Naming and shaming the rentaquote scientists

By Christopher Monckton of Brenchley

A CLIMATE SCIENCE PAPER by Dr Willie Soon, Professor David Legates, Matt Briggs and me, just published in the *Science Bulletin* of the Chinese Academy of Sciences, the Orient's equivalent of *Nature* (www.scibull.com: click on Vol. 60 no. 1, January 2015) demonstrates that the billion-dollar climate models that have so profitably predicted Thermageddon are prone to costly exaggeration.

Instead of the 3, 5 or even 10 C° of global warming they predict in response to our doubling the CO2 in the air, we find there will be 1 C° and perhaps less than that.

On January 22, Victoria Woollaston reported our results at www.mailonline.com, the website of the London *Daily Mail,* under the heading *Is climate change really that dangerous? Predictions are 'very greatly exaggerated', claims study*.

What happened next demonstrates the sorry state to which climatology has sunk.

Within hours a blog funded by the "European Climate Foundation" had gathered instant rent-a-quotes from half a dozen climate scientists attacking our paper.

The piece was misleadingly called "Factcheck". Each of the scientists who were quoted made untrue assertions. Several can be proven not to have read our paper before expressing openly hostile opinions about it.

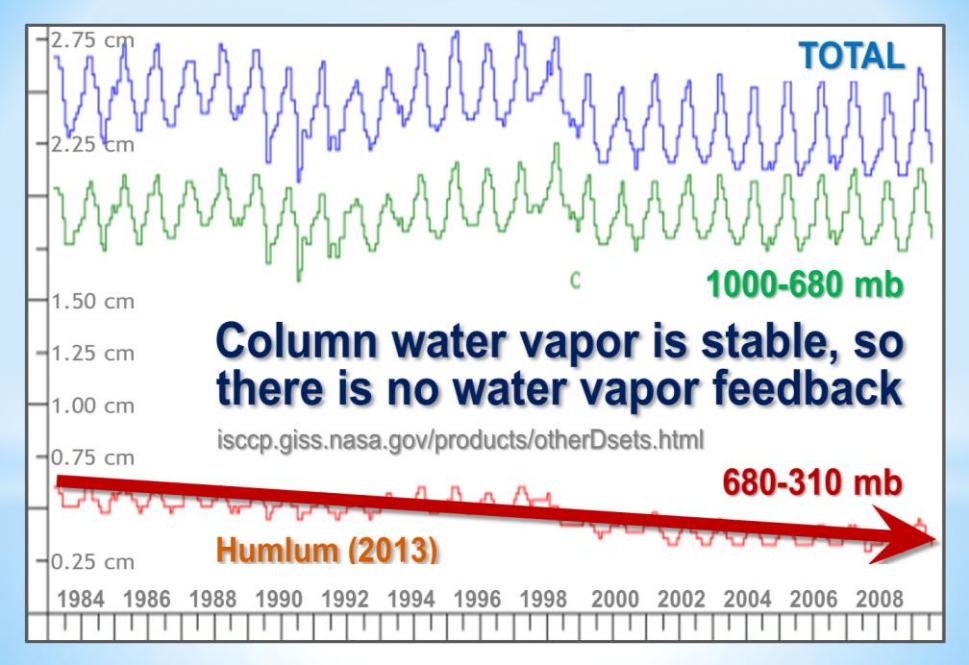
The so-called "Factcheck" article gets its facts wrong from the start. It says our paper had claimed that the major errors made by the huge computer models, each of which gobbles as much electricity as a small town, occur because the models are complex.

No. We said the models were wrong because they were using a rogue equation borrowed from electronic circuitry and bolted on to the climate, where it does not fit. That equation, and that alone, leads the modelers erroneously to triple the small and harmless 1 C° global warming we should expect from a doubling of CO2 in the air.

We now name and shame the six rentaquote climate scientists.

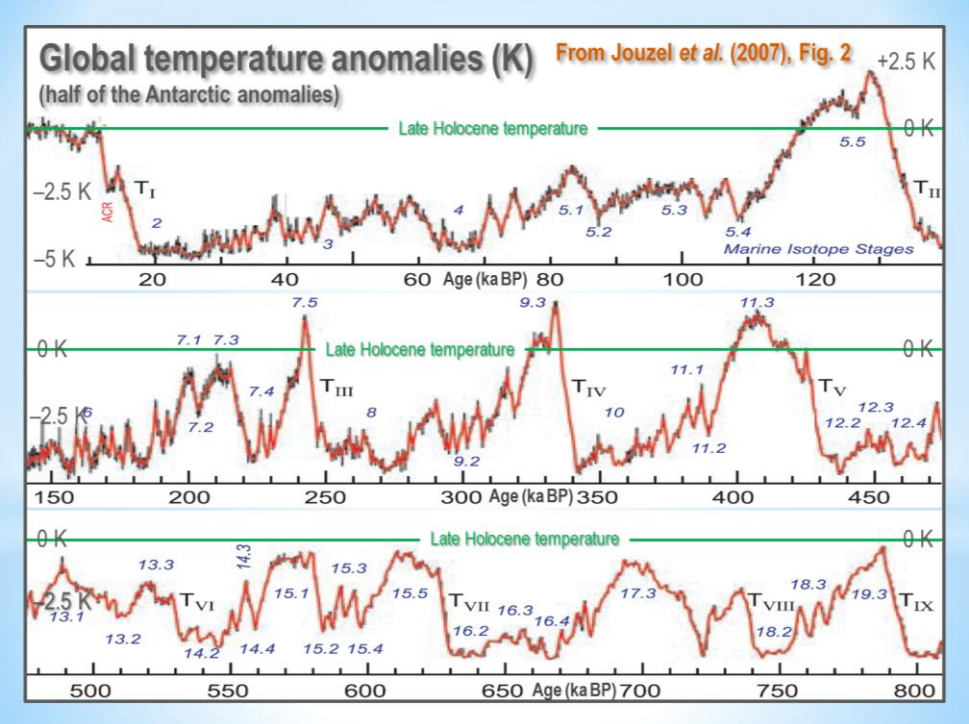
Professor Richard Allan, a weatherman at Reading University, said observations confirmed that water vapour strongly amplifies the small direct warming from CO2.

The truth: Some do, some don't. The Clausius-Clapeyron relation mandates that a warmer atmosphere can carry near-exponentially more water vapour. *Can,* not *must*. The International Satellite Cloud Climatology Project shows the water vapour content of the atmosphere as stable except in the climate-crucial mid-troposphere, where it has actually been declining for 30 years. That is the very opposite of what Professor Allan claims. The world has warmed by 0.5 C° over the period, but the ISCCP record, at any rate, shows a little less water vapour than before:



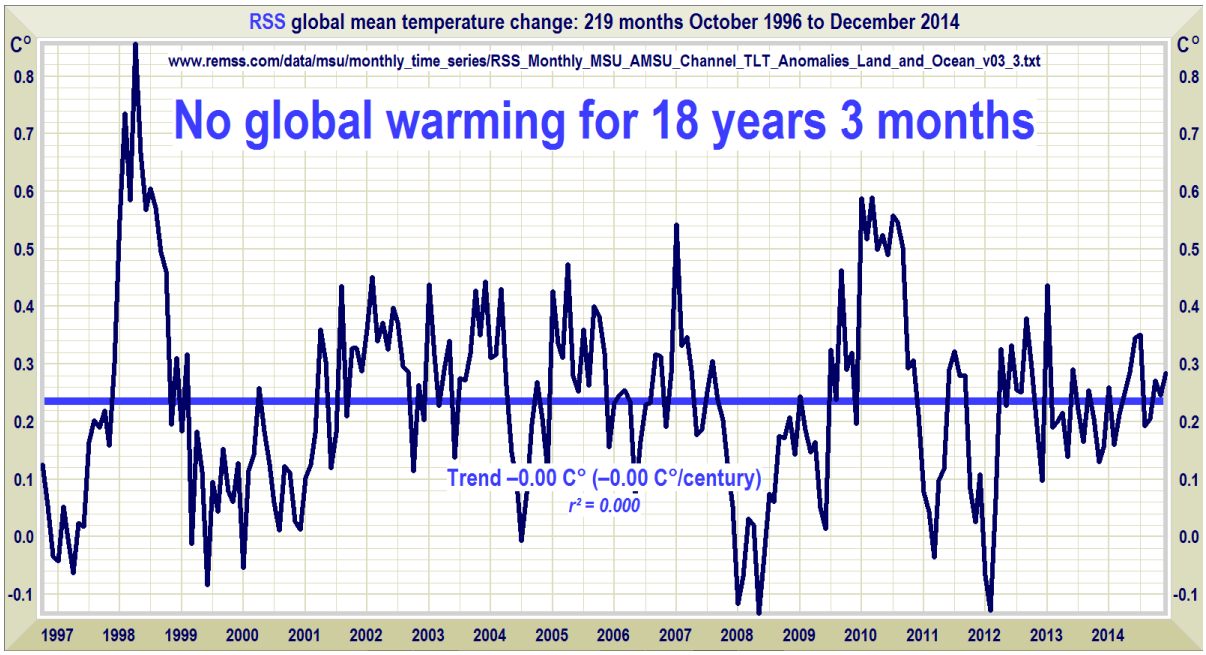
Professor Reto Knutti of the Swiss Federal Institute of Technology said we were wrong to base results on temperature change over the past 810,000 years because the climate was different when whole continents were covered by snow and ice.

