

The Skeptic's Case

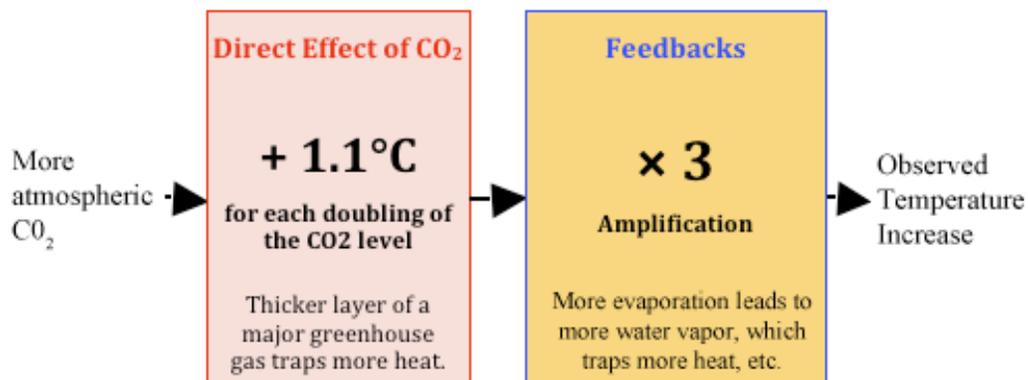
Mises Daily: Friday, February 24, 2012 by [David M.W. Evans](#)

We check the main predictions of the climate models against the best and latest data. Fortunately the climate models got all their major predictions wrong. Why? Every serious skeptical scientist has been consistently saying essentially the same thing for over 20 years, yet most people have never heard the message. Here it is, put simply enough for any lay reader willing to pay attention.



What the Government Climate Scientists Say

Figure 1



The climate models. If the CO₂ level doubles (as it is on course to do by about 2070 to 2100), the climate models estimate the temperature increase due to that extra CO₂ will be about 1.1°C × 3 = 3.3°C.[1]

The direct effect of CO₂ is well-established physics, based on laboratory results, and known for over a century.[2]

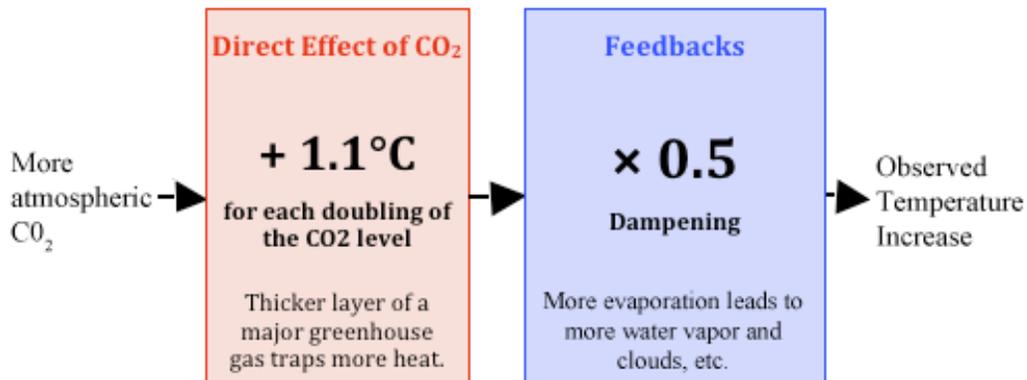
Feedbacks are due to the ways the Earth reacts to the direct warming effect of the CO₂. The threefold amplification by feedbacks is based on the assumption, or guess, made around 1980, that more warming due to CO₂ will cause more evaporation from the oceans and that this extra water vapor will in turn lead to even more heat trapping because water vapor is the main greenhouse gas. And extra heat will cause even more evaporation, and so on. This amplification is built into all the climate

models.[3] The amount of amplification is estimated by assuming that nearly all the industrial-age warming is due to our CO₂.

The government climate scientists and the media often tell us about the direct effect of the CO₂, but rarely admit that two-thirds of their projected temperature increases are due to amplification by feedbacks.

