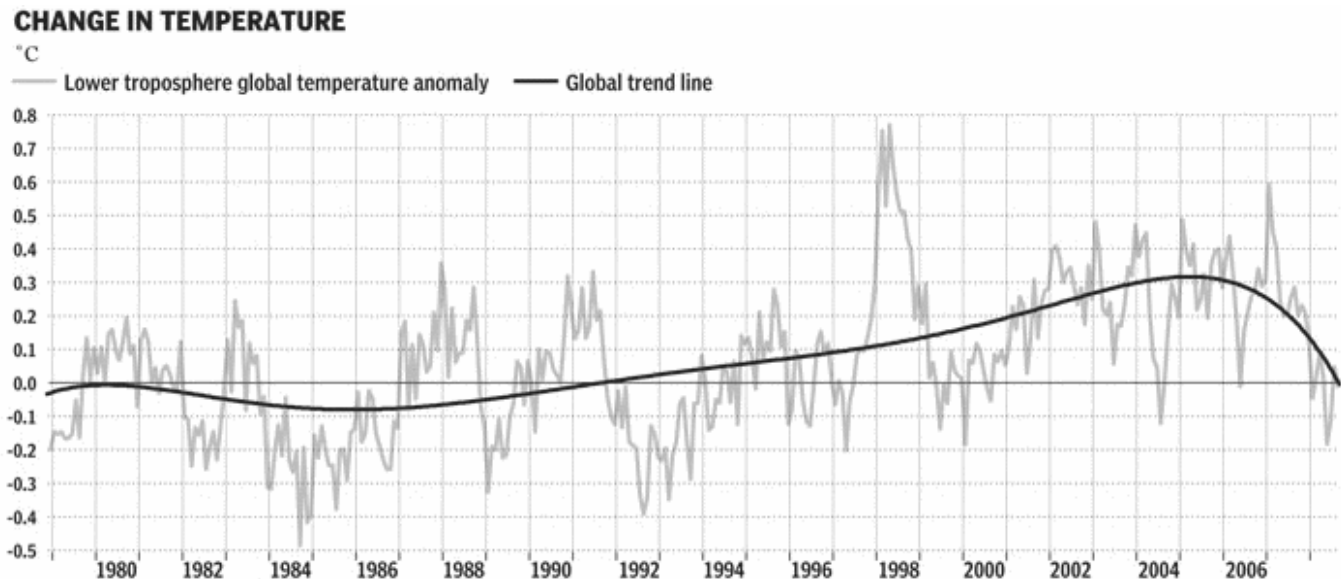


Fig. 1: Global temperature anomaly.⁴

The grayish noisy line is real data, averaged globally, freely available online.⁵ But the thick line labeled “Global Trend Line” was apparently drawn by Andrew Barr, graphic artist at the National Post. This is the line upon which Gunter’s article is based. How was this line obtained? Notice that the real data show a drop in temperature of 0.3°C from mid-2005 to mid-2008. The “Global Trend Line” follows this drop. So why does this line not also follow fluctuations of similar time scale in

² Q&A: Professor Phil Jones (Interview by Roger Harrabin), *BBC News*, 13 February 2010; online at <http://news.bbc.co.uk/2/hi/science/nature/8511670.stm> .

³ Lorne Gunter, *National Post*, 20 October 2008; online at <http://network.nationalpost.com/np/blogs/fullcomment/archive/2008/10/20/lorne-gunter-thirty-years-of-warmer-temperatures-go-poof.aspx> .

⁴ Figure from *National Post*, 20 October 2008; online at <http://www.nationalpost.com/893554.bin> .

