

# Climate Coup—The Science

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*We check the climate models against our best and latest data. They got all their major predictions wrong—air temperatures, oceans temperatures, atmospheric warming patterns, and outgoing radiation.*

*This article is the science foundation for "[Climate Coup—The Politics](#)".<sup>1</sup>*

*Dr David M.W. Evans, 29 Feb 2012 (last change 16 Aug 2012), latest pdf [here](#)*

## Introduction

Our emissions of carbon dioxide cause some global warming, and it has indeed warmed over the last century. But this doesn't prove that our emissions are the *main* cause of that warming—there might be other, larger, natural forces on the temperature. The key question is: *how much* warming do our emissions cause?

Climate scientists use their climate models to estimate how much. In this article we check their main predictions against our best and latest data, and find they got them all wrong: they exaggerated the warming of the air and oceans, they predicted a very different pattern of atmospheric warming, and they got the short-term relationship between outgoing radiation and surface warming backwards. The latter two items are especially pertinent, because they show that the crucial amplification due to the water feedbacks (mainly humidity and clouds), that is assumed by the models, does not exist in reality. This amplification causes two-thirds of the temperature rises predicted by the models, while carbon dioxide only directly causes one third. This explains why the models overestimate temperature rises.

We check the performance of the climate models against impeccably sourced, publicly-available data from our best and latest instruments. See the endnotes for how to download the data yourself.

## Checking the Theory of Manmade Global Warming Against the Data

The theory of manmade global warming is that the world has been warming for the last few decades, that this is almost entirely due to our emissions of carbon dioxide (CO<sub>2</sub>)<sup>2</sup>, and that the warming by 2100 will be a dangerous 3–4°C.

The theory is embodied in the climate models, which are used to predict the future climate. We will now check their predictions against the best and latest global data, collected by our most sophisticated instruments. The climate models have been essentially the same for almost 30 years now, maintaining roughly the same sensitivity to extra CO<sub>2</sub> even while they became more detailed as computer power increased.<sup>3</sup> So it is fair to compare their predictions from over two decades ago with what subsequently happened.

**Warning, forbidden data:** The data in this article is impeccably sourced, from our best instruments, and is publicly available. Yet none of it has appeared in the mainstream media, ever, anywhere in the world.<sup>4</sup> This observation leads into the political argument in [Climate Coup—The Politics](#). As you look at the data, ask yourself whether it is relevant and whether the media should withhold it from us.

## Air Temperatures

The best sources of air temperature data are the satellites.<sup>5</sup> They circle the earth 24/7, measuring the air temperature above broad swathes of land and ocean, covering all of the globe except near the poles, and are unbiased. Satellite measurements started in 1979; early problems with calibration have long since been resolved to everyone’s satisfaction. The data presented here comes from NASA satellites and is managed at the University of Alabama Huntsville (UAH).<sup>6</sup> This is an impeccable source of data, and you can easily download the data yourself<sup>7</sup>. The data is currently collected from this satellite:

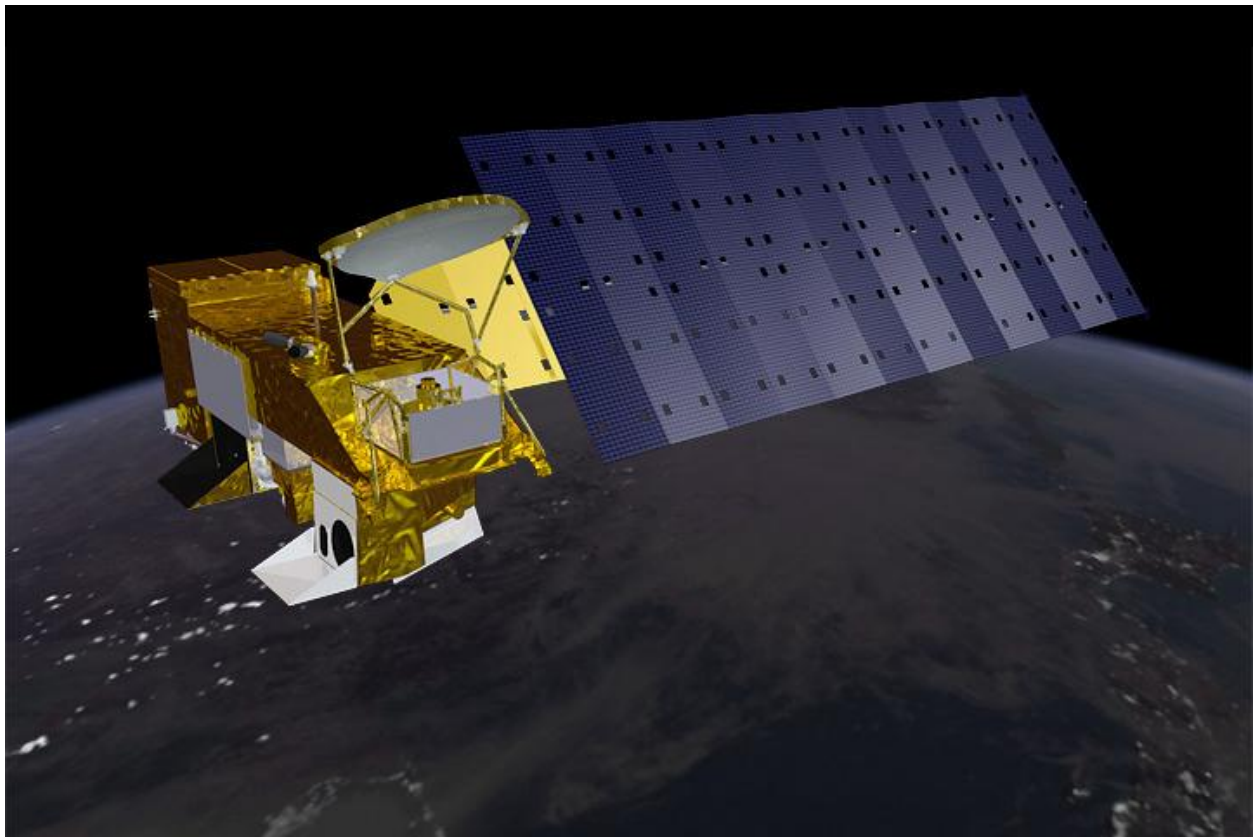


Figure 1: NASA's Aqua satellite<sup>8</sup>, measuring air temperature since 2002.

One of the earliest and most politically important predictions was presented to the US Congress in 1988 by Dr James Hansen, the “father of global warming”:



Figure 2: Dr James Hansen before Congress in 1988<sup>9</sup>, giving his predictions about air temperatures, and before the White House in 2011<sup>10</sup>, being arrested at a protest against an oil pipeline (since vetoed by President Obama).

Here are his three predicted scenarios, taken from his peer-reviewed paper in 1988<sup>11</sup> and re-graphed against what the NASA satellites subsequently measured (all starting from the same point in mid-1987):