What the Skeptics Say

Figure 2



The skeptic's view. If the CO₂ level doubles, skeptics estimates that the temperature increase due to that extra CO₂ will be about $1.1^{\circ}\text{C} \times 0.5 \approx 0.6^{\circ}\text{C}$. [4]

The serious skeptical scientists have always agreed with the government climate scientists about the direct effect of CO₂. The argument is entirely about the feedbacks.

The feedbacks dampen or reduce the direct effect of the extra CO₂, cutting it roughly in half.[5] The main feedbacks involve evaporation, water vapor, and clouds. In particular, water vapor condenses into clouds, so extra water vapor due to the direct warming effect of extra CO₂ will cause extra clouds, which reflect sunlight back out to space and cool the earth, thereby reducing the overall warming.

There are literally thousands of feedbacks, each of which either reinforces or opposes the direct-warming effect of the extra CO₂. Almost every long-lived system is governed by net feedback that *dampens* its response to a perturbation. If a system instead reacts to a perturbation by amplifying it, the system is likely to reach a tipping point and become unstable (like the electronic squeal that erupts when a microphone gets too close to its speakers). The earth's climate is long-lived and stable – it has never gone into runaway greenhouse, unlike Venus – which strongly suggests that the feedbacks dampen temperature perturbations such as that from extra CO₂.

What the Data Say

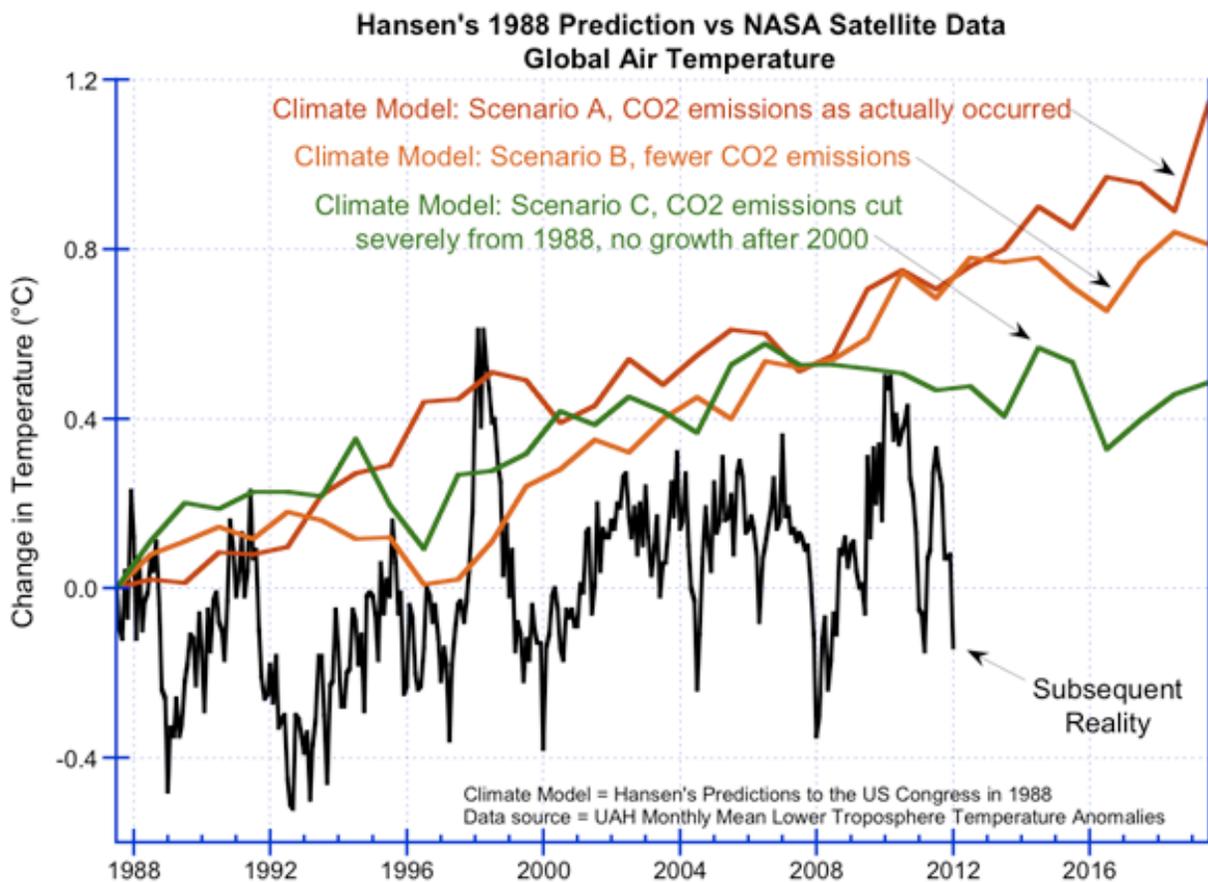
The climate models have been essentially the same for 30 years now, maintaining roughly the same sensitivity to extra CO₂ even while they got more detailed with more computer power.