⁵ Available online from Remote Sensing Systems (<http://www.remss.com/>) at http://www.remss.com/data/msu/monthly_time_series/RSS_Monthly_MSU_AMSU_Channel_TLT_Anomalies_Land_and_Ocean_v03_2.txt .

the rest of the graph? Let me state it another way. The earlier part of the “Global Trend Line” clearly smooths or averages data over at least 5 years. Therefore it cannot carry on to the end of the data, but only to (at the very least) 2.5 years from the end. Thus, the “Global Trend Line” must end at 2006; there simply is not enough data to go further. The part of the “Global Trend Line” from the beginning of 2006 to the end is a dishonest fabrication based on the presupposition that the trend is a cooling one.

Secondly, I want to make a point regarding statistical fluctuations. Dr. Jones, in the interview referenced above, was asked: “Do you agree that from January 2002 to the present there has been statistically significant global cooling?” His answer: “No. This period is even shorter than 1995-2009. The trend this time is negative (-0.12°C per decade), but this trend is not statistically significant.” Journalists, not trained in statistical analysis, assume that by “not significant,” Jones is trying to brush aside data that do not agree with the AGW thesis. But “not significant” has a statistical definition. It means that the downward fluctuation is not unexpected on the ground of purely random chance. The fluctuation size is quantified as the *root-mean-square*, or *standard deviation*. For the data over the last 30 years, this standard deviation is 0.22°C . From elementary statistics, we know that for any given year to be 0.22°C higher than the average or 0.22°C lower than the average, there is a chance of 1 in 3. Similarly, for any given year to be 0.44°C higher than the average or 0.44°C lower than the average, there is a chance of 1 in 20. Over the last 20 years, we did have such a year: it is 1998 (see Fig. 2). Statistics is a very highly developed field. One cannot simply quote Dr. Jones’s comment on “significant” without understanding at least some statistics. Poor Dr. Jones’s only fault in the interview is that he thought too highly of the interviewer and the general public.

Note: The above analysis assumes NO warming or cooling trend, as appropriate for the presupposition that there is no trend. If the data are analyzed for a linear trend, we find 0.16°C per decade warming, in agreement with published results. If we then subtract this trend and recalculate the standard deviation, we find it is 0.17°C rather than 0.22°C . The comment regarding chance fluctuations remains true regardless, however.

Plainly, there are year-to-year fluctuations as large as 0.5°C . Plainly also, the AGW deniers like Gunter waited for exactly such a fluctuation in order to declare that warming had ceased. Theirs is not just a presupposition; it is much worse. It is outright dishonesty. This, by the way, is called cherry-picking: one picks a data set from a set of noisy sets, that best exemplifies one’s presupposed viewpoint. In fact, the 30-year range 1979 to 2009 is barely large enough to draw any firm conclusions. With a warming rate of 0.16°C per decade, over the whole period of the graph, only 0.48°C is expected. But the data have 0.5°C fluctuations. So it is difficult to either prove or disprove a warming trend.

What do the data tell us?

Nevertheless, I will show you what one sees if the data are treated fairly. I have re-plotted the same data below (but extended to April 2010):