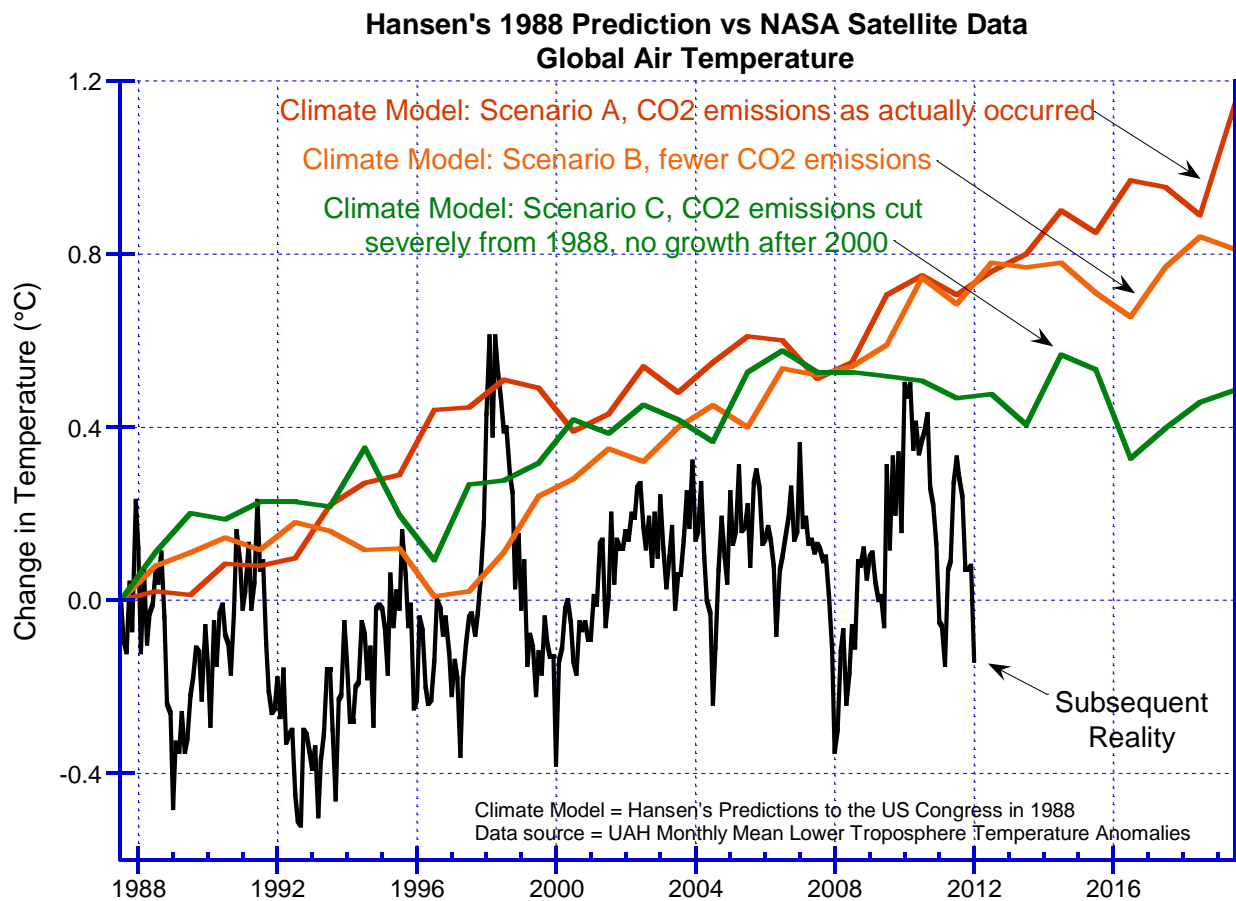


Figure 3: Hansen's predictions to the US Congress in 1988, versus air temperatures as measured by NASA satellites.

Hansen's climate model clearly exaggerated future temperature rises.

In particular, look at his scenario C, which is what his climate model predicted would happen if human CO<sub>2</sub> emissions were cut back drastically starting in 1988, such that by year 2000 the CO<sub>2</sub> level was no longer rising. In reality the temperature is below his scenario C prediction even though our CO<sub>2</sub> emissions continued to increase—which suggests that the climate models greatly overestimate the warming effect of our CO<sub>2</sub> emissions.

A more considered prediction by the climate models (and the earliest that cannot be wiggled out of) was made in 1990 in the IPCC's First Assessment Report:<sup>12</sup>

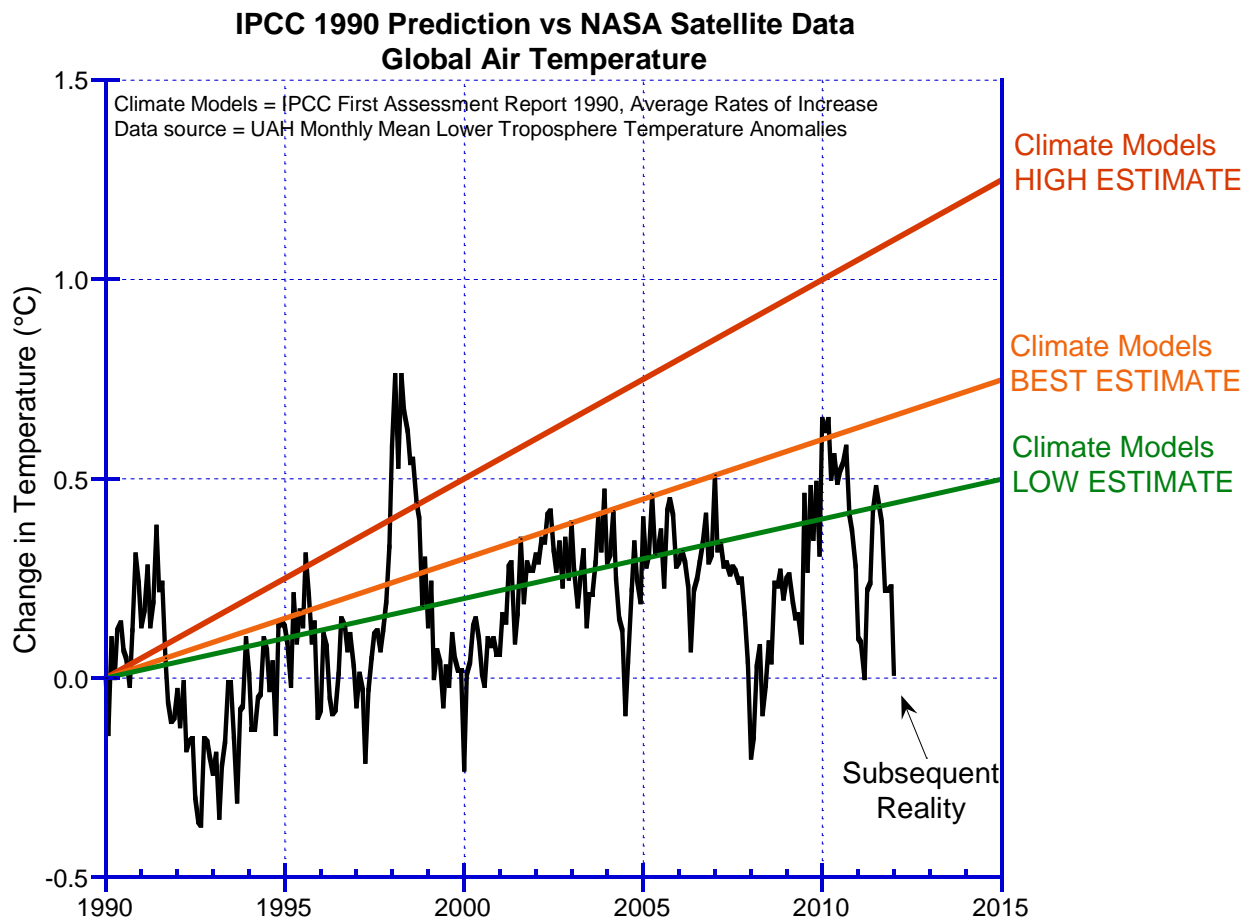


Figure 4: Predictions of the IPCC's First Assessment Report in 1990, versus air temperatures as measured by NASA satellites.

After 21 years, the real-world warming trend is below the lowest IPCC prediction.

## Ocean Temperatures

The oceans hold the vast bulk of the heat in the climate system. We've only been measuring ocean temperature properly since mid-2003, when the Argo system became operational.

Ocean temperature measurements before Argo are nearly worthless. They were made with buckets, or with bathythermographs (XBTs)—expendable probes that fall through the water, transmitting data back along a pair of thin wires. Nearly all measurements were from ships along the main commercial shipping lanes, so geographical coverage of the world’s oceans was very poor—for example the huge southern oceans were barely monitored. XBT data is much less precise and much less accurate than Argo data—for one thing, they move too quickly through the water to come to thermal equilibrium with the water they are trying to measure.