The truth: We said climate feedbacks were likely to be small because four times in the past 810,000 years there were interglacial warm periods just like today (all were actually warmer than the present). We had pointed out, correctly, that the range of average global temperatures in all that time, from iceball to hothouse and back, was little more than 3 C° either side of the long-run average – about the same as the range of temperatures you set on your home heating thermostat:



Professor Knutti went on to say we had ignored the warming of the oceans.

The truth: Professor Knutti cannot have read our paper before criticizing it. Far from ignoring the oceans, we had added a lengthy appendix on ocean "warming". We cited papers by members of the Chinese Academy of Sciences disproving the "ocean notion" that heat hiding in the oceans is the reason why satellites defy the UN's predictions and show no global warming for up to 18 years 3 months:



One our diligent reviewers had in fact questioned whether our simple model of the climate was able to simulate the transfer of the "missing heat" to the oceans. An array variable had been explicitly incorporated into the model to allow for delays in the emergence of warming owing to the considerable heat capacity of the oceans.

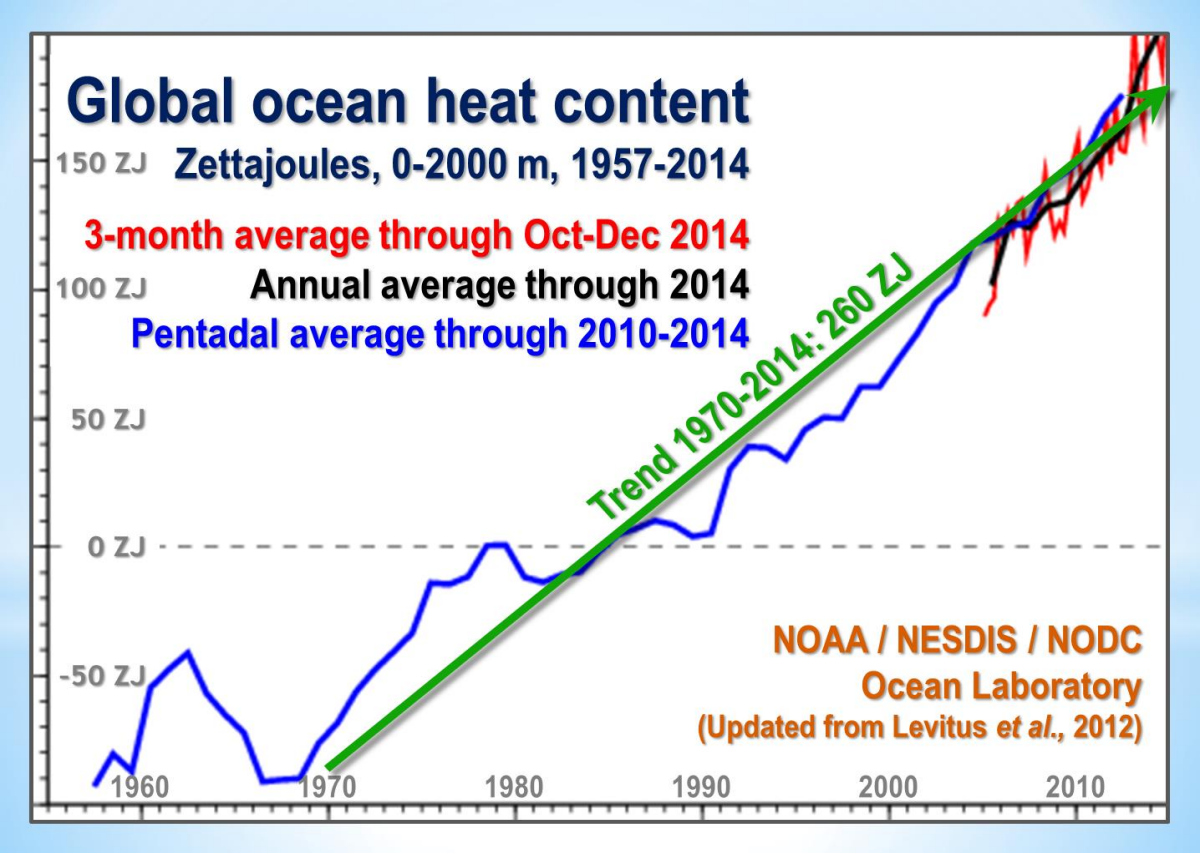
The ocean notion had in fact been put forward by a single small group of climate scientists writing each of four papers under different lead authors' names. In that way, when – as is usual – other scientists mentioned the papers citing only the lead author's name, it was made to appear that four different groups were advancing the ocean notion when in fact the four groups were only one group.

In the climate journals, we also found and reported at least two dozen other mutually incompatible excuses for the failure of the world to warm at even half the central, business-as-usual rate the UN's climate panel had predicted in its *First Assessment Report* in 1990.

The likeliest of those reasons why the models have exaggerated warming is that the models had predicted far too much global warming in the first place. Since 1990, little more than one-third of a Celsius degree of global warming has been measured (taking the mean of three terrestrial and two satellite datasets); but the IPCC's business-as-usual prediction in 1990 was equivalent to a warming of more than two-thirds of a degree by now, and 1 degree by 2025.

Professor Myles Allen, an earth scientist at Oxford, said the oceans had warmed "substantially" since 1970, though we had said they had not.

The truth: One of the most extreme estimates of ocean warming is that of the US National Oceanographic and Atmospheric Administration, which measures the warming as a global ocean temperature change but then converts it into Zettajoules of ocean heat content – in fact, some 260 ZJ since 1970. That looks substantial:



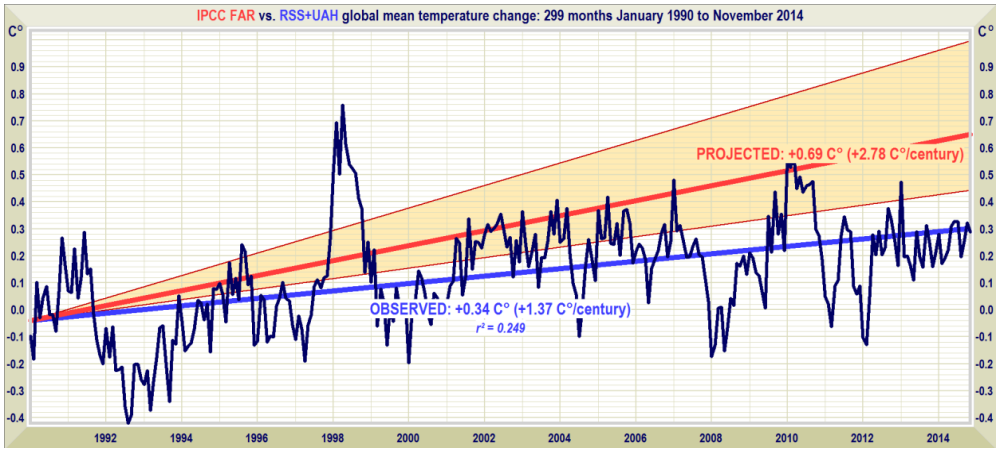
However, the ocean-atmosphere system is more substantial still. Converting the ocean heat content back to temperature, in recent decades the ocean has been warming at a rate equivalent to just 0.2 C° per century.

There are 650 million km³ of ocean. Each cubic meter weighs 1.033 tonnes. There are 4,186,800 Joules per tonne per Kelvin. Accordingly, to raise the ocean temperature by 1 K requires 2.8 Yottajoules. Dividing 260 ZJ by 2.8 YJ gives an ocean warming of just above 0.09 K in 45 years, equivalent to only one-fiftieth of a Celsius degree per decade, or one-fifth of a degree per century. Confining the analysis only to the most recent eight years, during which the 3500 ARGO bathythermograph buoys have been measuring ocean temperature change, the warming is equivalent to half a Celsius degree per century.