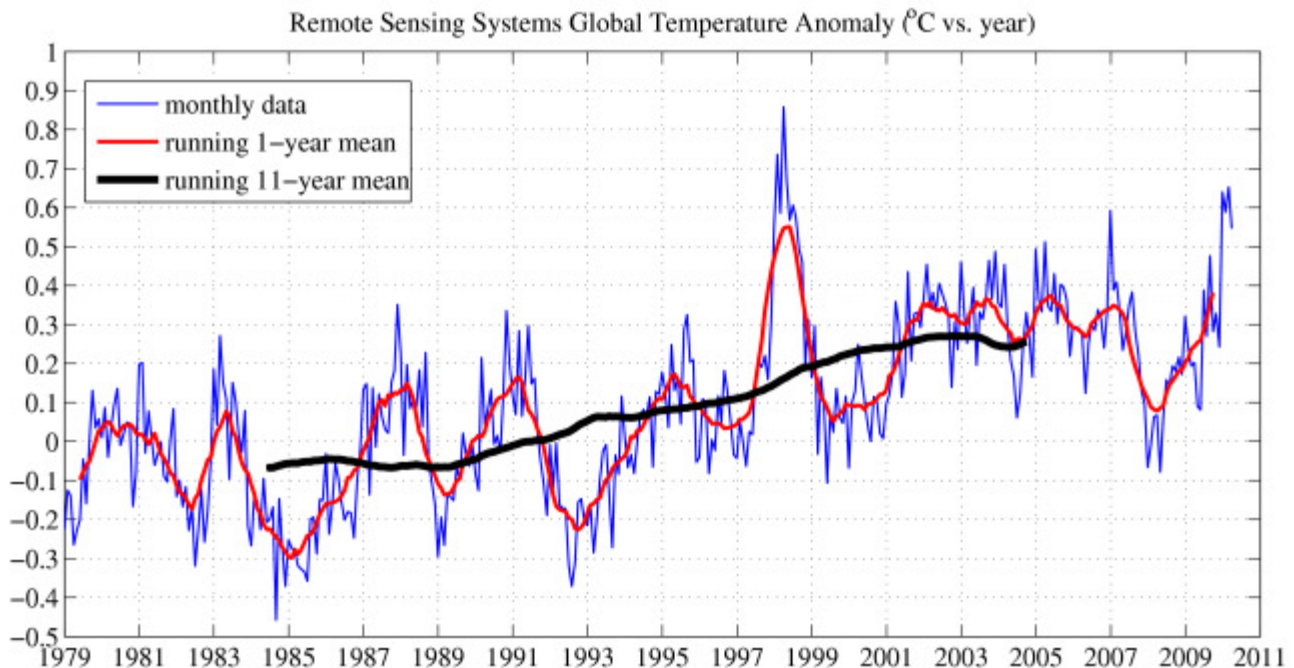
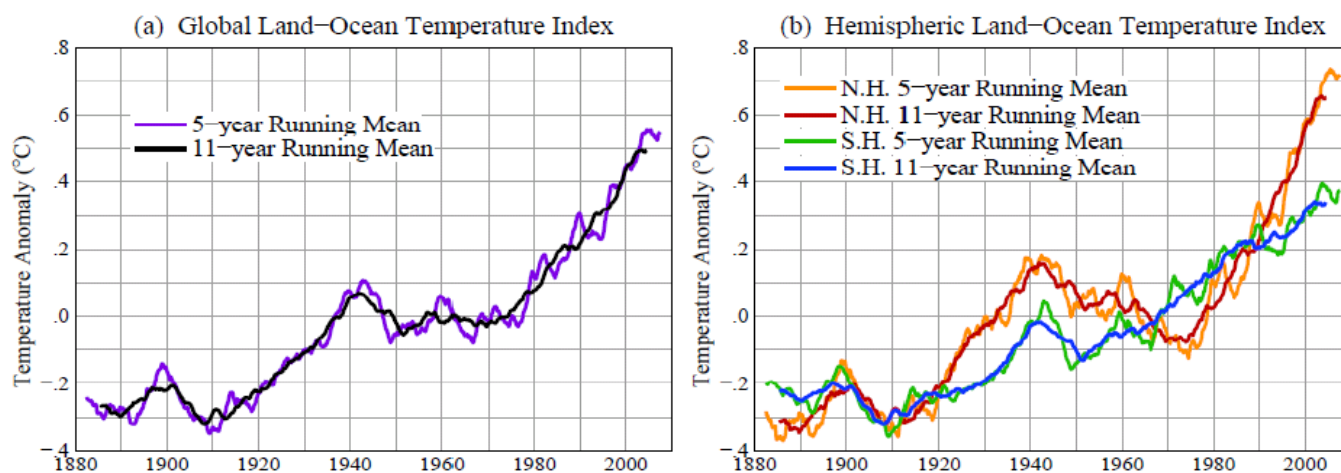


Fig. 2: Global temperature anomaly using recent data and smoothing by running average.