Argo buoys duck dive down to 2,000 meters, measuring temperatures as they slowly ascend, then radio the results back to headquarters via satellite. Over 3,000 Argo buoys constantly patrol all the oceans of the world.

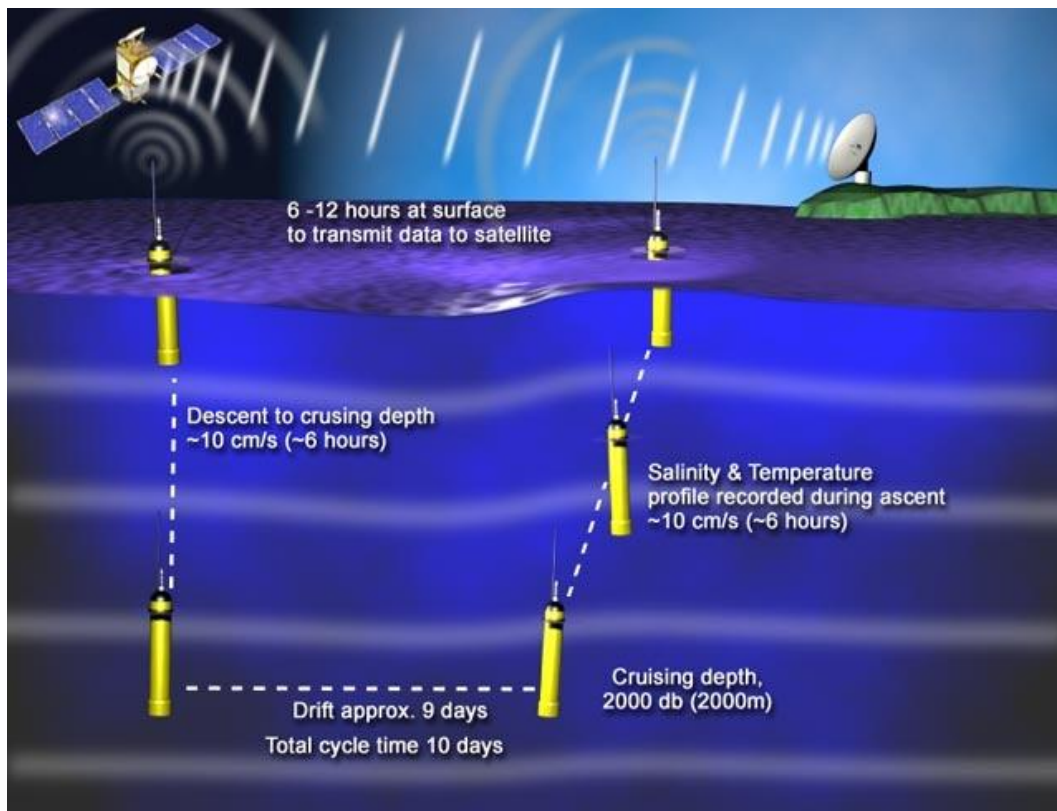


Figure 5: Each Argo buoy measures ocean temperature down to 2,000m every 10 days.<sup>13</sup>

The ocean heat content down to 700m as measured by Argo is now publicly available, and you can easily download the data yourself.<sup>14</sup> Ocean heat content is measured in units of  $10^{22}$  Joules, which corresponds to a temperature change of about  $0.01^{\circ}\text{C}$ . The climate models project ocean heat content increasing at about  $0.7 \times 10^{22}$  Joules per year.<sup>15</sup>

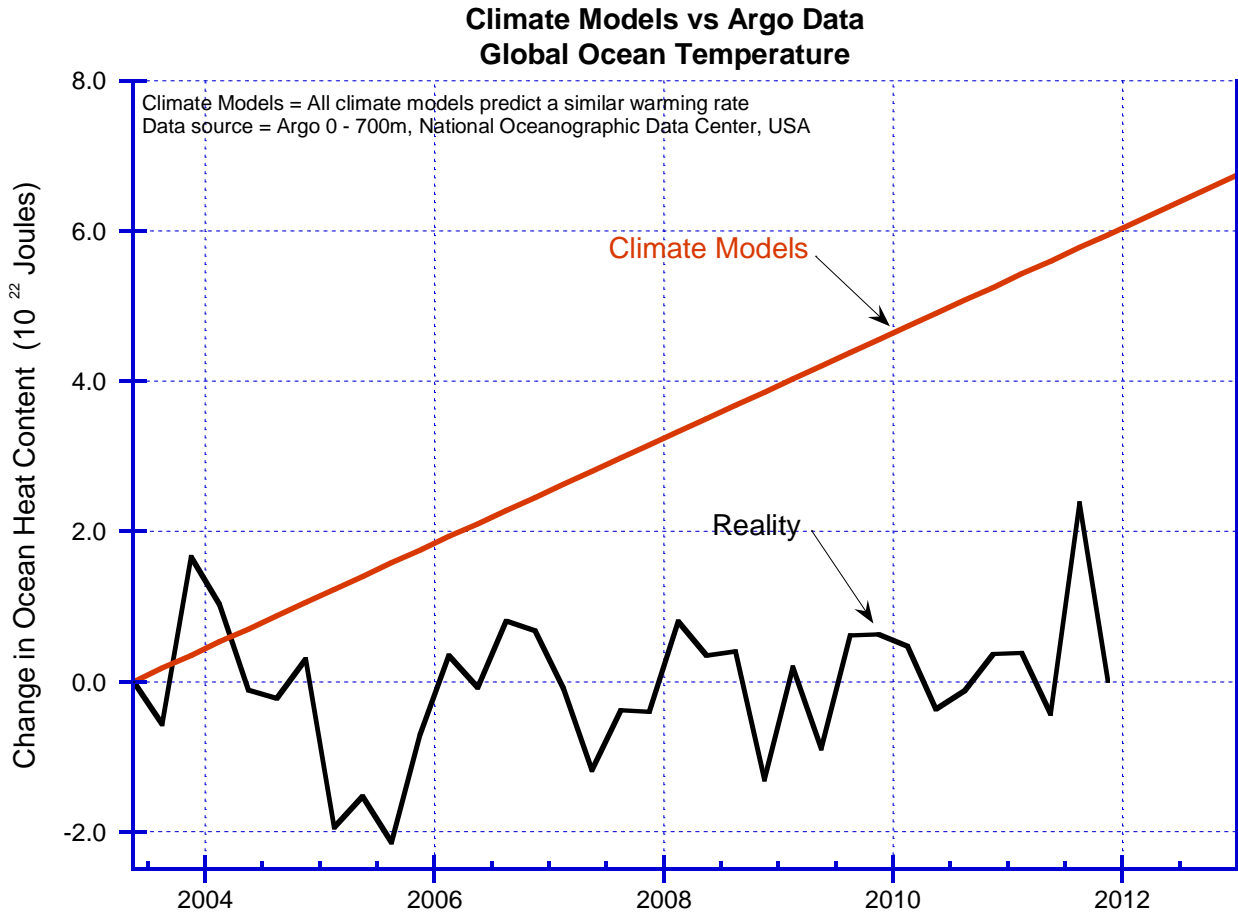


Figure 6: Climate model predictions of ocean temperature, versus the measurements by Argo.

The ocean temperature has been basically flat since we started measuring it properly. It has not been warming as quickly as the climate models predict.