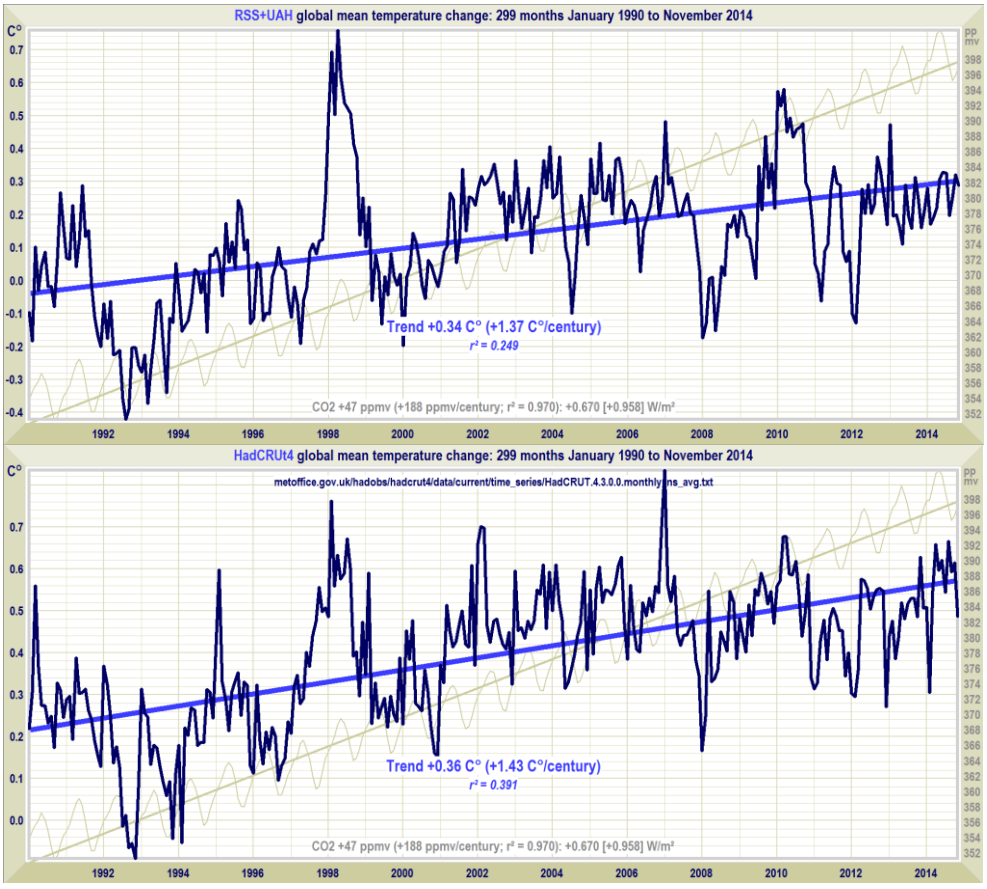
Each buoy has to cover almost 200,000 cubic kilometres of seawater, and the measurements were sparser still before the array was fully deployed in 2006. The resolution of ocean temperature measurements is insufficient to be reliable.

Professor Allen went on to say we should not have compared long-term predictions by the UN with medium-term warming since 1990.

The truth: We compared the UN's business-as-usual *medium*-term predictions from 1990-2025, adjusted to 2014, with real-world, measured *medium*-term warming. The UN had predicted twice the observed warming. We had carefully compared apples with apples. The graph would certainly not have passed peer review otherwise. It showed that the world has warmed in the quarter-century since 1990 at half the business-as-usual rate then predicted by the UN with "substantial confidence":



Professor Allen also said we had confused satellite and surface temperature measurements: the two, he said, were "simply not related". Yet, obviously, they are:



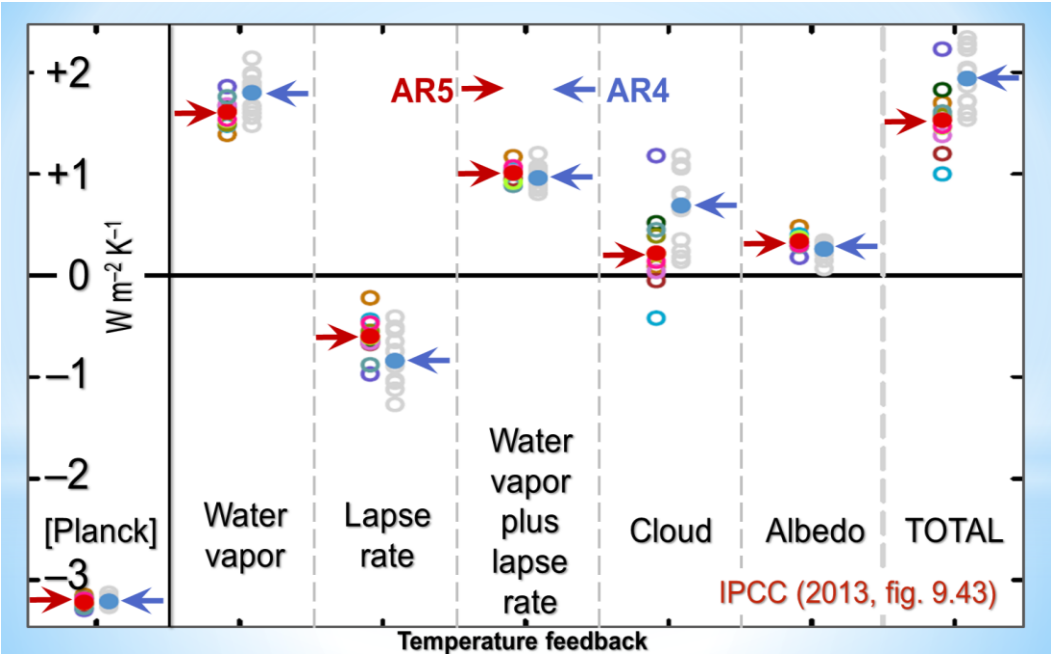
The truth: At a climate conference I helped to organize at Cambridge in 2011, Professor Jones of UEA showed a graph of warming since the UN's first report in 1990. His own surface temperature record showed much the same trend as the satellite datasets over the period. I have updated his graph. The average of the two satellite datasets shows 0.34 C° warming since 1990. Professor Jones' surface dataset shows 0.36 C°. The difference: only one-fiftieth of a Celsius degree in 25 years.

Professor Piers Forster, a climatologist at Leeds University, said we had "cherry-picked numbers".

The truth: Professor Forster cannot read our paper before attacking it without providing a single item of evidence, scientific or other, that we had cherry-picked any of our quantities. Our paper had in fact fully discussed each parameter value we used. Most of our parameter values had come from official sources.

Professor Forster went on to challenge our assertion that modellers' current central prediction of global warming was far too big because they had not taken account of a new, lower feedback estimate from the UN's climate panel. He said the panel had "not identified or quantified significant changes in feedback estimates".

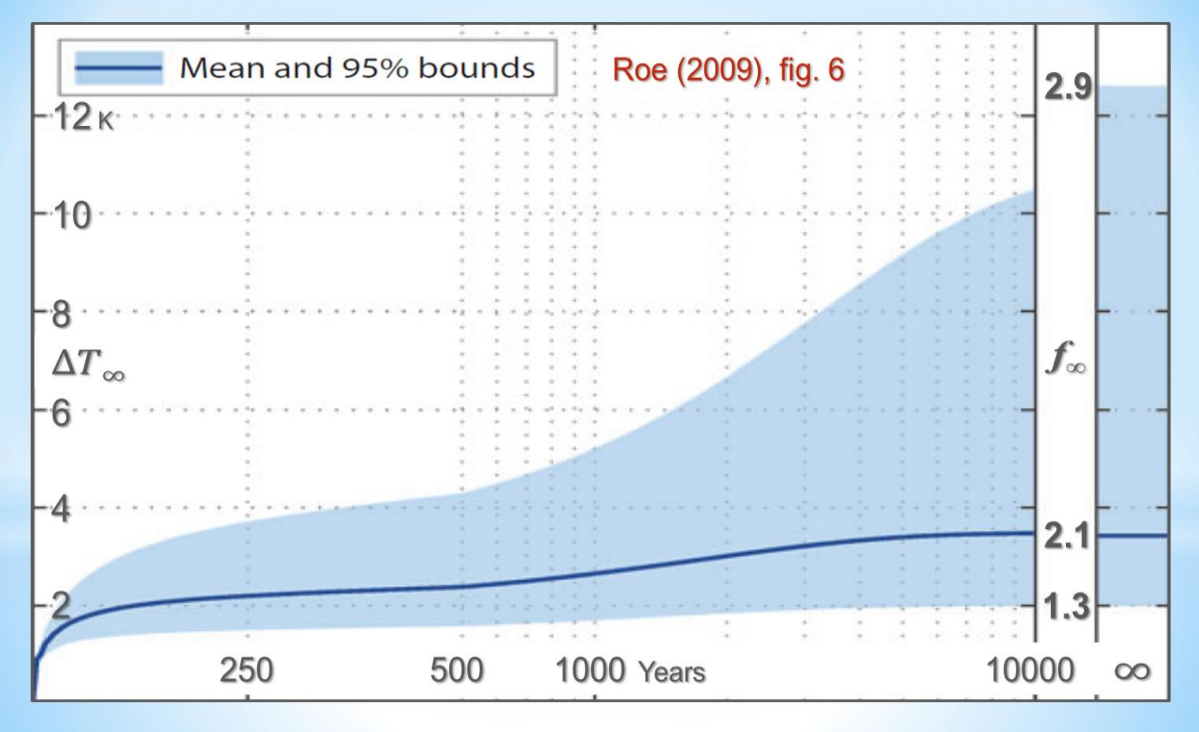
The truth: Again, Professor Forster attacked us before he had read either our paper or the UN climate panel's latest report, for which I was an expert reviewer. We said the UN should have reduced its central warming estimate from 3.2 to 2.2 C° because we had showed a diagram from the UN's report that cut its former feedback estimate from 2 to 1.5 Watts per square meter per C°:



However, the UN had instead refused to make any central estimate of how much warming a CO2 doubling would cause – even though that is the main purpose of its reports. Plainly it did not want to admit that all its previous central estimates of global warming had been very substantial exaggerations.

Dr Jan Perlwitz, a NASA modeller, said our model was not new.