Notice firstly that Gunter's fluctuation of 2008 down to 0.0°C has been nullified by a subsequent upward fluctuation of $+0.6^{\circ}\text{C}$. So now that his cherry-picking has been exposed, is Lorne Gunter going to publish an article entitled "Warming Temperatures are Back"? I don't think so. But if a scientist had been so bold as to say some generally accepted trend had gone "poof," and he was subsequently proved wrong, he would have to either admit his error to his peer group or suffer a permanent loss of credibility. As a scientist, I have seen it happen.

Even when temperature data are averaged over all locations and a full year, there are fluctuations of about 0.3°C (red curve above). So at any given time, Prof. Van Dam's "last number of years" could equally likely show either cooling or warming. Why are there fluctuations? Because there are many cyclic phenomena in play. Two examples: the El Niño cycle is 5 years, and the solar output fluctuates very slightly with a period of 10 to 12 years. A good way to smooth the data is therefore to average over such cycles; indeed, averaging over 11 years does a remarkably good job of smoothing out the fluctuations (thick black curve in Fig. 2). (Technical point about data averaging: using a moving window of 11 years, and assigning this average to the mid-point means that this curve only reaches October 2004, 5.5 years from the end.)

Let us expand the data now to reach back to the start of the industrial revolution (see Fig. 3). When this is done, we see an increase of about 0.8°C during the past 100 years. There is also an obvious steady increase totaling 0.5°C over the period 1975 to 2004, in agreement with the published figure of 0.15°C per decade.

Fig. 3: Graph from Hansen et al.⁶

(S.H. and N.H. denote southern and northern hemispheres respectively.)

Look again at the graph of Fig. 3 and in particular the trend up to 1974. An interesting historical note is that in 1974, there had been a net cooling since a peak at around 1940. In a 1971 paper in the journal *Science*,⁷ Rasool & Schneider indicated that there was a competition between aerosols (cooling) and CO₂ (warming), and did not know which would win out, although they indicated the possibility of an ice age. *Newsweek* ran an article in 1975 on the next “ice age.”⁸

Since that time, regulations to curb acid rain have come into effect and sulfur emissions have dropped considerably.⁹ This has the effect of reducing global cooling. On October 23, 2006, *Newsweek* issued a correction,¹⁰ over 31 years after the original article, stating that it had been “so spectacularly wrong about the near-term future.” Why were such articles written in *Time* and *Newsweek*? Because there is always a journalistic bias to print articles that are spectacular in some way. They are after all in the business of selling news, not science.

Whom to believe: minority or majority?

Yet Prof. Van Dam claims, “The earth has actually been cooling for the last number of years.” He says “A minority of scientists have [sic] happily bucked the consensus.” But how did he decide to believe this minority? Perhaps he is not aware how very small this minority is. In January 2009, the geoscience newspaper *Eos* published the results of a survey of 3,146 Earth Scientists

⁶ James Hansen, Reto Ruedy, Makiko Sato, Ken Lo, “If It’s That Warm, How Come It’s So...Cold?”; online at http://www.columbia.edu/~jeh1/mailings/2010/20100115_Temperature2009.pdf.

⁷ S.I. Rasool & S.H. Schneider, “Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate,” *Science* v. 173, n. 3992 (9 July 1971) pp. 138-141; online at <http://www.sciencemag.org/cgi/content/abstract/sci;173/3992/138>.

⁸ Peter Gwynne, “The Cooling World,” *Newsweek* (28 April 1975) p. 64; online at http://denisdutton.com/cooling_world.htm.

⁹ David I. Stern, “Global sulfur emissions from 1850 to 2000,” *Chemosphere* v. 58, n. 2 (2005) pp. 163-175; online at <http://linkinghub.elsevier.com/retrieve/pii/S0045653504006708>.