Sea level measurements confirm what Argo is telling us. Sea levels are best measured by satellites, and later satellites are better at making those measurements. The European Space Agency's Envisat is the newest satellite that has been up long enough to establish a trend:



Figure 7: Envisat, by the European Space Agency, was launched in 2002 and measures sea levels.<sup>16</sup>

The satellite sea level data is nicely presented by Aviso<sup>17</sup>; they even make the graphs for you:

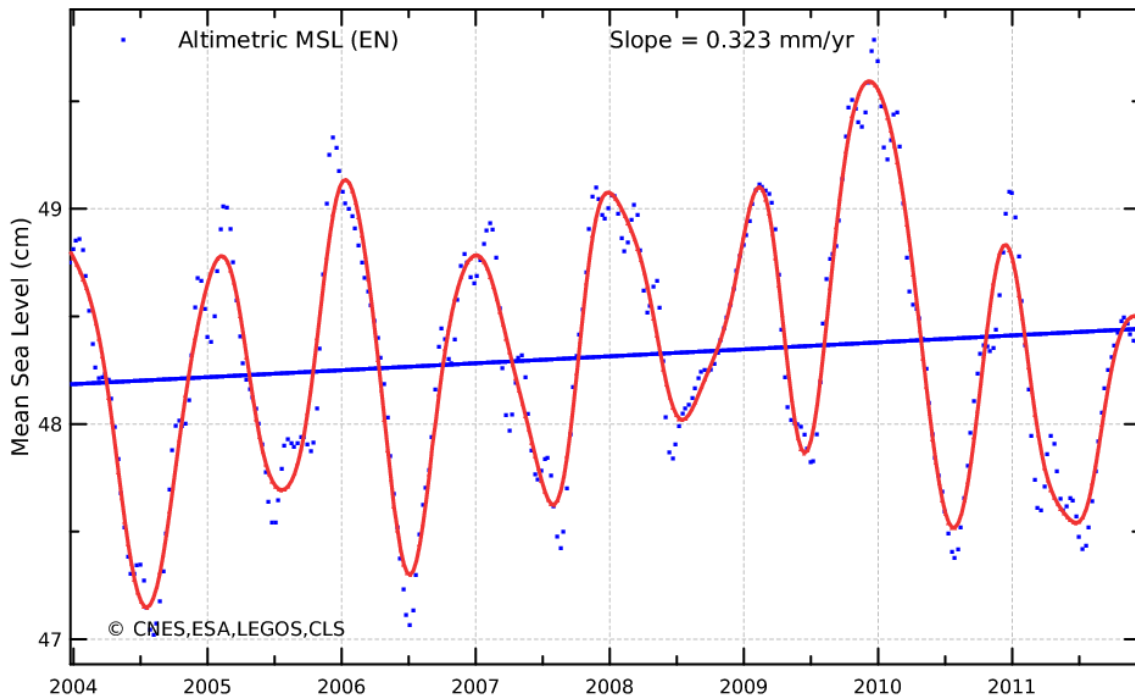


Figure 8: Sea level for the last eight years, as measured by the Envisat satellite (without any adjustment by models).<sup>18</sup> The average rise is 0.323 mm per year, a rate of 3.23 cm (1.3 inches) per century.

The average sea level rise since 2004 is about 0.33 mm per year, or about 3.3 cm (1.3 inches) per century, which confirms the Argo message that the oceans haven't warmed recently. In contrast, the IPCC in 2007 predicted a sea level rise of 26 to 59 cm by the end of the century if our CO<sub>2</sub> emissions continue unabated<sup>19</sup>, and Al Gore suggested in his movie that we might see a rise of 20 feet and half of Florida underwater.

### Atmospheric Hotspot

The climate models predict a particular pattern of warming in the atmosphere during periods of global warming; the most prominent change they predict is a warming in the tropics about 10 km up, the so-called "hotspot".

We have been measuring the temperature in different parts of the atmospheric with weather balloons since the 1960s. Many millions of weather balloons<sup>20</sup> have built up a good picture of the pattern of atmospheric temperature changes over the last few decades, including the warming period from the late 1970's to the late 1990's.



Figure 9: A weather balloon launch (NOAA).<sup>21</sup>

This important and pivotal data was not released publicly by the government climate scientists until 2006, and then in an obscure place.<sup>22</sup> Here it is, compared to the models:



## Atmospheric Warming 1979 - 1999

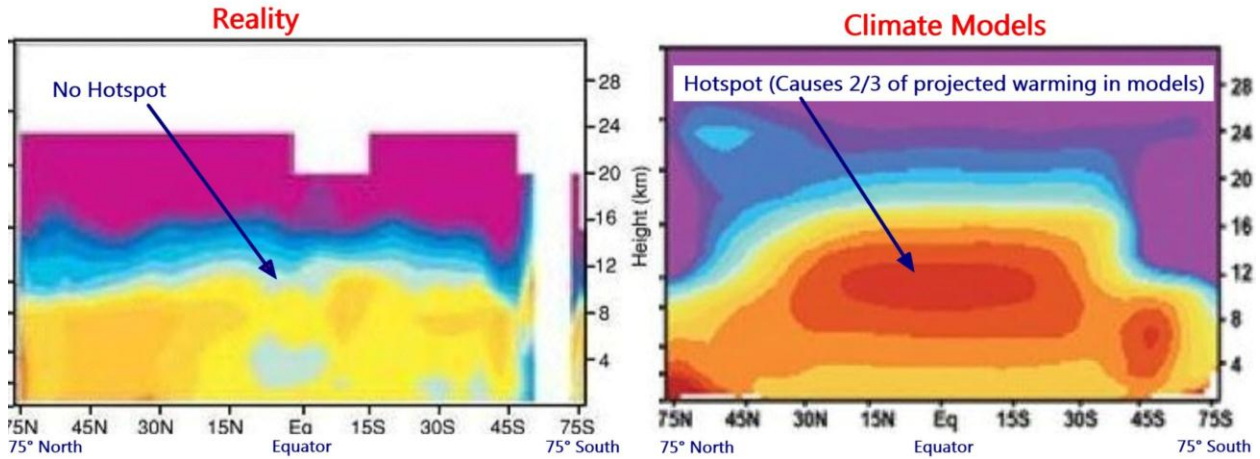


Figure 10: On the left is the data collected by millions of weather balloons. On the right is what the climate models say was happening.<sup>23</sup> In both diagrams the horizontal axis shows latitude, and the right vertical axis shows height in kilometers.

In reality there was no hotspot, not even a small one. The climate models' understanding of what is going on is clearly incompatible with the data: their prediction of a hotspot was completely wrong.

### Outgoing Radiation

The climate models predict that when the surface of the earth warms, *less* heat is radiated from the earth into space (on a weekly or monthly time scale). Satellites have been measuring the radiation emitted from the earth for the last two decades.

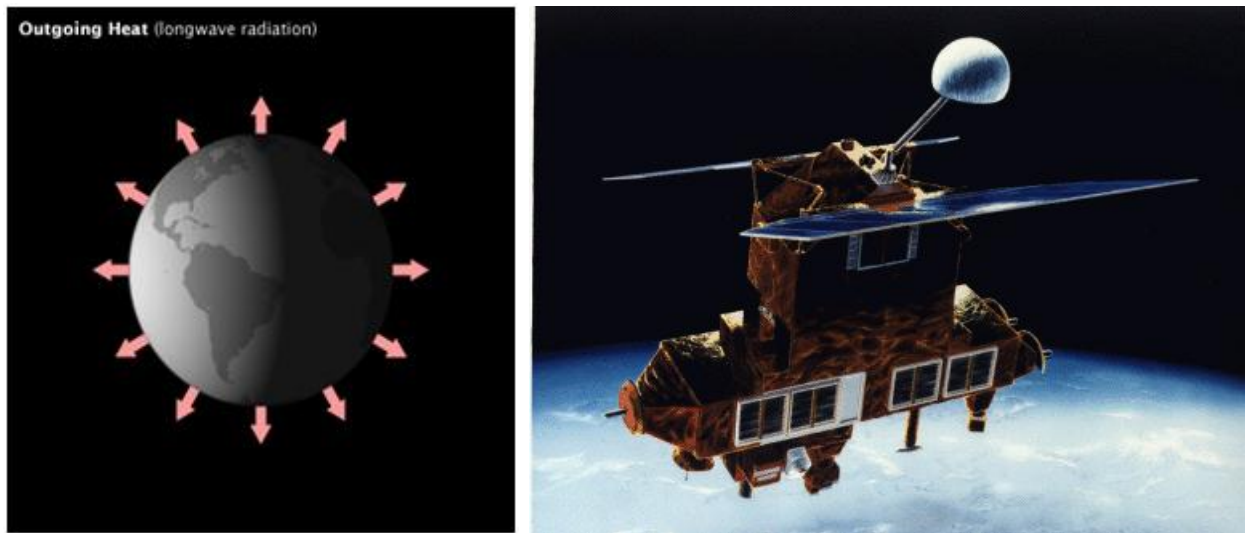


Figure 11: Outgoing radiation is heat radiated by the earth into space.<sup>24</sup> It has been measured since the 1980's by NASA satellites carrying the ERBE instruments (ERB = Earth Radiation Budget); this is NASA's ERBS satellite.<sup>25</sup>