- How well have the climate models predicted the temperature?
- Does the data better support the climate models or the skeptic's view?

Air Temperatures

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

Figure 3



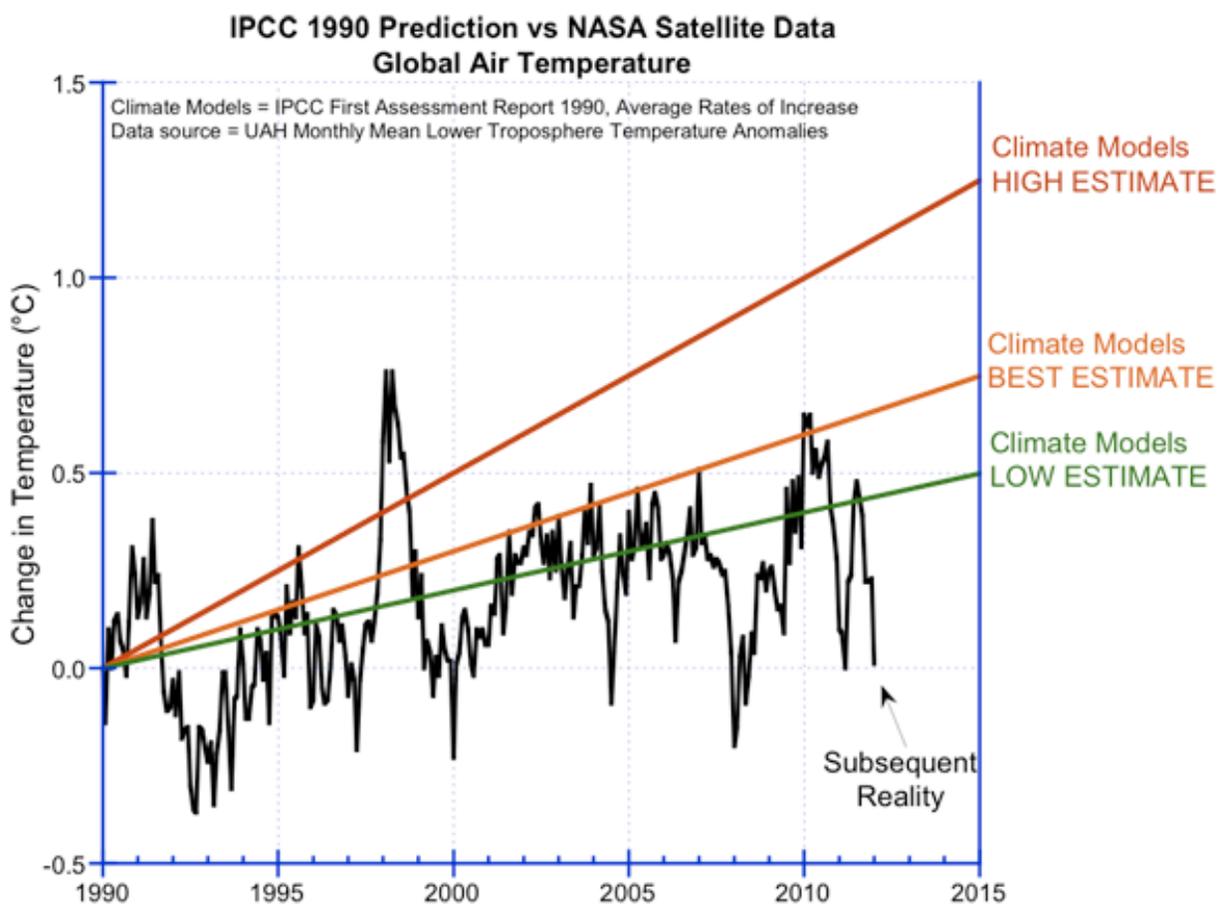
Hansen's predictions to the US Congress in 1988,^[6] compared to the subsequent temperatures as measured by NASA satellites.^[7]