¹⁰ Jerry Adler, “Remember Global Cooling?” *Newsweek* (23 October 2006); online at <http://www.newsweek.com/2006/10/22/remember-global-cooling.html>.

conducted by Doran & Zimmerman.¹¹ A few details about this survey: 10,257 geoscience faculty members were solicited and 3,146 responded; almost all were Ph.D.'s. They were selected independent of whether or not their publications indicated that they were AGW skeptics. 82% answered "Yes" to the posed question: "Do you think that human activity is a significant contributing factor in changing mean global temperatures?" Keep in mind that this includes scientists who have nothing to do with climatology. Significantly, the closer an earth scientist was to the field of climatology, the more likely (s)he answered "Yes." Of the 77 scientists who are actively publishing climatologists, 75 said "Yes." The number of skeptics (2) is so small, that it is easy to guess who they are.

Let us imagine you go to your doctor because of a skin rash. He is worried so he sends you to a dermatologist, who diagnoses melanoma and advises immediate surgical removal. But you have read in the newspaper that the melanoma scare has been overblown, and most of these cases clear up on their own or with the use of special creams. So you tell the doctor you are going out for a second opinion. The second dermatologist tells you the same thing as the first. You do it again and again, 77 times in all, and of those, 75 tell you that you need surgery immediately. Would you believe the 2 (who are "happily bucking the consensus"), or the 75? What presuppositions are needed to make such a seemingly illogical conclusion? You would have to believe that there is a conspiracy among the 75 to "sell" their surgery. And to carry the analogy further, what if I told you the two doctors are in the business of selling a special ointment that they claim cures melanoma?

Believe "Friends of Science"?

So why does Prof. Van Dam believe the minority? He states: "*An ideology is being promoted which is not sustained by the facts.*" I do not know which facts he is using for reference; certainly not the same ones as the vast majority of climatology experts are using.

He apparently is in part convinced by the arguments found on the "Friends of Science" website.¹² One of their main arguments is that the Antarctic Vostok ice core record shows that the CO₂ increase lagged warming by about 800 years. They hypothesize that temperature increases cause the oceans to expel CO₂, increasing the CO₂ content of the atmosphere.

But, ironically, these ice core records cover the years 150,000 to 100,000 years before present. Prof. Van Dam in the selfsame editorial (when debunking dinosaur dating) is saying that belief that the earth is older than 6,500 years is unbiblical and further that scientists' findings to the contrary are based upon an incorrect ideology. It seems to me that Prof. Van Dam's interpretation of the Bible is contradicted by the global warming skeptic website that he is promoting.

As well, the "Friends of Science" are no better at statistical analysis than any journalist. In 2008, they published the following graph on their website:

¹¹ Peter T. Doran and Maggie Kendall Zimmerman, "Examining the Scientific Consensus on Climate Change", *Eos* v. 90, n. 3 (20 January 2009) pp. 22f.; online at http://tigger.uic.edu/~pdoran/012009_Doran_final.pdf.

¹² Online at <http://www.friendsofscience.org/>.