The truth: Our model, unlike any other simple model, included several array variables allowing very sophisticated estimates to be made very simply. For instance, the different temperature feedbacks – influences triggered by a direct warming that either amplify or attenuate it – operate over different timescales, so that the rate of warming may well change from decade to decade or century to century. Our model used the output of a simple model by Dr Gerard Roe, a pupil of the formidable Professor Richard Lindzen of MIT, and incorporated it into a table of data that could be fed into our own simple model:



Also, in a single densely-argued paper, we had for the first time enabled any physics undergrad with a pocket calculator to make respectable estimates of future manmade global warming. Never before had anyone let the daylight in on the magic. Here is the central equation of our model:

$$\Delta T_t = q_t^{-1} \Delta F_t \, r_t \, \lambda_\infty$$

$$= q_t^{-1} k \ln\left(\frac{C_t}{C_0}\right) r_t \, \lambda_\infty$$

$$= q_t^{-1} k \ln\left(\frac{C_t}{C_0}\right) r_t \, \lambda_0 \, G$$

$$= q_t^{-1} k \ln\left(\frac{C_t}{C_0}\right) r_t \, \lambda_0 \, (1-g)^{-1}$$

$$= q_t^{-1} k \ln\left(\frac{C_t}{C_0}\right) r_t \, \lambda_0 \, (1-\lambda_0 f_t)^{-1}$$

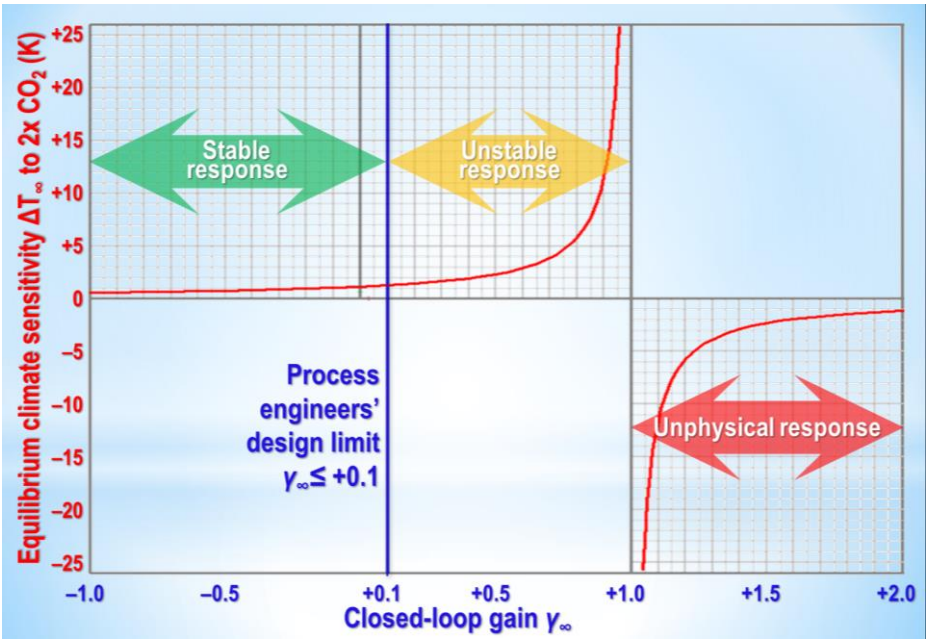
Dr Perlwitz also said we had not cited previous authorities for one of the equations in our model.

The truth: Dr Perlwitz cannot have read our paper before attacking it. He has since had to row back on his allegation, for he had not realized we had indeed attributed the relevant equation to a systems engineer in the 1940s. We had also acknowledged that the UN had mentioned it in its *Fourth Assessment Report*.

Dr Perlwitz then contradicted himself, saying that the inapplicable equation was not used in the climate models anyway. The equation, which comes from modelling the design of electronic circuits, is not suitable for use in the climate, especially if it is assumed, as the UN assumes, that temperature feedbacks are strongly net-positive:

$$G_t = (1 - \lambda_0 f_t)^{-1}$$

The truth: Two papers by James Hansen, one of which was actually cited by Dr Perlwitz in his comments, are among many that refer to the use of the equation, or of the system gain it determines, in determining climate sensitivity. But the equation is not suitable to the climate because it does not correctly represent the fact that temperature change, unlike changing voltage in a circuit, restores equilibrium after a radiative imbalance. Also, the equation mandates that if feedbacks become great enough they will drive temperature down, but that cannot occur in the real climate.



If the system-gain equation applies to the climate, it does so only where temperature feedback is small. Then global warming cannot exceed 1.3 C° per CO2 doubling, and with plausible negative feedbacks it might well be as little as 0.4 C°. The equation was incorporated into our model to allow calibration against the outputs of general-circulation model, and because at the net-negative feedbacks we consider likely in a thermostatic system the use of the model introduces no significant error.

Dr Perlwitz then makes a similar point to Dr Knutti's about our interpretation of the mere 7 C° range of global temperatures from ice ages to hothouse Earths and back over the past 810,000 years. He cites Dr James Hansen to the effect that the influence of orbital variations on incoming radiation was less than 0.5 W m^{-2}.

The truth: The UN's climate panel says the manmade increase in radiation since 1750 is 2.3 Watts per square meter – almost 5 times the forcing that Dr Perlwitz says was enough to cause 7 C° warming during each of the past four interglacial warm periods. Yet the warming since 1750 has been only 0.9 C°. If Dr Knutti is right, the warming since 1750 should have been 32 C°. That is 36 times what has actually been observed. Plainly there was more than 0.5 Watts per square meter of forcing at work.

Dr Perlwitz goes on to say we should not have set an upper limit of 0.1 on the closed-loop gain in the climatic feedback circuit. He thinks this value, which he quotes us as saying was "the maximum value allowed by process engineers designing electronic circuits", is too low. He says:

> "There is no logic here, whatsoever, unless there is some metaphysical belief behind this of the kind that there was a chief process engineer of everything who wouldn't allow positive feedbacks in the climate system either."

The truth: Dr Perlwitz has regrettably quoted us incompletely. Our paper had said:

> "… a regime of temperature stability is represented by [the equilibrium loop gain] $g_\infty \leq +0.1$, the maximum value allowed by process engineers designing electronic circuits **intended not to oscillate under any operating conditions.**"

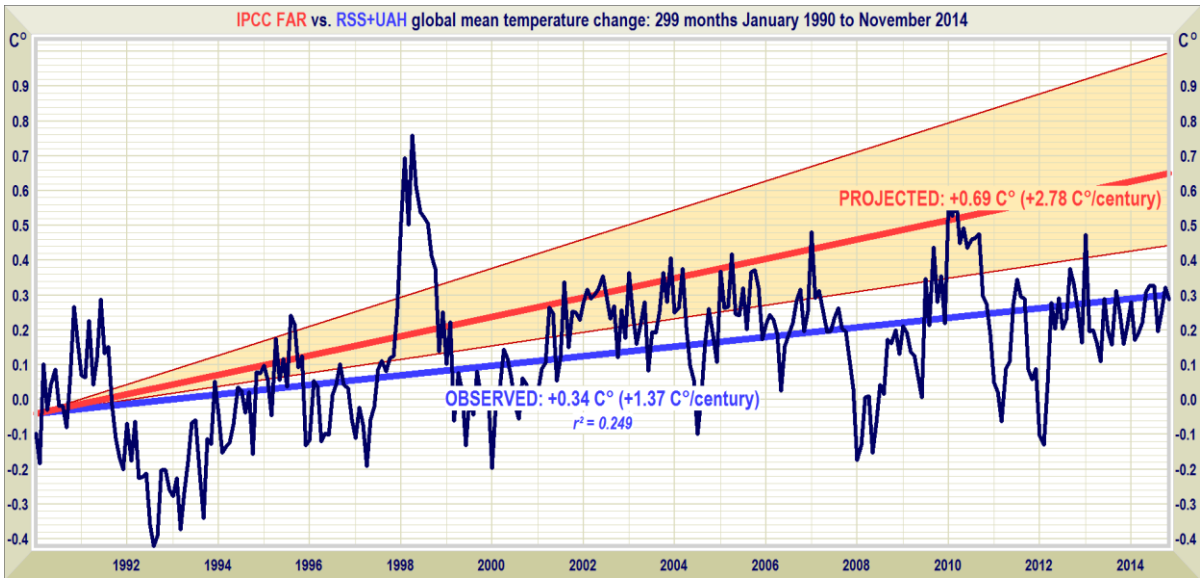
Unaccountably, Dr Perlwitz, having mentioned "the maximum value allowed by process engineers designing electronic circuits", somehow failed to complete the quotation by also mentioning the words in bold type. Furthermore, he omitted to mention our explanation that followed:

> "Of course, other assumptions might be made: however, in a near-perfectly thermostatic system net-negative feedback is plausible, indicating that the climate – far from amplifying any temperature changes caused by a direct forcing – dampens them instead. Indeed, this damping should be expected, since temperature change is not merely a bare output, as voltage change is in an electronic circuit: temperature change is also the instrument of self-equilibration in the system, since radiative balance following a forcing is restored by the prevalence of a higher temperature."