Hansen's climate model clearly exaggerated future temperature rises.

In particular, his climate model predicted that if human CO₂ emissions were cut back drastically starting in 1988, such that by year 2000 the CO₂ level was not rising at all, we would get his scenario C. But in reality the temperature did not even rise this much, even though our CO₂ emissions strongly increased – which suggests that the climate models greatly overestimate the effect of CO₂ emissions.

A more considered prediction by the climate models was made in 1990 in the IPCC's First Assessment Report:[\[8\]](#)

Figure 4



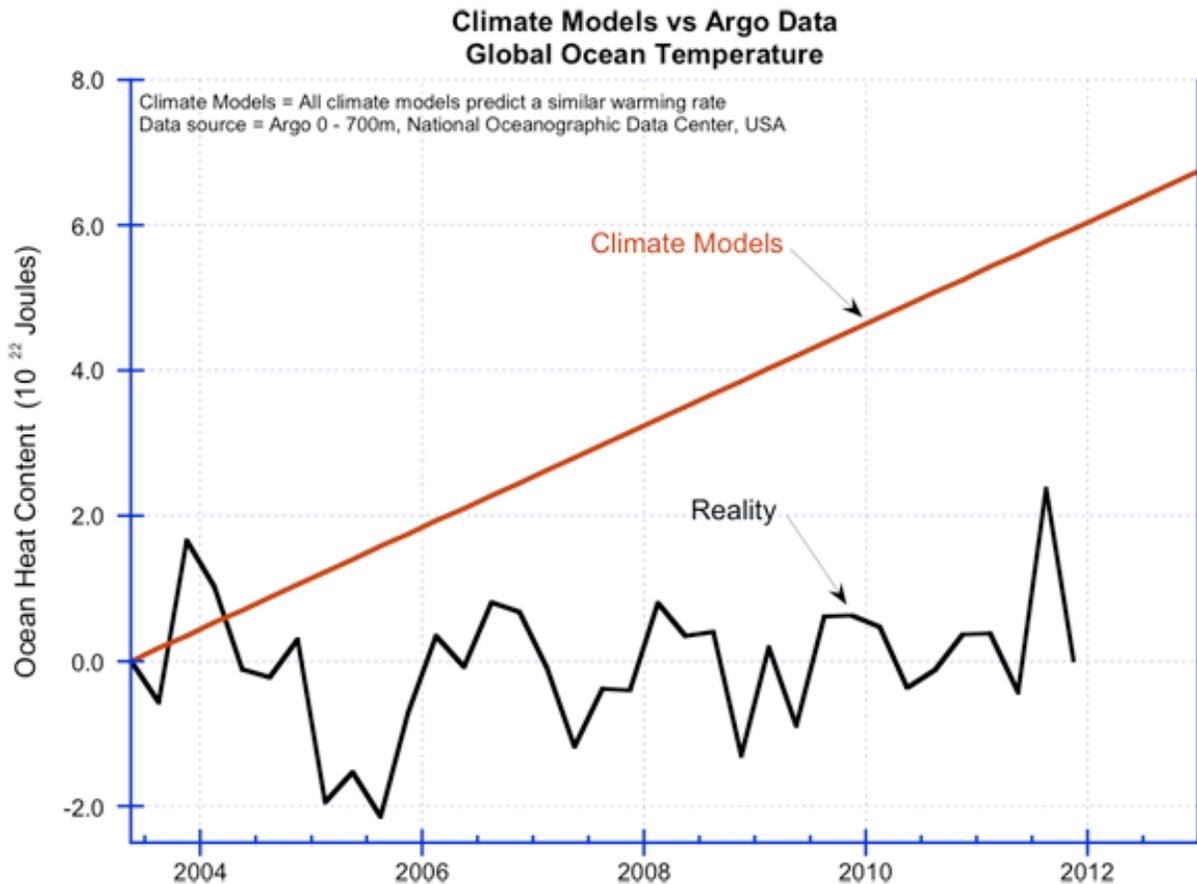
Predictions of the IPCC's First Assessment Report in 1990, compared to the subsequent temperatures as measured by NASA satellites.