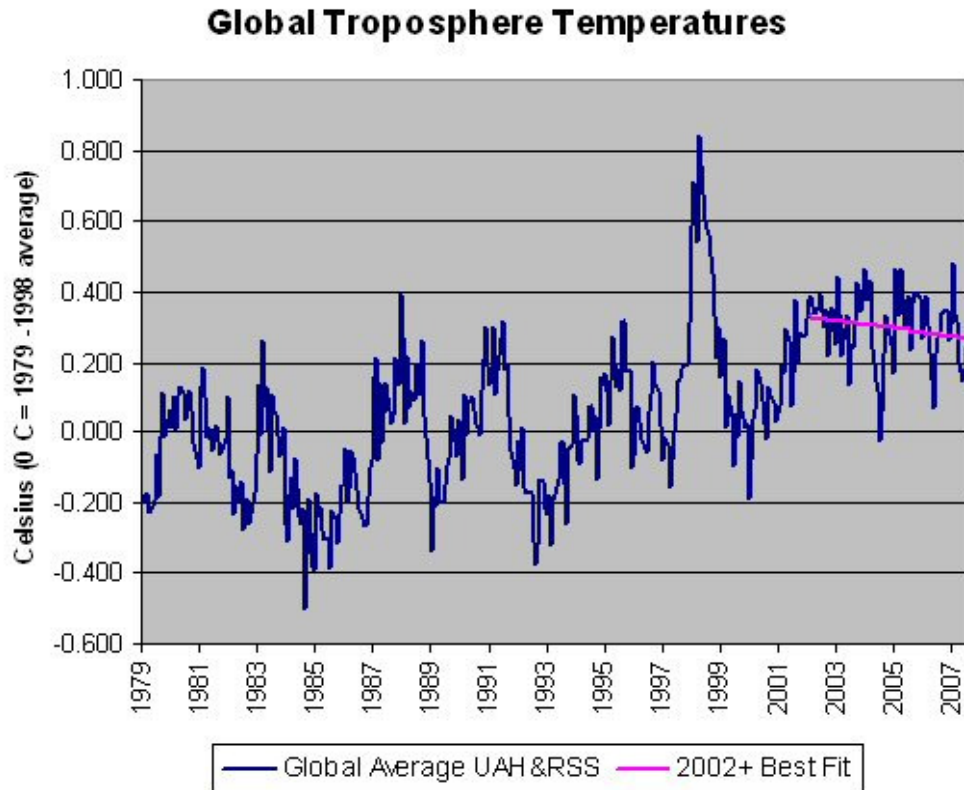


Fig. 4: Graph from "Friends of Science" with their "Best Fit."

In a sense, this is an even more egregious example of data abuse than the Gunter article, hardly what one would expect from a scientific website.

AGW in the context of other physics

But a physicist (like me) is not convinced of the validity of AGW by a majority vote, or even by the Antarctic ice core data. Physics is not simply data collecting followed by more or less vague speculation to find an explanation. If it were, then indeed one could use science to promote a personal political or religious agenda.

Rather, the data are analyzed in the context of all currently known science. This includes thermodynamics, radiation, chemistry, solar physics, etc. (Prof. Van Dam does delve at one point into the physics, stating, "For example, the sun, rather than human activity, could be responsible for fluctuations in temperature." Perhaps Prof. Van Dam, like most of the general population, does not realize how much research climate scientists have done on the sun's variability. A quick Google Scholar search of the phrases "solar variability" and "global warming" occurring together turns up over 1,000 articles.)

If the data set fits with currently-known physics, then it is considered to be understood. If it does not fit, there is great excitement since the data represent the discovery of new knowledge. In the case of global temperatures, there is a very simple explanation for the overall trend. It is simple, but it is "inconvenient" to the oil industry and so to the world economy. To see how well the currently-known physics explains for example the data of Fig. 2, look at Fig. 5 below:

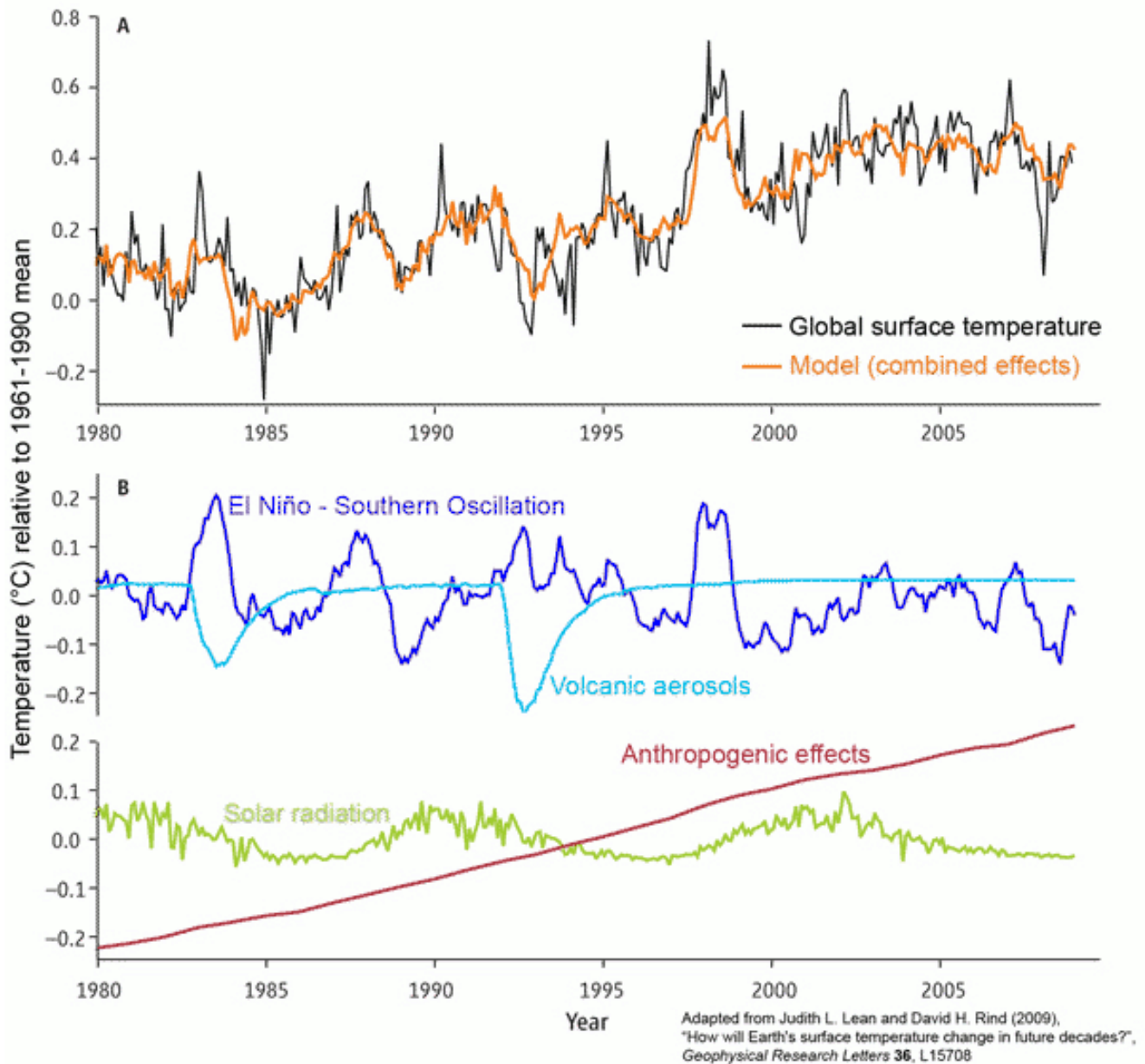


Fig. 5: Modeling results using currently-known physics.
A (Upper): net effect. B (Lower): constituent effects.¹³

Compare the black data curve in the upper plot with the orange calculated curve. It's pretty convincing evidence that the physics is understood. The orange curve is derived from the El Niño effect (blue), the aerosols released as the result of the two major volcanic eruptions (cyan), the solar variation (green), and the AGW effect (red).

¹³ Adapted from Judith L. Lean & David H. Rind, "How will Earth's surface temperature change in future decades?" *Geophysical Research Letters* v. 36 (2009) L15708 (5 pp.); online at <http://dx.doi.org/10.1029/2009GL038932> or <http://sciences.blogs.liberation.fr/files/climat-2009-2019-2.pdf>.

Let me take a moment to explain the physics behind the red curve labeled “Anthropogenic effects,” and you can judge for yourself whether it is based upon an incorrect ideology.