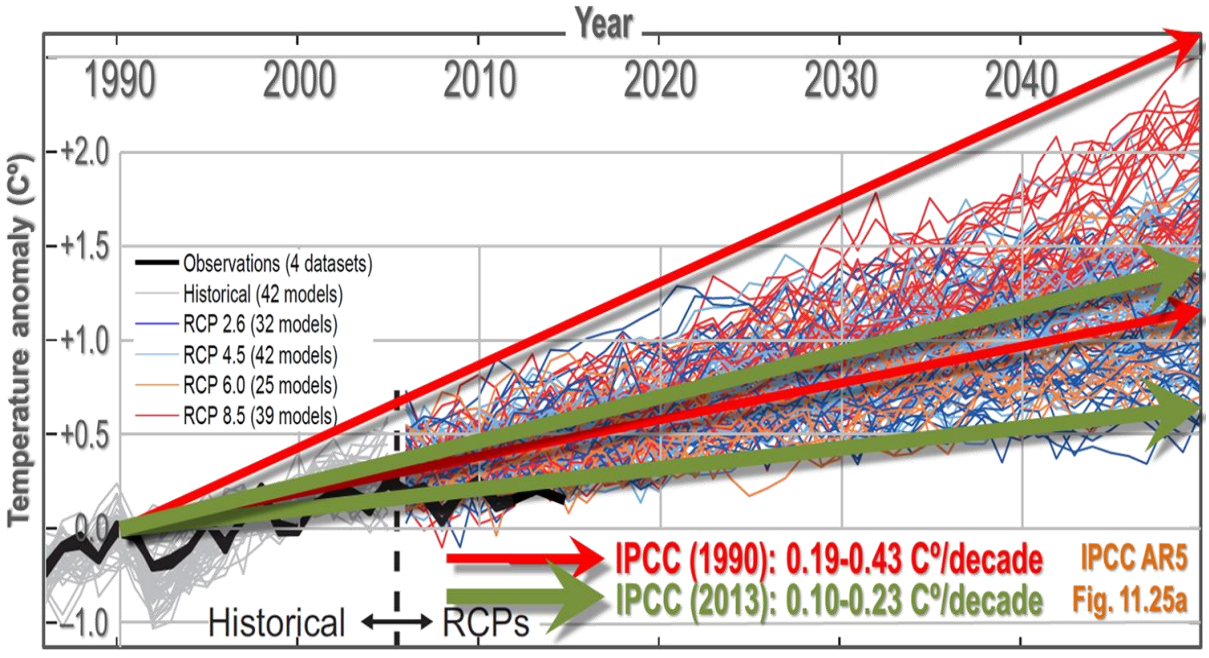
Indeed, there is a growing body of papers in the peer-reviewed literature (see, for instance, Lindzen & Choi, 2009, 2011; Spencer & Braswell, 2010, 2011), whose authors, by a variety of methods, find temperature feedbacks net-negative, so that global warming cannot be much more than 1 C° per CO2 doubling. Indeed, these two papers were among a dozen such papers referenced in our paper. From these considerations it may be deduced that Dr Perlwitz's allegation that we had posited "intelligent design" as our reason for finding temperature feedbacks net-negative is false and without foundation.

Dr Perlwitz goes on to say we had made "claims" that complex models had "very much overstated global warming", and that we had tried to substantiate this assertion with "merely a few graphics that are shown as supposed evidence".

The truth: Our first graph compared the UN's business-as-usual range of global-temperature predictions from its 1990 *First Assessment Report* and the observed temperature record since that date. The UN had predicted 0.7 to 1.5 C° of global warming from 1990-2025: best estimate 1 C°. However, the straight-line real-world warming trend is currently half the UN's central prediction, and is visibly well below even the lower end of the UN's range. The models had clearly "very much overstated global warming". The graph is precisely plotted. The trend-line was calculated with a standard statistical formula, the least-squares linear-regression trend:



Even the IPCC realizes its models have been running hot, as our second graph shows. Between the first and fifth Assessment Reports, it has all but halved its predictions:



Dr Perlwitz said the models that made the predictions in the UN's 1990 report were not as sophisticated as those of today, and that we should have allowed for that.

The truth: The UN's panel should have allowed for that. Instead its 1990 report said:

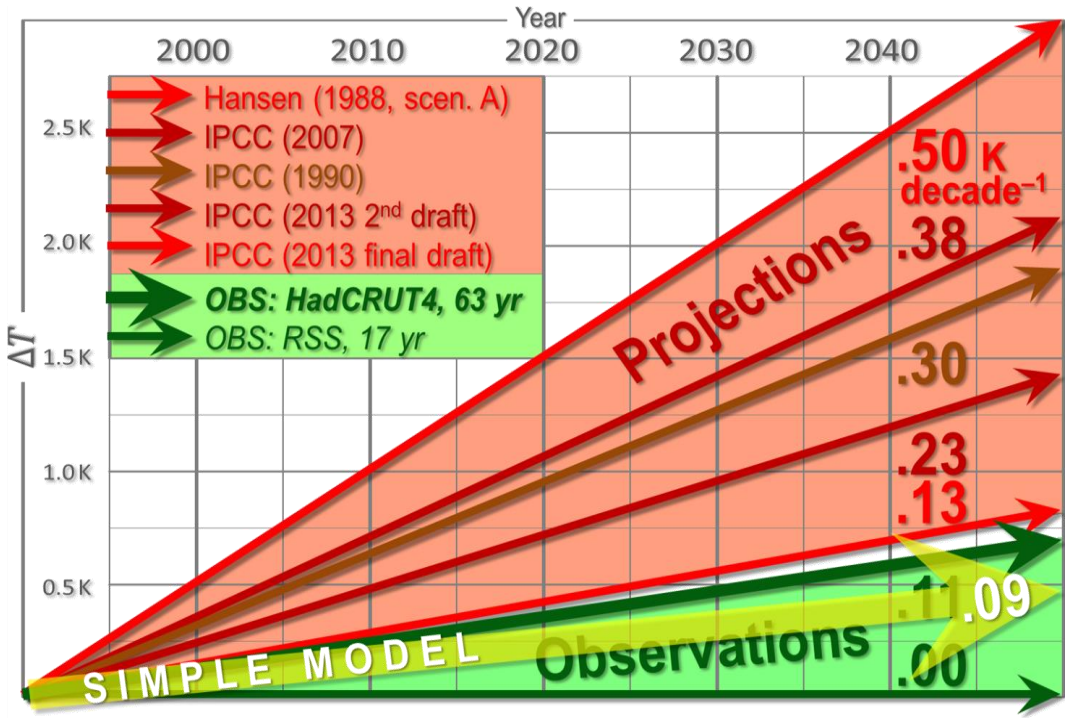
> "... we have substantial confidence that models can predict at least the broad-scale features of climate change."

It was on the basis of that "substantial confidence" that we were told the science was "settled". Global temperature change, after all, is the key "broad-scale feature" that climate models claim to be able to predict. Now that our devastating graphs have shown the UN's models had failed and the science was self-evidently not settled, Dr Perlwitz says we cannot blame the UN because its models were too simple. The fact is that its climate panel should not have expressed "substantial" or any "confidence" in predictions made by models that it ought to have known were inadequate.

Dr Perlwitz said that in our graph comparing the UN's predictions with observed reality we had "only selected the scenario with the strongest forcing (Scenario A)". Scenario B, he said had come closer to what had happened in the real world.

The truth: We selected Scenario A because, though Dr Perlwitz somehow failed to make this clear, the UN's climate panel had described scenario A, not scenario B, as its "business-as-usual" prediction.

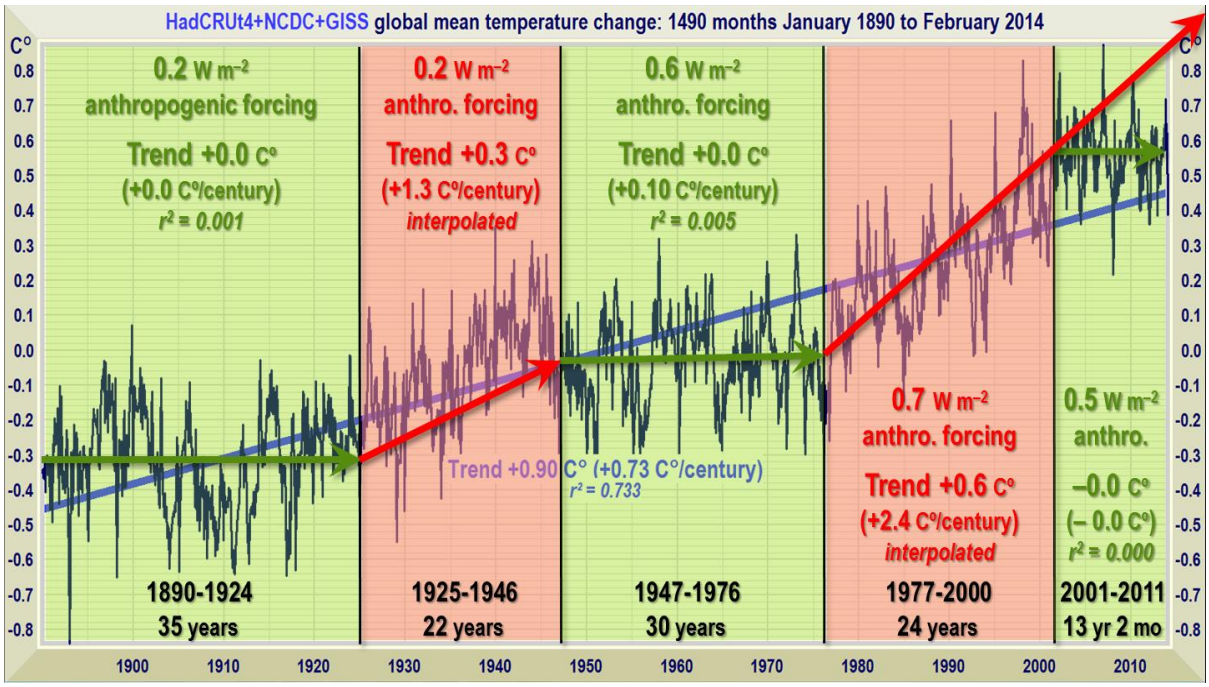
Dr Perlwitz said that in another comparison of several models' predictions with real-world warming we had used only Scenario A from James Hansen's testimony to the US Congress in 1988:



The truth: Though Dr Perlwitz somehow failed to say so, Dr Hansen, in his testimony to the U.S. Senate in 1988, had said that Scenario A was his business-as-usual case.