It's 20 years now, and the average rate of increase in reality is below the lowest trend in the range predicted by the IPCC.

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.^{[9][10]} In Argo, a buoy duck dives down to a depth of 2,000 meters, measures temperatures as it very slowly ascends, then radios the results back to headquarters via satellite. Over 3,000 Argo buoys constantly patrol all the oceans of the world.

Figure 5



Climate model predictions of ocean temperature,^[11] versus the measurements by Argo.^[12] The unit of the vertical axis is 10^{22} Joules (about 0.01°C).

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

Atmospheric Hotspot

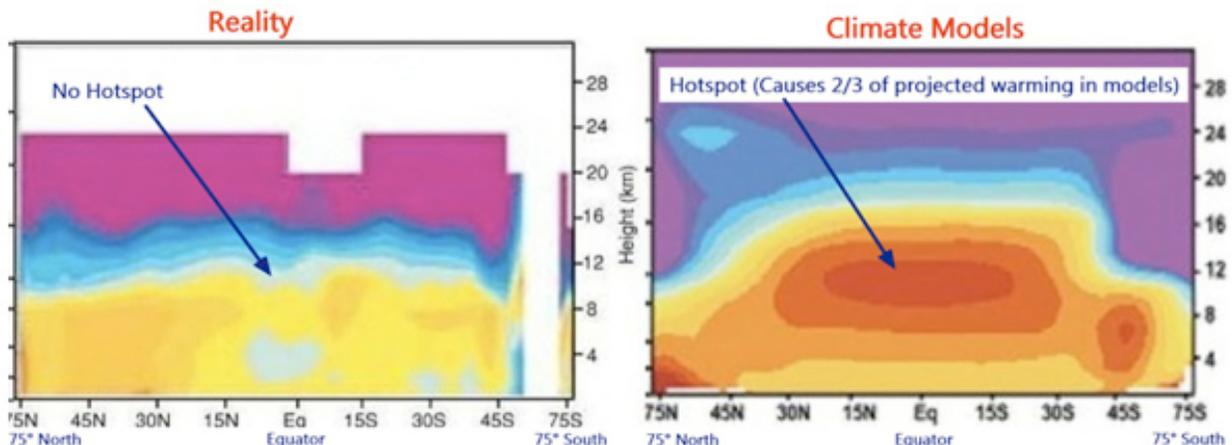
Climate models predict a particular pattern of atmospheric warming during periods of global warming; the most prominent change they predict is a warming in the tropics about 10 km up, the "hotspot."

The hotspot is the sign of the amplification in their theory (see figure 1). The theory says the hotspot is caused by extra evaporation, 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.

We have been measuring atmospheric temperatures with weather balloons since the 1960s. Millions of weather balloons have built up a good picture of atmospheric temperatures over the last few decades, including the warming period from the late 1970s to the late '90s. This important and pivotal data was not released publicly by the climate establishment until 2006, and then in an obscure place.[13] Here it is:

Figure 6

Atmospheric Warming 1979 - 1999



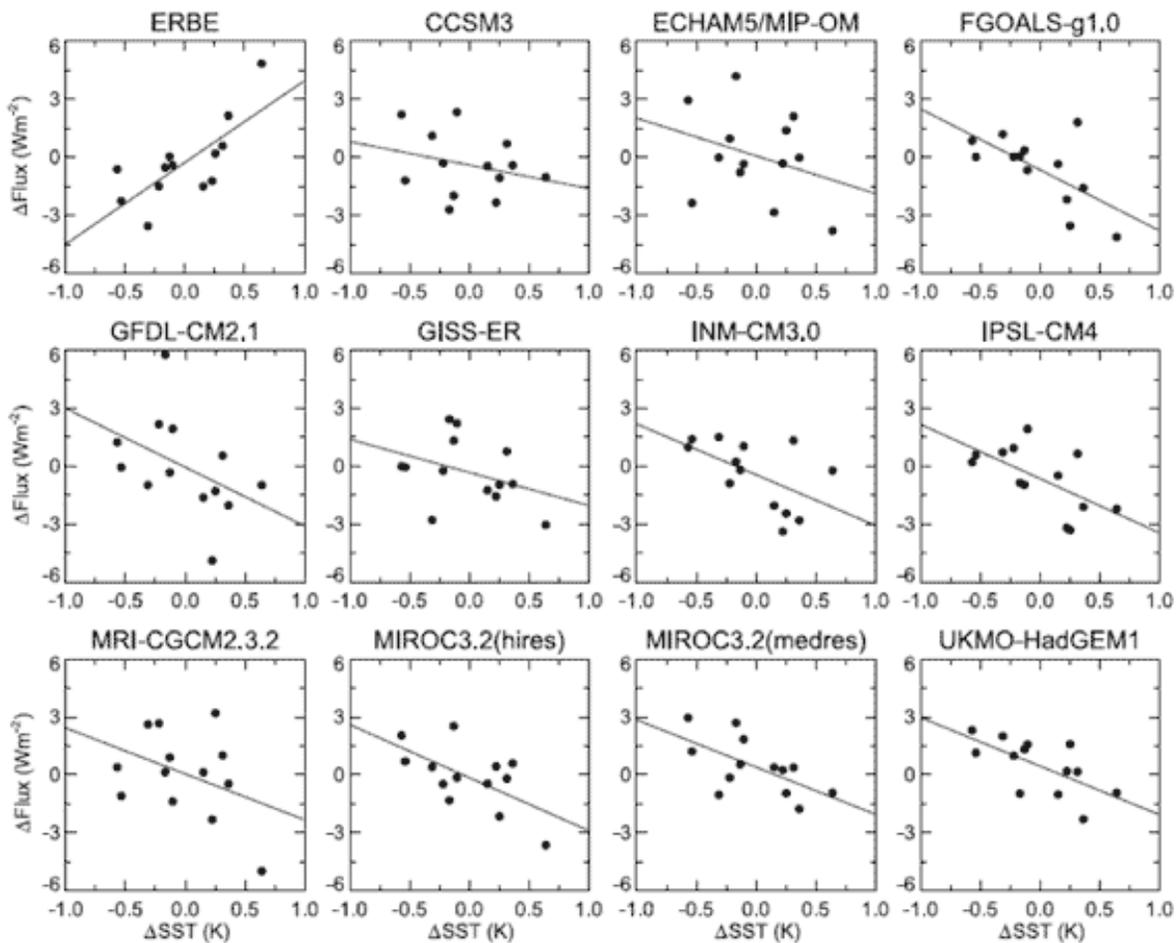
On the left is the data collected by millions of weather balloons.[14] On the right is what the climate models say was happening.[15] The theory (as per the climate models) is incompatible with the observations. In both diagrams the horizontal axis shows latitude, and the right vertical axis shows height in kilometers.

In reality there was no hotspot, not even a small one. So in reality there is no amplification – the amplification shown in figure 1 does not exist.[16]

Outgoing Radiation

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). This is because, according to the theory, the warmer surface causes more evaporation and thus there is more heat-trapping water vapor. This is the heat-trapping mechanism that is responsible for the assumed amplification in figure 1.

Satellites have been measuring the radiation emitted from the earth for the last two decades. 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:



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). [17] Notice that the slopes of the graphs for the climate models are opposite to the slope of the graph for the observed data.

This 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. This shows that the climate

models trap heat too aggressively, and that their assumed amplification shown in figure 1 does not exist.