A major study has linked the changes in temperature on the earth's surface with the changes in the outgoing radiation. Here are the results:

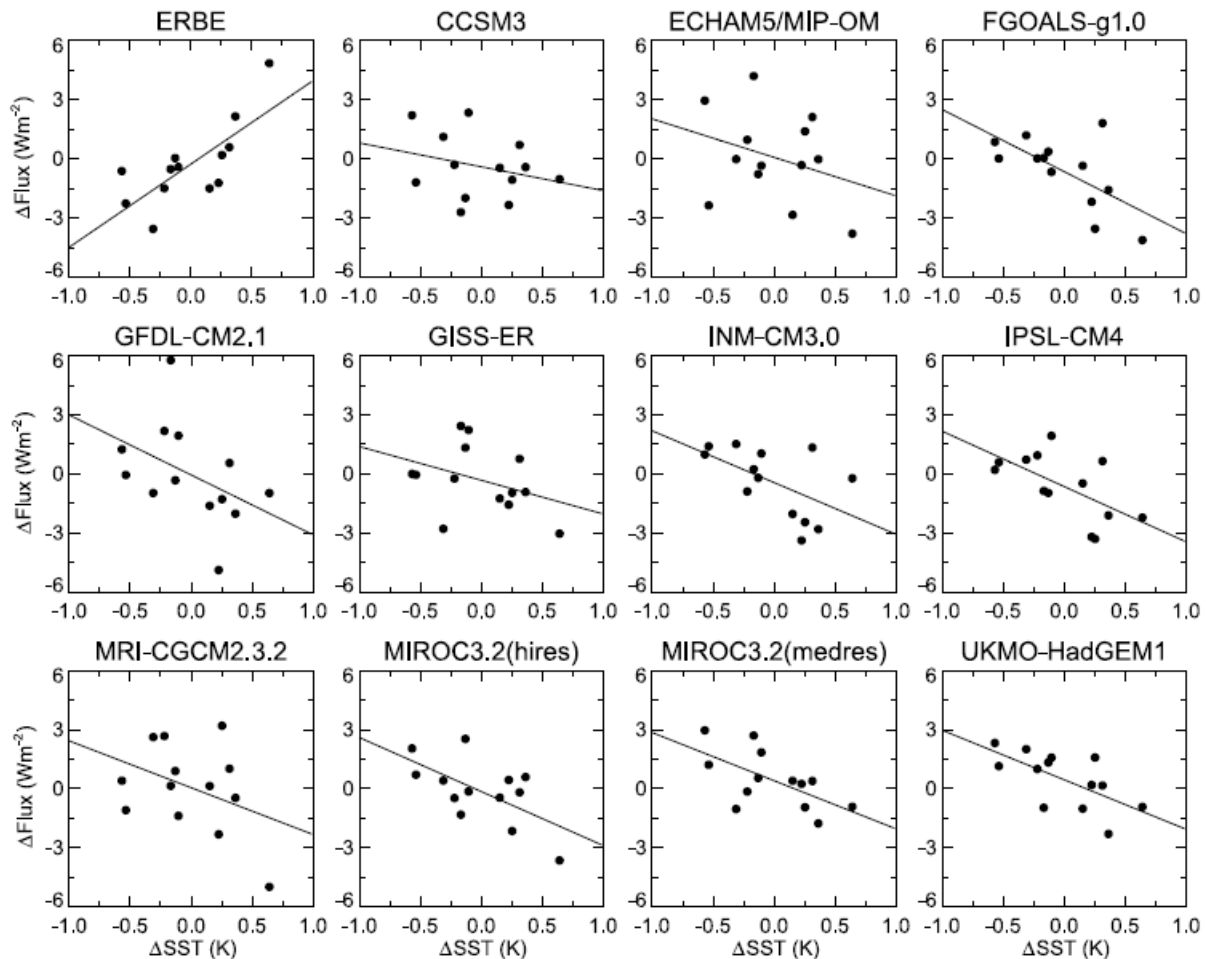


Figure 12: Outgoing radiation from earth (vertical axis) against sea surface temperature (horizontal), as measured by the ERBE satellites (upper left graph) and as “predicted” by 11 climate models (the other graphs).<sup>26</sup> Notice that the slopes of the graphs for the climate models are opposite to the slope of the graph for the observed data.

The data shows that in reality the earth gives off *more* heat when its surface is warmer. This is the opposite of what the climate models predict; the climate models get it the wrong way around.

## The Structural Flaw in the Climate Models

We have checked the climate models against the best data and found them wrong or exaggerated in all their major predictions. Finally, it is important to get a little technical and see why they are wrong, how it is due to a bad guess about the effect of the water feedbacks and *not* about our understanding of the direct effect of CO<sub>2</sub>.

Here is the basic structure of all the climate models, simplified enough for the back of an envelope:

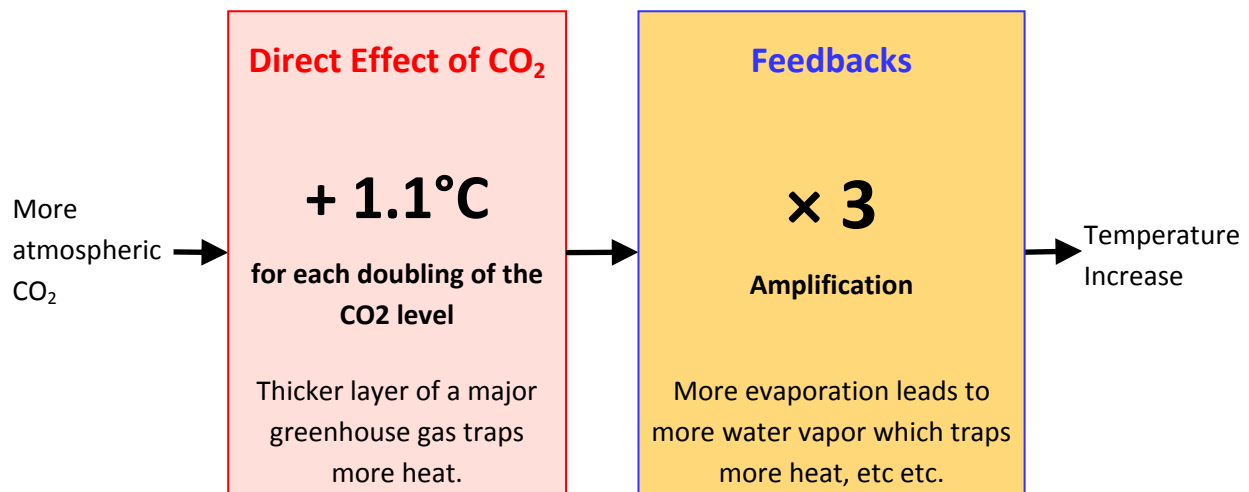


Figure 13: The back-of-the-envelope view of the climate models. If the CO<sub>2</sub> level doubles (it is on course to double the pre-industrial level by 2070 to 2100), the total temperature increase due to that extra CO<sub>2</sub> will be about  $1.1^{\circ}\text{C} \times 3 = 3.3^{\circ}\text{C}$ .<sup>27, 28</sup>

The direct effect of CO<sub>2</sub> is well-established physics, based on laboratory results, and known for over a century: each time the concentration of atmospheric CO<sub>2</sub> doubles, it warms up the planet’s surface by about 1.1°C because of the extra heat trapped by the extra CO<sub>2</sub>.<sup>29</sup> This is agreed upon by the government climate scientists and all serious skeptical scientists.