Dr Perlwitz criticized us for using 63 years of terrestrial temperature measurements as a basis for projecting observed trends into the future.

The truth: Global temperature follows an approximately 60-year natural cycle caused by what are known as the "ocean oscillations", with approximately 30 years of warming followed by 30 years of cooling. The PDO oscillations are shown here:



Our 63-year period was thus approximately a full natural cycle. Why does this matter? The U.N.'s projections not only in 1990 but in subsequent Assessment Reports were based on the warming period of the ocean-oscillation cycle from 1976 to the turn of the millennium. That is why they were exaggerated and overshot so disastrously. Our use of the full cycle length was designed to avoid this problem and remove a well-known, major, naturally-occurring signal that might mask or distort the (probably small) contribution from Man.

Dr Perlwitz said we had compared satellite and surface thermometer data. The two, he said, were too different.

The truth: Professor Allen had already trotted out this particular talking-point. In fact, the average of the two satellite datasets shows 0.34 C° warming since 1990, while Professor Jones' surface dataset shows 0.36 C°, a difference of just one-fiftieth of a Celsius degree in 25 years between the surface and the air above the surface.

Dr Perlwitz said we had only used one of the two satellite datasets.

The truth: Our graph comparing predicted and observed global warming is plainly and clearly labelled to show that we used the mean of the temperature measurements from the two satellite datasets – Remote Sensing Systems, Inc. (RSS), and the University of Alabama at Huntsville (UAH).

Dr Gavin Schmidt, director of NASA's Goddard Institute for Space Studies, said we had "arbitrarily restricted" the values of the parameters in our model.

The truth: We had provided reasons for our choice of every parameter value we used. Nearly all were from standard climate modelling – including Dr Schmidt's model.

Dr Schmidt said that our paper was "complete trash". Yet Dr Perlwitz said it was "not new".

The truth: These two responses, taken together, imply that the pre-existing models are complete trash. However, we had said nothing of the kind.

Dr Schmidt said we had "declared all other models wrong".

The truth: No, except to the extent that their predictions to date have proven very much exaggerated. We had said of the central equation in our model:

> "It is not, of course, intended to replace the far more complex general-circulation models: rather, it is intended to illuminate them."

Various blogs in the Leftosphere also commented, though few of them raised any serious scientific points. One of these blogs is run by Arthur Smith, a climate campaigner who works as the database manager for the American Physical Society.

Mr Smith had previously attempted to rebut a reviewed paper of mine – *Climate Sensitivity Reconsidered,* in the July 2008 edition of *Physics and Society,* a journal of the APS, which, at the time of my paper, carried an editorial slug saying that it printed "reviewed articles". The climate extremists were so furious at the publication of that paper that they dismissed the two editors (one had commissioned the paper, the other – an eminent professor of physics, had reviewed it), and went on falsely to deny that the paper had been reviewed. The new editors changed the editorial slug to say that the journal printed *non*-reviewed articles.

In 2008, Mr Smith wrote a 3000-word attempt at a rebuttal of my paper and sent it to the editors and to me, so that I could reply and both pieces would appear in the following issue of the journal, in the usual academic fashion. Within 12 hours I had produced a 3000-word point-by-point refutation. The new editors, on seeing how insubstantial and easily answered Mr Smith's piece was, declined to print it.

Now Mr Smith is back with a further attempt at a rebuttal – this time almost 5000 words of it. The tone, as in his previous failed attempt, is patronizing, though, as will become apparent, Mr Smith understands very little math or physics.

He gets off to a poor start by citing the Greenpeace front group's article with its parroting of the six instaquote rent-by-the-hour "scientists", but he is careful not to state that I had refuted their points. He also mentions with approval an attempt by a climate campaigner in the UK to allege that I had tampered with a graph published alongside an article by me in the London *Sunday Telegraph* without acknowledging

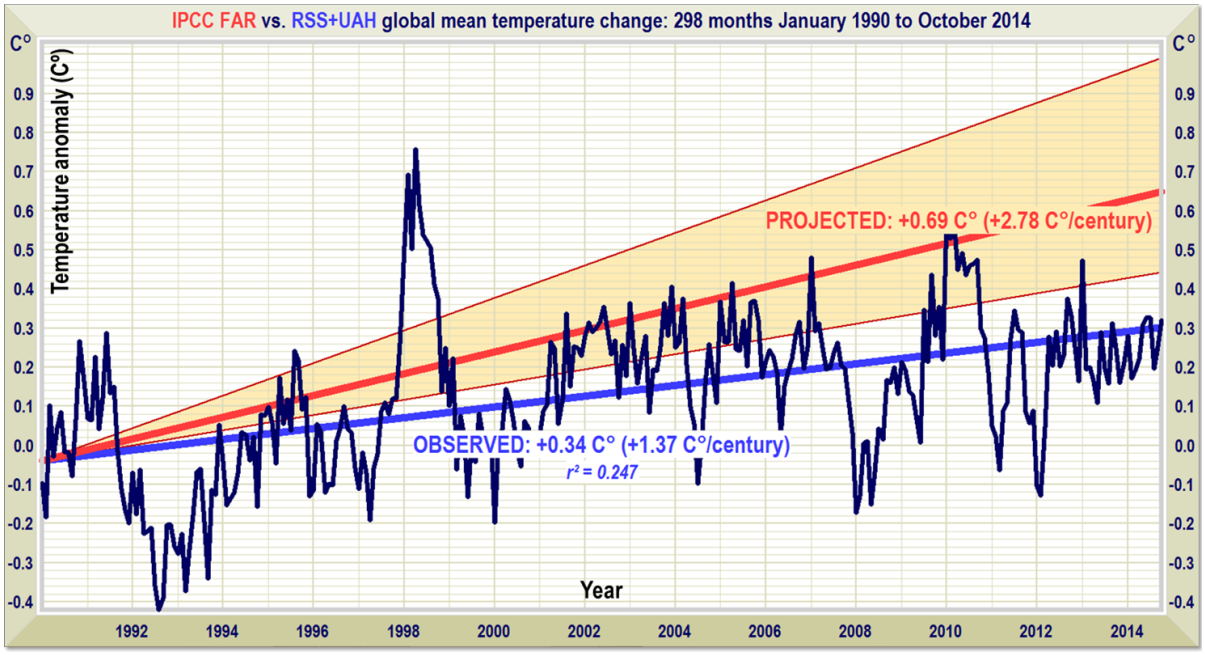
that, as is well known, I had had nothing to do with the selection or publication of that graph, which was in any event innocuous.

Mr Smith says the paper contained algebra but no calculus.

The truth: Regrettably, Mr Smith had not read the appendix, in which calculus was used to determine whether non-linear temperature feedbacks would alter our paper's central argument that climate sensitivity was probably no more than 1 K per CO_2 doubling and could be substantially less. And he had not understood the central, stated purpose of the paper: to produce a model so simple that anyone could operate it on a pocket calculator and still obtain results that were if anything more reliable than those of the more complex models.

Mr Smith goes on to say that Fig. 1 in our paper (reproduced below) is misleading because "Monckton is showing *monthly* temperatures rather than the much more stable annual averages ... The resulting display of month-to-month variance ... makes the strong warming trend less visually noticeable."

The truth: The trends are more accurately determined if more data points are used, and the trend line is clearly visible in bright blue on the graph, which Mr Smith chose not to reproduce.