It is easy to calculate, based upon fuel consumption that on average every person in the US puts 20 tons, yes, 40,000 pounds, of carbon dioxide (CO₂) in the air each year. But Americans are not typical: the average over the earth is about 4 tons per person per year. Multiply by the number of people (6 billion), the number of years (about 100 since we started burning oil), and divide by the weight of the atmosphere, you find roughly 100 parts per million (ppm) extra CO₂ in the atmosphere. The CO₂ concentration is also measured quite accurately and it agrees: over the past 100 years, the atmospheric concentration of CO₂ has risen roughly 100 ppm. Next, we find the thermal insulation effect of this extra CO₂. The answer is approximately 1°C, also in agreement with measurement (seen in Fig. 3 above). The reason it is approximate is that there are other anthropogenic effects that play a role. For example, man causes clouds and creates sulfates that cause “acid rain,” and both of these contribute a cooling effect. Cloud formation and dissipation are particularly difficult to model and calculate. (The figures given here are approximate and not all effects are included; I have written a more detailed article.¹⁴ An even better one was presented to the Heartland Institute.¹⁵)

There seems to be a general mistrust of physicists’ ability to model and predict AGW. I do not know the reason. The models depend only upon the sun’s output and the earth’s efficiency in absorbing and re-emitting electromagnetic radiation through the atmosphere. Consider that physicists can understand radiation so well that they have been able to provide millions of people with the ability to have private conversations on cell phones over long distances, with no cross-talk. This depends upon a very good understanding of electromagnetic radiation. The release of heat from earth is just another kind of electromagnetic radiation. Does it make sense to believe that physicists understand one type of radiation but are completely incompetent to understand another? Would such a belief not be exactly the type of presupposition that Prof. Van Dam is warning against?

Stolen emails

Prof. Van Dam devotes a large part of the editorial to the sordid story of the stolen CRU emails. He states: “quite unscientific methods are being used,” “records have been falsified,” “evidence has been manipulated,” “doubts concealed about the validity of global warming,” “There was even a long series of communications discussing how best to marginalize and professionally hurt scientists who did not agree with the so-called consensus.” Every one of these allegations has been found by independent inquiries to be false.¹⁶ And so Prof. Van Dam has become party to the

¹⁴ Rick Baartman, “A Global Warming Primer”, *Reformed Academic* (17 August 2009); online at <http://reformedacademic.blogspot.com/2009/08/global-warming-primer.html> or http://lin12.triumf.ca/text/interesting_articles/GW/GW.pdf.

¹⁵ Scott Denning, “Debunking Common Myths about Global Warming,” presented at the 4th International Conference on Climate Change, The Heartland Institute, 16-18 May 2010; slides online at http://www.heartland.org/events/2010Chicago/PowerPoints/Scott_Denning.ppt.

¹⁶ See http://en.wikipedia.org/wiki/Climatic_Research_Unit_email_controversy.

spreading of false information that has significantly hurt the scientists involved, one of them even becoming suicidal.¹⁷

Conclusions

1. The editorial in question is based partly upon a misunderstanding of the phrase “statistically significant,” and partly upon dishonest information from non-expert skeptics.
2. As well, the editorial, taking both parts together, is self-inconsistent.
3. Moreover, it contains uncharitable allegations against the experts, and these have been found to be incorrect.

Acknowledgments

I am indebted to Jitse van der Meer, Arnold Sikkema, and Freda Oosterhoff for valuable comments. I also acknowledge helpful comments by Prof. Van Dam.

¹⁷ Aislinn Laing, “‘Climategate’ Professor Phil Jones ‘considered suicide over email scandal’”, *Telegraph* (7 February 2010); online at <http://www.telegraph.co.uk/earth/environment/climatechange/7180154/Climategate-Professor-Phil-Jones-considered-suicide-over-email-scandal.html>.