Then come the feedbacks. The Earth reacts to the direct warming effect of the CO<sub>2</sub> in many ways that further influence the temperature. Each way is called a “feedback”, and there are literally thousands of feedbacks, each of which individually reinforces or counteracts the direct warming effect of the extra CO<sub>2</sub>. But there is one group of feedback that is much stronger and more important than the others, the feedback involving water in all its forms—water, water vapor (humidity), clouds, rain, lapse rate, etc.<sup>30</sup> The only fundamental disagreement between the government climate scientists and the skeptics is about the effect of the water feedbacks.

In the climate models, the water feedbacks amplify the direct warming effect of the CO<sub>2</sub> by a factor of about three, that is, they triple the warming directly due to CO<sub>2</sub>. Put another way, two thirds of the predicted warming in the climate models is due to the water feedbacks, only one third is directly due to CO<sub>2</sub>. This threefold amplification is built into all the climate models.<sup>31</sup>

The reasoning is that extra CO<sub>2</sub> will cause more surface warming, which will cause more evaporation from the oceans, leading to extra water vapor in the atmosphere, which in turn will lead to even more heat trapping—because water vapor is the main greenhouse gas. The “feeding back” upon itself is apparent when you notice that this extra heat trapping will cause even more surface warming, and thus even more evaporation, and so on.

The government climate scientists estimated the amount of amplification in about 1980 by *assuming* that nearly all the warming since 1750 is due to our CO<sub>2</sub> emissions.<sup>32</sup> We know the increases in CO<sub>2</sub> levels and in global temperature since then; if the global temperature increase is to be nearly all due to

the increased CO<sub>2</sub> levels, then threefold amplification by the feedbacks is required. Thus the amplification by the water feedbacks in the models is due to an assumption, a guess about changing forces on the planet's temperature. You will see immediately that if other forces on the global temperature were in fact changing after 1750, then the estimate of threefold amplification is wrong.

What does the data say? The atmospheric hotspot is caused by the amplifying feedbacks—it is due to extra evaporation and condensation, mainly in the tropics, and by extra water vapor pushing the warmer wetter lower troposphere up into volume previously occupied by cool dry air. The presence of a hotspot would indicate amplification is occurring, and vice versa. However the data in Figure 10 shows there is no hotspot in reality, which proves that the water feedback are not in fact amplifying.<sup>33</sup>

The outgoing radiation data confirms this. In the climate models, the outgoing radiation decreases (on a weekly or monthly timescale) with surface temperature because of the water feedbacks—the extra surface warming causes more evaporation and thus more water vapor and more heat trapping. The data in Figure 12 shows that the opposite occurs, that the models are much too aggressive in trapping heat, that the water feedbacks in fact work in the other direction.

The skeptic's view is compatible with the data:

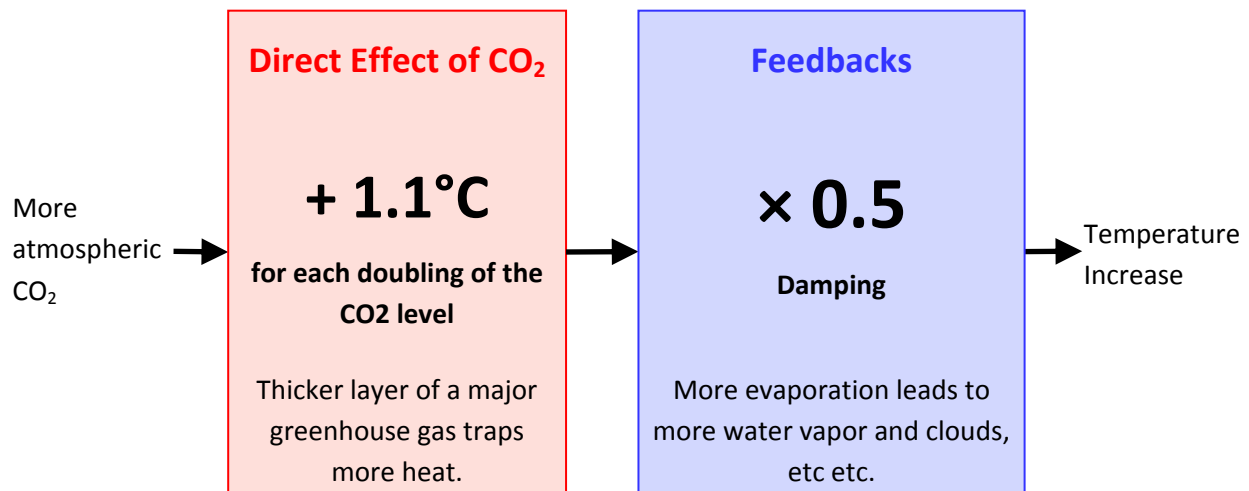


Figure 14: The skeptic's back-of-the-envelope. If the CO<sub>2</sub> level doubles, skeptics estimates that the temperature increase due to that extra CO<sub>2</sub> will be about  $1.1^{\circ}\text{C} \times 0.5 \approx 0.6^{\circ}\text{C}$ .<sup>34</sup>

The only difference is that the skeptics see the feedbacks as net damping, counteracting about half the direct effect of the CO<sub>2</sub>. (The effect of feedbacks is hard to pin down with empirical evidence because there are more forces affecting the temperature than just changes in the CO<sub>2</sub> level, but seems to be multiplication by something between 0.2 and 0.9. We have used 0.5 here for simplicity.) The skeptic's reasoning on the water feedbacks is the same, except that they continue it one more step: the extra water vapor causes extra clouds, which cause cooling because they reflect incoming sunlight back into space.

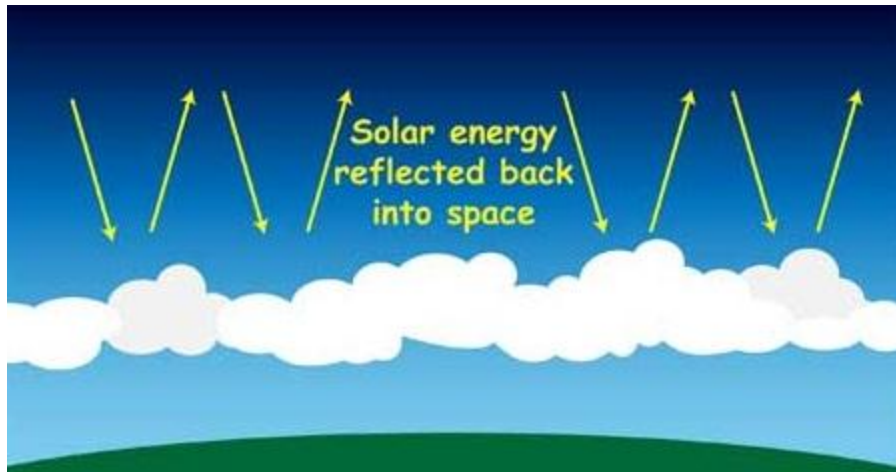


Figure 15: Extra CO<sub>2</sub> causes a warmer surface, more evaporation, more water vapor, and thus more clouds—and clouds reflect sunlight into space, cooling the planet and counteracting some of the surface extra heat due to the extra CO<sub>2</sub>.<sup>35</sup>

The skeptics point out that the world has been warming since the depth of the Little Ice Age in 1680, at a roughly steady rate of 0.5°C per century, with alternating periods of 25–30 years of cooling and warming imposed on top.<sup>36</sup> This is clear evidence of changes in other forces acting on the planet’s temperature since 1750, which invalidates the government climate scientists’ estimate of the amplifying feedbacks.