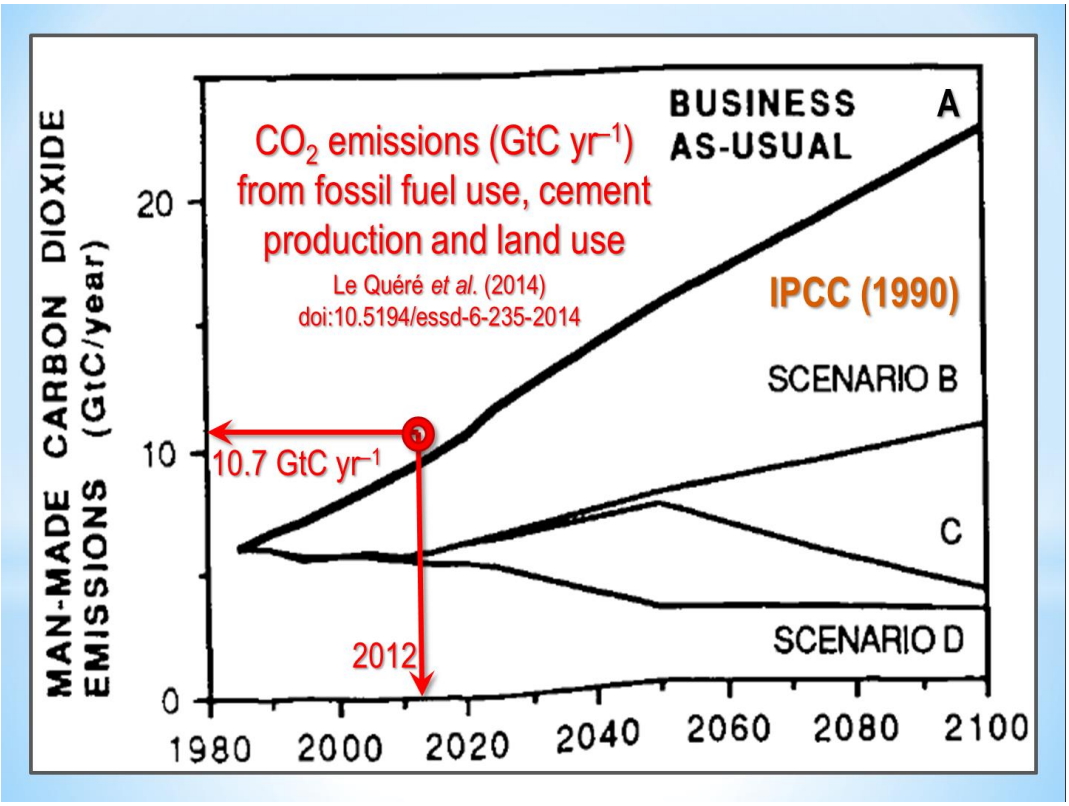


Indeed, the warming trend of one-third of a Celsius degree in 25 years, equivalent to 1.4 C° over a century, which Mr Smith calls a "strong warming trend") is explicitly stated on the graph. That trend is accurately and fairly compared with the IPCC's exaggerated predictions made in 1990.

Mr Smith complains that we have relied on the IPCC's business-as-usual Scenario A from 1990, rather than on other scenarios that envisaged some degree of global emissions control.

The truth: There has been no global emissions control. Mr Smith does not seem to realize this. He says: "Humans have actually been much better than expected at restraining the rate of increase of these pollutants into the atmosphere."

No. CO2 emissions have risen above even IPCC's business-as-usual Scenario A, and well above Scenarios B-D, which show emissions as static or even falling from 1990-2012. Scenario A is the only one that shows emissions rising over the period:

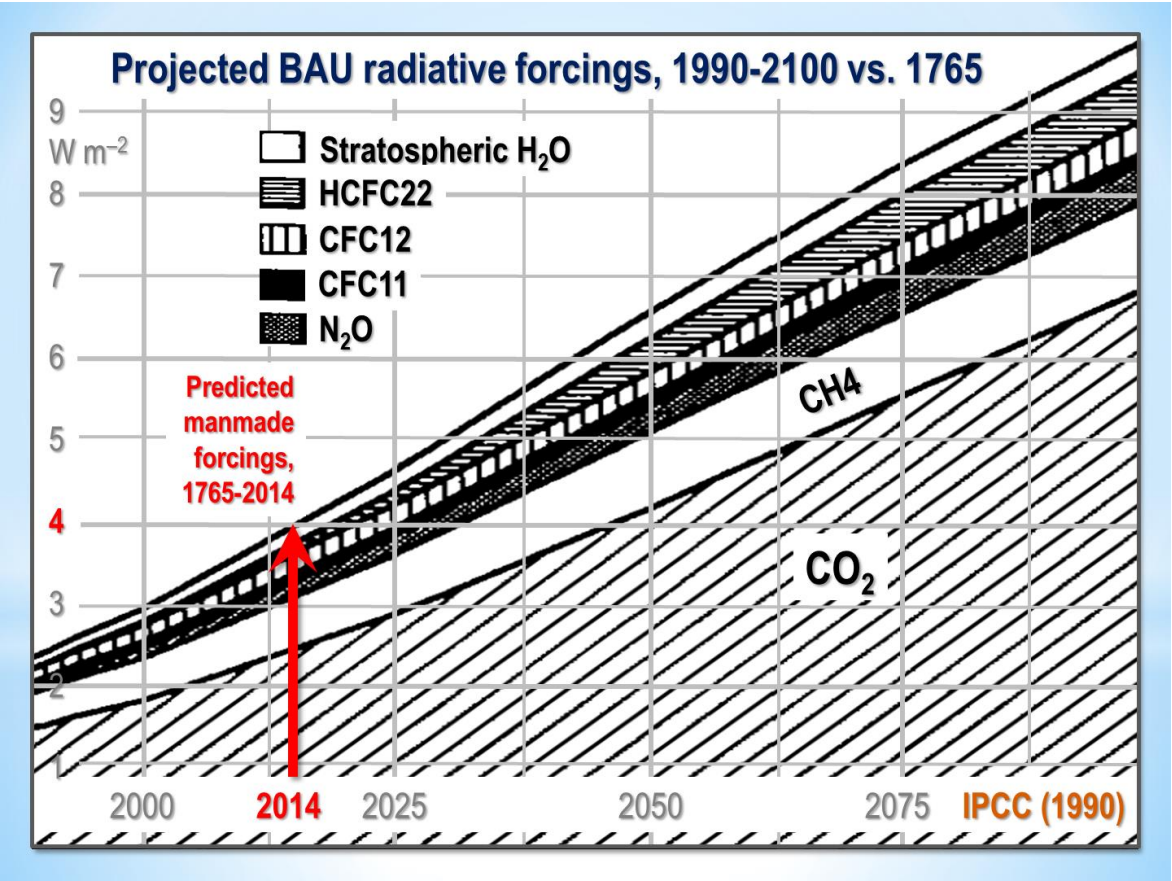


CO2 concentration has continued to rise unchecked because third-world countries like China, India and Brazil are industrializing and will continue to do so. Yet temperature has not performed as the IPCC had predicted with what it described at the time as "substantial confidence". That "substantial confidence" was substantially misplaced.

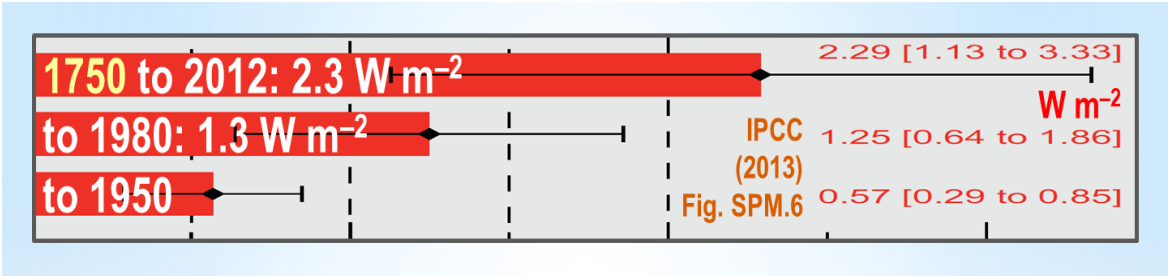
We based our Fig. 1 on Scenario A's statement that there would be 1.0 [0.7, 1.5] C° of global warming from 1990 to 2025. The observed trend is still more greatly at variance with IPCC's projection, also made in 1990, that there would be 1.8 C° warming to 2030.

Mr Smith says the IPCC's range of estimates of Earth's climate sensitivity now is the same as it was 25 years ago and that "the only sense in which climate models have run hot is that the projected forcings were too large.

The truth: IPCC (1990) projected 4 W m^{-2} of manmade radiative forcings by 2014 compared with 1765:



This projection was indeed excessive. IPCC (2013) reduced its estimate of manmade forcings from the onset of the Industrial Revolution to 2012 to just 2.3 W m⁻²:



The IPCC, therefore, had been fundamentally wrong in 1990 to claim "substantial confidence" that the models on which it relied had captured the principal features of the climate system. Though CO2 emissions have risen faster even than the IPCC's business-as-usual Scenario A, the CO2 forcing compared with 1750 is currently thought to have been just 1.9 Wm⁻², which would have caused not more than 0.6 K global warming in the absence of net-positive temperature feedbacks. The IPCC's 1990 forcings of 4 W m⁻² would have caused 1.25 K global warming even in the absence of feedbacks: yet less than 1 K has occurred, of which only 0.7 K has occurred since our influence began in 1950. Whichever way the numbers are done, the IPCC's projections have proven excessive: and it is on the basis of those early projections that the climate scare began.

Mr Smith says our simple model should not have concluded that a reduction in temperature feedbacks should also entail a reduction in climate sensitivity. He says the question of feedbacks is more complicated than our model suggests, involving partial differential equations to handle non-linearity.

The truth is that a temperature feedback is itself a radiative forcing, whose magnitude is dependent upon the temperature change that triggered it. A lower temperature feedback means less forcing, and that in turn means less warming. At equilibrium, there is no need for partial differential equations: one is concerned about the total forcings and feedbacks that have acted and the consequent warming. The question of non-linearity in feedbacks was addressed in our Appendix.

Mr Smith challenges our conclusion that the climate of the past 800,000 years has shown far too little variability in global temperature to give any credence to the application of the Bode equation to feedbacks. It is that equation that produces the exaggerated projections of temperature change relied upon by the IPCC and others. Mr Smith says, "The last 8000 years have been very nice and quiet, climatically, but there's plenty of evidence recent climate was not Earth's normal state."