## Science Summary

We’ve checked all the main predictions of the climate models against the best data:

Test	Climate Models
Air temperatures from 1988	Actual rise was less than the rise predicted for drastic cuts in CO <sub>2</sub>
Air temperatures from 1990	Over-estimated trend rise
Ocean temperatures from 2003	Greatly over-estimated trend rise
Atmospheric hotspot	Completely missing → water feedbacks not amplifying
Outgoing radiation	Opposite to reality → water feedbacks not amplifying

The climate models get them all wrong. The missing hotspot and outgoing radiation data both, independently, prove that the amplification in the climate models is not present. Without the amplification the climate model temperature predictions would be cut by at least two thirds, which would explain why they overestimated the recent air and ocean temperature increases.

## About the Author

Dr David M.W. Evans consulted full-time for the Australian Greenhouse Office (now the Department of Climate Change) from 1999 to 2005, and part-time 2008 to 2010, modeling Australia’s carbon in plants,

debris, mulch, soils, and forestry and agricultural products. Evans is a mathematician and engineer, with six university degrees including a PhD from Stanford University in electrical engineering. The area of human endeavor with the most experience and sophistication in dealing with feedbacks and analyzing complex systems is electrical engineering, and the most crucial and disputed aspects of understanding the climate system are the feedbacks. The evidence supporting the idea that CO<sub>2</sub> emissions were the main cause of global warming reversed itself from 1998 to 2006, causing Evans to move from being a warmist to a skeptic. Of course, in science, it is only the credibility of the data that counts—so the credibility of the messenger is irrelevant when you can check the data yourself (see the endnotes).

Inquiries to [david.evans@sciencespeak.com](mailto:david.evans@sciencespeak.com).

The sister article of this article, called “Climate Coup—The Politics”, is at [jonova.s3.amazonaws.com/guest/evans-david/climate-coup-politics.pdf](http://jonova.s3.amazonaws.com/guest/evans-david/climate-coup-politics.pdf).

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<sup>1</sup> [jonova.s3.amazonaws.com/guest/evans-david/climate-coup-politics.pdf](http://jonova.s3.amazonaws.com/guest/evans-david/climate-coup-politics.pdf)

<sup>2</sup> And other minor greenhouse gases such as methane. For simplicity we just refer to CO<sub>2</sub> here.

<sup>3</sup> [wattsupwiththat.com/2012/03/07/under-the-radar-the-nas-report/#more-58606](http://wattsupwiththat.com/2012/03/07/under-the-radar-the-nas-report/#more-58606)

<sup>4</sup> As far as I know. The Internet skeptics would very likely have noticed and commented if it had occurred.

<sup>5</sup> All our air temperature measurements come from either satellites or land thermometers (the latter sometimes augmented with a few ocean thermometers). Land thermometers have problems with placement, both with being near local heat sources and with inadequate and uneven coverage of the planet. The official land thermometers are often located in the warm exhaust of air conditioning outlets, over hot tarmac at airports where they get blasts of hot air from jet engines, at waste-water plants where they get warmth from decomposing sewage, or in hot cities choked with cars and buildings. Global warming is measured in 10ths of a degree, so any extra heating nudge is important. In the United States, nearly 90% of official thermometers surveyed by volunteers violate official siting requirements that they not be too close to an artificial heating source. The global air temperature records that rely mostly or wholly on the land thermometers include HadCRUT (Hadley Center and the Climate Research Unit at East Anglia University in England), GISS (Goddard Institute of Space Studies, part of NASA) or GISTEMP, and NCDC (National Climatic Data Center, in the US). These three sources each get most of their raw data from the same land thermometers—but arrive at significantly different results, which tells you that the processing and assumptions used to construct a global temperature from a patchwork of land thermometers are crucial to the results. For more details, such as photos of land thermometers and the difference it makes to the recorded temperatures, see [jonova.s3.amazonaws.com/corruption/climate-corruption.pdf](http://jonova.s3.amazonaws.com/corruption/climate-corruption.pdf) by the same author.

<sup>6</sup> There are two sources of satellite air temperatures. One is UAH (presented in this article) and the other is RSS (Remote Sensing Systems). These two agree with each other; it matters not which one you use. Compare them at [www.junksciencearchive.com/MSU\\_Temps/RSSglobe.html](http://www.junksciencearchive.com/MSU_Temps/RSSglobe.html), [www.junksciencearchive.com/MSU\\_Temps/RSSglobe.html](http://www.junksciencearchive.com/MSU_Temps/RSSglobe.html).

<sup>7</sup> Download the data from [vortex.nsstc.uah.edu/data/msu/t2lt/uahncdc.lt](http://vortex.nsstc.uah.edu/data/msu/t2lt/uahncdc.lt). The numbers in the “Globe” column are the changes in Global Monthly Mean Lower Troposphere Temperatures in °C.

<sup>8</sup> Image: [earthobservatory.nasa.gov/Features/OrbitsManeuver](http://earthobservatory.nasa.gov/Features/OrbitsManeuver)

<sup>9</sup> Image: [en.wikipedia.org/wiki/James\\_Hansen#Arrests](http://en.wikipedia.org/wiki/James_Hansen#Arrests)

<sup>10</sup> Image: [en.wikipedia.org/wiki/James\\_Hansen#Arrests](http://en.wikipedia.org/wiki/James_Hansen#Arrests)

<sup>11</sup> Hansen’s predictions were made in Hansen et al, Journal of Geophysical Research, Vol 93 No D8 (20 Aug 1988) Fig 3a Page 9347: [pubs.giss.nasa.gov/docs/1988/1988\\_Hansen\\_etal.pdf](http://pubs.giss.nasa.gov/docs/1988/1988_Hansen_etal.pdf).

<sup>12</sup> IPCC First Assessment Report, 1990, page xxii ([www.ipcc.ch/ipccreports/far/wg\\_i/ipcc\\_far\\_wg\\_i\\_full\\_report.pdf](http://www.ipcc.ch/ipccreports/far/wg_i/ipcc_far_wg_i_full_report.pdf)) in the Policymakers Summary, Figure 8 and surrounding text, for the business-as-usual scenario (which is what in fact occurred, there being no significant controls or decrease in the rate of increase of emissions to date). “Under the IPCC Business-as-Usual (Scenario A) emissions of greenhouse gases, the average rate of increase of global

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mean temperature during the next century is estimated to be about 0.3°C per decade (with an uncertainty range of 0.2°C to 0.5°C).”

<sup>13</sup> Image: [www.metoffice.gov.uk/weather/marine/observations/gathering\\_data/argo.html](http://www.metoffice.gov.uk/weather/marine/observations/gathering_data/argo.html)

<sup>14</sup> Download the data (save it as a file) from [ftp://ftp.nodc.noaa.gov/pub/data.nodc/woa/DATA\\_ANALYSIS/3M\\_HEAT\\_CONTENT/DATA/basin/3month/ohc\\_levtus\\_climdash\\_seasonal.csv](ftp://ftp.nodc.noaa.gov/pub/data.nodc/woa/DATA_ANALYSIS/3M_HEAT_CONTENT/DATA/basin/3month/ohc_levtus_climdash_seasonal.csv). Open it from within Microsoft Excel. The first column is the three month period, and the second column is the change in average ocean heat content during that three months, in units of  $10^{22}$  Joules, seasonally adjusted. The Argo system started in mid-2003, so the Argo data starts at 2003-6 (the prior data is bucket and XBT data).

<sup>15</sup> See Hansen et al, 2005: Earth's energy imbalance: Confirmation and implications. Science, 308, 1431-1435, page 1432 ([pubs.giss.nasa.gov/cgi-bin/abstract.cgi?id=ha00110y](http://pubs.giss.nasa.gov/cgi-bin/abstract.cgi?id=ha00110y)), where the increase in ocean heat content per square meter of surface, in the upper 750m, according to typical models, is 6.0 Watt-year/m<sup>2</sup> per year, which converts to  $0.7 \times 10^{22}$  Joules per year for the entire ocean as explained at [bobtisdale.wordpress.com/2011/06/14/giss-ohc-model-trends-one-question-answered-another-uncovered/](http://bobtisdale.wordpress.com/2011/06/14/giss-ohc-model-trends-one-question-answered-another-uncovered/).