The truth: Our paper produced evidence from the reviewed literature that temperature variability not over 8000 but over 800,000 years, encompassing eight ice ages and interglacial warm periods, had been little more than 3 K (or 1% in absolute terms) either side of the long-run mean:

Mr Smith's remark about the past 8000 years also applies over a period longer by two orders of magnitude. He appears not to have noticed that we were talking about 800,000 years, not 8000 years. The self-evident temperature stability of the climate over that long period is indeed a powerful argument against the notion that temperature feedbacks in the climate system are strong enough to approach the singularity in the Bode equation and hence to produce the very high climate sensitivities on which the climate scare is founded.

Mr Smith wonders why we had based our graph of real-world temperature change on the 63-year period since 1950, and accuses us of "cherry-picking".

The truth: It is from 1950 that the IPCC dates our influence on the climate: before then we could not have made much of a contribution to global temperature change. Also, the period since 1950, being close to 60 years, covers a full warming and cooling cycle of the Pacific Decadal Oscillation, removing one of the major distortions that might otherwise have skewed the result.

Mr Smith says that time-dependence in climate modelling "doesn't make a whole lot of sense".

The truth: In fact, since temperature feedbacks are non-linear (requiring some calculus unless one is discussing equilibrium sensitivity), their impact varies over

time and our model included a variable to allow a simple representation of this time-dependence.

Mr Smith says the time-dependence method in our model is too simple, in that one should take account of annual changes in forcing.

The truth: Mr Smith seems to have failed to recall that models determining climate sensitivity avoid the difficulty he describes by studying the transient and equilibrium response to a single, sharp increase in radiative forcing. Mr Smith's objection is, therefore, in truth an objection to the more complex models' simplification. He appears not to appreciate that every model is to some degree a simplification.

Mr Smith says our discussion of "committed but unrealized warming" is "nonsensical".

The truth: Our conclusion is that all of the warming to be expected as a result of our emissions to date has already occurred – indeed, this is a consequence of our assumption that temperature feedbacks are more likely than not to be net-negative. There is nothing "nonsensical" about this. Indeed, there is something nonsensical about the IPCC's assumption that there is some 0.6 K warming "in the pipeline" as a result of our past sins of emission, even though there has been no global warming for up to 18 years.

Mr Smith says our conclusion that instability on the scale mandated by the Bode equation is not possible in the climate is incorrect, and that the singularity in that equation does have a real physical meaning in the climate.

The truth: The singularity in the Bode equation has a real meaning in dynamical systems such as electronic circuits, where the voltage flicks from the positive to the negative rail at the singularity. However, it does not apply to dynamical systems such as the climate, where feedbacks cannot push temperatures towards positive infinity and then an instant later drive temperatures towards negative infinity. Furthermore, in electronic circuits the output (the voltage) plays no part in equilibrating the system, while in the climate the output (the temperature) is the instrument that brings about equilibrium after a radiative imbalance.

Dr Kevin Trenberth, interviewed by the climate-campaigning former science journal *Nature,* sent a statement that makes several questionable points. First, Dr Trenberth says that the opening of our paper is "Very misleading" in that "IPCC does not make predictions [as we had said]: they have made scenario-dependent projections and early projections in the *First Assessment Report* [1990] were of just unrealistic GHG scenarios. The paper completely misrepresents IPCC in this regard."

The truth: On two counts, Dr Trenberth's facts are incorrect. First, the IPCC's 1990 temperature prediction that our paper compared with the far less extreme observed temperature change over the quarter-century from 1990-2015 was preceded in the

IPCC's text by the words "We predict …" Since the IPCC said it was making predictions, we were reasonably entitled to assume that it meant what it said.

Secondly, we compared the real-world temperature change since 1990 with the IPCC's then Scenario A, which it had itself stated was its "business-as-usual" scenario. It is worth again reproducing the IPCC's own presentation of the annual CO2 emissions growth, compared with the observed emissions growth. It will be seen that we had correctly and reasonably chosen Scenario A. In fact, that Scenario A had predicted a little less CO2 emissions growth than has actually occurred, and yet global temperature has risen since 1990 at less than half the rate that the IPCC had predicted under Scenario A with what it called "substantial confidence".

Dr Trenberth says our model fails to allow for the fact that large changes in climate can occur even if the radiative forcings change very little.

The truth: Our model supplies a new term for the fraction of expected equilibrium warming that will have occurred by a given year. This term may be adjusted at will by means of an array variable so that any profile of temperature response can be modeled. Since the model is irreducibly simple, there would have been no great value in adding further complexities to it.

Dr Trenberth describes our conclusion that there is no "in-the-pipeline" global warming yet to emerge as a result of our past sins of emission as "ludicrous" and as a "what-if statement without justification", on the ground that our conclusion is "totally at odds with the heat capacity and response of the ocean". Once again, on multiple grounds Dr Trenberth has his facts wrong. First, if he had read our paper before rushing to comment on it he would have been aware that we had provided a detailed justification for our conclusion that there is no global warming that would occur even if we now stopped emitting CO2. He might perhaps legitimately have questioned our justification on some scientific ground or another, but on any view his factually-incorrect statement that we had not provided any justification for our conclusion was unscientific.

Secondly, the climate system consists of an atmosphere sandwiched between two near-infinite heat-sinks: outer space above and the ocean below. The mean density of the ocean is some three orders of magnitude greater than that of the atmosphere in which warming takes place. If Man's extremely sparse measurements of changes in oceanic temperature are correct (each ARGO bathythermograph buoy has to cover some 3 million km^3 of ocean, so the coverage uncertainty is enormous), the oceans and the atmosphere have been warming at a rate equivalent to 0.15-0.2 K/century. It would certainly be surprising if the upper ocean had warmed at a rate markedly different from the atmosphere to which it is so intimately adjacent.

Dr Trenberth says he thinks Man's contribution to global warming is "greater than the observed value, because natural variability has recently suppressed warming at the surface".

The truth: We had expressly considered Dr Trenberth's notion in the supplementary matter annexed to our paper. If Dr Trenberth had read it, he would have realized that we had shown that the handful of papers advocating Dr Trenberth's notion had been roundly rebutted in the journals.

Dr Trenberth says our paper "ignores all of the literature related to the recent hiatus in warming related to small effects from missing forcings (mainly volcanoes) and natural variability, especially PDO and consequential burying heat in the ocean".

The truth: If Dr Trenberth had read our paper and its associated supplementary matter, he would have realized that we had listed and considered some 24 papers each advocating different and mutually incompatible reasons for the failure of global temperatures to rise as predicted or, in the recent decade or two, at all. We had thus demonstrated that there is no agreement as to the reason why warming has not occurred as ordered, and had also used our model to demonstrate that one possible reason why the predicted warming is not occurring is that the complex general-circulation models are greatly overestimating climate sensitivity.

The truth: As Dr Trenberth would have discovered if he had read our paper and its supplementary material, we were able to demonstrate that the evidence in the journals against the notion that the "missing heat" of which he has so often spoken is hiding in the abyssal strata of the ocean is compelling. Only a few papers had advocated his ocean notion, and they had been roundly rebutted in subsequent papers, some of them by members of the Chinese Academy of Sciences, in whose journal our paper was published.

Dr Trenberth says we had ignored the fact that 2014 was the "warmest on record".

The truth: If Dr Trenberth had even begun to read our paper before presuming to pronounce upon it, he would have realized that it is prefaced with the following statement by the *Science Bulletin:* "Received 27 August 2014 • Accepted 12 November 2014".

In the United Kingdom, at any rate, 2014 did not end until 31 December, and the records of global temperature change were not available until some weeks after our paper had been published in the first issue of *Science Bulletin* for January 2015.

Furthermore, Dr Trenberth would have been less intellectually dishonest if he had been willing to admit that on the two satellite temperature datasets 2014 was far from being the warmest year on record; that on two of the three terrestrial datasets 2014 might or might not have been the warmest; that the record is only 150 years long; that at least two-thirds of the 11,700 years since the end of the last Ice Age were warmer than the present; and that it is now self-evident that the rate at which the world is warming is a very long way below what the IPCC had predicted in 1990 when launching the climate scare.

Conclusion: The supporters of official climate science are unscientific

In the corporate and financial worlds, economies with the truth such as those evident in the comments of the climate-extremist "scientists" whose responses we have seen would be severely punished. The misrepresentations, the outright falsehoods, the misquotations, the incomplete quotations, the unproven assertions, the venomous eagerness to criticize a paper before it had even been read, the fallacious appeals to authority: these and multiple other instances of research misconduct are evident in the scientists' comments on our paper. They would not be tolerated outside the privileged groves of academe.

The cost of the climate deception to taxpayers runs to the tens of billions a year. It has been called the biggest fraud in history. So far, the perpetrators have proven untouchable.

It is not for us to say whether the "scientists" whose untruths, errors and departures from scientific method we have exposed here were fools or knaves or both. However, allowing the UN to establish an unelected, unaccountable, all-powerful global climate tyranny at Paris in December 2015 on the basis of science as shoddy, threadbare and unprincipled as theirs would be a costly and – as our reviewed paper at www.scibull.com establishes – entirely unnecessary mistake.