<sup>16</sup> Image:

[www.cnes.fr/imagezoom.php?location=public&file=p7013\\_56e2c2eb9d1d089ee42430cf1a5889c7envisat.jpeg&label=The+European+Envisat+satellite+is+often+called+into+action.+Credits%3A+ESA](http://www.cnes.fr/imagezoom.php?location=public&file=p7013_56e2c2eb9d1d089ee42430cf1a5889c7envisat.jpeg&label=The+European+Envisat+satellite+is+often+called+into+action.+Credits%3A+ESA).

<sup>17</sup> [www.aviso.oceanobs.com/en/news/ocean-indicators/mean-sea-level/products-images/index.html](http://www.aviso.oceanobs.com/en/news/ocean-indicators/mean-sea-level/products-images/index.html)

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[www.aviso.oceanobs.com/fileadmin/images/news/indic/msl/MSL\\_Serie\\_EN\\_Global\\_NoIB\\_RWT\\_NoGIA\\_NoAdjust.png](http://www.aviso.oceanobs.com/fileadmin/images/news/indic/msl/MSL_Serie_EN_Global_NoIB_RWT_NoGIA_NoAdjust.png)

<sup>19</sup> [en.wikipedia.org/wiki/IPCC\\_Fourth\\_Assessment\\_Report](http://en.wikipedia.org/wiki/IPCC_Fourth_Assessment_Report)

<sup>20</sup> Currently weather balloons are released twice a day from almost 900 locations worldwide. Balloon flights last around two hours, and can rise to 30km. [www.wrh.noaa.gov/vef/kids/wxballoon.php](http://www.wrh.noaa.gov/vef/kids/wxballoon.php)

<sup>21</sup> [www.ncdc.noaa.gov/oa/climate/igra/index.php](http://www.ncdc.noaa.gov/oa/climate/igra/index.php)

<sup>22</sup> The weather balloon data showing the atmospheric warming pattern was finally released in 2006, in the US Climate Change Science Program, 2006, part E of Figure 5.7, on page 116 ([www.climate-science.gov/Library/sap/sap1-1/finalreport/sap1-1-final-chap5.pdf](http://www.climate-science.gov/Library/sap/sap1-1/finalreport/sap1-1-final-chap5.pdf)).

There is no other data for this period, and we cannot collect more data on atmospheric warming during global warming until global warming resumes. This is the only data there is. By the way, isn't this an obscure place to release such important and pivotal data—you don't suppose they are trying to hide something, do you?

<sup>23</sup> Any climate model, for example, IPCC Assessment Report 4, 2007, Chapter 9, page 675, which is also on the web at [www.ipcc.ch/publications\\_and\\_data/ar4/wg1/en/ch9s9-2-2.html](http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch9s9-2-2.html) (Figure 9.1 parts c and f). There was little warming 1959–1977, so the commonly available 1959–1999 simulations work as well.

<sup>24</sup> Image: [earthobservatory.nasa.gov/Features/EnergyBalance/printall.php](http://earthobservatory.nasa.gov/Features/EnergyBalance/printall.php)

<sup>25</sup> Image: [asd-www.larc.nasa.gov/erbe/erbssat.gif](http://asd-www.larc.nasa.gov/erbe/erbssat.gif)

<sup>26</sup> Lindzen and Choi 2009, Geophysical Research Letters Vol. 36: [www.drroyspencer.com/Lindzen-and-Choi-GRL-2009.pdf](http://www.drroyspencer.com/Lindzen-and-Choi-GRL-2009.pdf). The paper was corrected after some criticism, coming to essentially the same result again in 2011: [www.eaps.mit.edu/faculty/lindzen/236-Lindzen-Choi-2011.pdf](http://www.eaps.mit.edu/faculty/lindzen/236-Lindzen-Choi-2011.pdf).

<sup>27</sup> More generally, if the CO<sub>2</sub> level is x (in parts per million, ppm) then the climate models estimate the temperature increase due to the extra CO<sub>2</sub> over the pre-industrial level of 280 ppm as  $4.8 \ln(x / 280)$ . For example, the climate models attribute a temperature rise of  $4.8 \ln(392/280) = 1.6^\circ\text{C}$  to the increase from pre-industrial to the current CO<sub>2</sub> level of 392 ppm. (Note that  $4.8 = 3 * 1.1 / \ln(2)$ .)

<sup>28</sup> The IPCC, in their last Assessment Report in 2007, project a temperature increase for a doubling of CO<sub>2</sub> (called the *climate sensitivity*) in the range 2.0°C to 4.5°C. The central point of their model estimates is 3.3°C, which is 3.0 times the direct CO<sub>2</sub> effect of 1.1°C, so we simply say their amplification is threefold. To be more precise, each climate model has a slightly different effective amplification, but they are generally around 3.0.

<sup>29</sup> The direct effect of CO<sub>2</sub> is the same for each doubling of the CO<sub>2</sub> level (that is, the effect is logarithmic). Calculations of the increased surface temperature due to of a doubling of the CO<sub>2</sub> level vary from 1.0°C to 1.2°C. These have been made by many scientists including both government climate scientists and skeptics, and are made by considering the many spectral lines of CO<sub>2</sub>. In this document we use the midpoint value 1.1°C; which value you

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use does not affect the arguments made here. See Hansen et al. 1984 [pubs.giss.nasa.gov/abs/ha07600n.html](https://pubs.giss.nasa.gov/abs/ha07600n.html) or the IPCC's AR4 2007, chapter 8, page 631 [www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter8.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter8.pdf).

<sup>30</sup> Depending on who is doing the analysis, the feedbacks involving water in all its forms (freshwater, ocean water, water vapor, clouds, rain, snow, ice, etc) or the lapse rate may be considered to consist of several component feedbacks. For simplicity, here we combine them all into what we simply call "the water feedbacks". The main feedbacks are the water vapor and cloud feedbacks. (Water vapor is water in its gaseous form, i.e. humidity). We shall ignore the other feedbacks in what follows, because the water feedbacks are so dominant.

<sup>31</sup> See the Charney Report (1979), pages 1 and 8 ([www.atmos.ucla.edu/~brianpm/download/charney\\_report.pdf](http://www.atmos.ucla.edu/~brianpm/download/charney_report.pdf)) and the IPCC's 4<sup>th</sup> Assessment Report (2007), Chapter 8, page 633 [www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter8.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter8.pdf).

<sup>32</sup> There was also a minor increase in the radiation from the sun, but the serious skeptical scientists agree with the government climate scientists that it was scarcely significant.

<sup>33</sup> The government climate scientists admit there are [discrepancies](#), and go to great lengths to [resolve them](#) (see for example, [Thorne](#), [Dessler](#), [Sherwood](#)).

<sup>34</sup> More generally, if the CO<sub>2</sub> level is x (in parts per million) then skeptics estimate the temperature increase due to the extra CO<sub>2</sub> over the pre-industrial level of 280 ppm as  $0.79 \ln(x / 280)$ . For example, skeptics attribute a temperature rise of  $0.79 \ln(392/280) = 0.27^\circ\text{C}$  to the increase from pre-industrial to the current CO<sub>2</sub> level of 392 ppm. (Note that  $0.79 = 0.5 * 1.1 / \ln(2)$ .)

<sup>35</sup> Image: [climate.nasa.gov/kids/bigQuestions/greenhouseEffect](https://climate.nasa.gov/kids/bigQuestions/greenhouseEffect)

<sup>36</sup> See for instance [joannenova.com.au/2009/04/03/global-warming-a-classic-case-of-alarmism](http://joannenova.com.au/2009/04/03/global-warming-a-classic-case-of-alarmism), or pages 17–23 of [ionova.s3.amazonaws.com/corruption/climate-corruption.pdf](http://ionova.s3.amazonaws.com/corruption/climate-corruption.pdf).