Conclusions

All the data here is impeccably sourced – satellites, Argo, and weather balloons.[\[18\]](#)

The air and ocean temperature data shows that the climate models overestimate temperature rises. The climate establishment suggest that cooling due to undetected aerosols might be responsible for the failure of the models to date, but this excuse is wearing thin – it continues not to warm as much as they said it would, or in the way they said it would. On the other hand, the rise in air temperature has been greater than the skeptics say could be due to CO₂. The skeptic's excuse is that the rise is mainly due to other forces – and they point out that the world has been in a fairly steady warming trend of 0.5° C per century since 1680 (with alternating ~30 year periods of warming and mild cooling) where as the vast bulk of all human CO₂ emissions have been after 1945.

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

Test	Climate Models
Air temperatures from 1988	Overestimated rise, even if CO ₂ is drastically cut
Air temperatures from 1990	Overestimated trend rise
Ocean temperatures from 2003	Overestimated trend rise greatly
Atmospheric hotspot	Completely missing → no amplification
Outgoing radiation	Opposite to reality → no amplification

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. Therefore,

1. The climate models are fundamentally flawed. Their assumed threefold amplification by feedbacks does not in fact exist.
2. The climate models overestimate temperature rises due to CO₂ by at least a factor of three.

The skeptical view is compatible with the data.

Some Political Points

The data presented here is impeccably sourced, very relevant, publicly available, and from our best instruments. Yet it never appears in the mainstream media – have you ever seen anything like any of the figures here in the mainstream media? That alone tells you that the "debate" is about politics and power, and not about science or truth.

This is an unusual political issue, because there is a right and a wrong answer, and everyone will know which it is eventually. People are going ahead and emitting CO₂ anyway, so we are doing the experiment: either the world heats up by several degrees by 2050 or so, or it doesn't.

Notice that the skeptics agree with the government climate scientists about the direct effect of CO₂; they just disagree about the feedbacks. The climate debate is all about the feedbacks; everything else is merely a sideshow. Yet hardly anyone knows that. The government climate scientists and the mainstream media have framed the debate in terms of the direct effect of CO₂ and sideshows such as arctic ice, bad weather, or psychology. They almost never mention the feedbacks. Why is that? Who has the power to make that happen?

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 CO₂ 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. Send him [mail](#). See David M.W. Evans's [article archives](#).

Notes

[1] More generally, if the CO₂ level is x (in parts per million) then the climate models estimate the temperature increase due to the extra CO₂ over the preindustrial level of 280 ppm as $4.33 \ln(x / 280)$. For example, this model attributes a temperature rise of $4.33 \ln(392/280) = 1.46^\circ\text{C}$ to the increase from preindustrial to the current CO₂ level of 392 ppm.

[2] The direct effect of CO₂ is the same for each doubling of the CO₂ level (that is, logarithmic). Calculations of the increased surface temperature due to of a doubling of the CO₂ level vary from 1.0°C to 1.2°C . In this document we use the midpoint value 1.1°C ; which value you use does not affect the arguments made here.

[3] The IPCC, in their last Assessment Report in 2007, project a temperature increase for a doubling of CO₂ (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 CO₂ 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.

[4] More generally, if the CO₂ level is x (in parts per million) then skeptics estimate the temperature increase due to the extra CO₂ over the preindustrial level of 280 ppm as $0.72 \ln(x / 280)$. For example, skeptics attribute a temperature rise of $0.72 \ln(392/280) = 0.24^\circ\text{C}$ to the increase from preindustrial to the current CO₂ level of 392 ppm.

[5] The effect of feedbacks is hard to pin down with empirical evidence because there are more forces affecting the temperature than just changes in CO₂ level, but seems to be multiplication by something between 0.25 and 0.9. We have used 0.5 here for simplicity.

[6] Hansen's predictions were made in Hansen et al, *Journal of Geophysical Research*, vol. 93, no. D8 (August 20, 1988), fig. 3a, p. 9,347: pubs.giss.nasa.gov/docs/1988/1988_Hansen_et_al.pdf. In the graph here, Hansen's three scenarios are graphed to start from the same point in mid-1987 – we are only interested in changes (anomalies).

[7] The earth's temperature shown here is as measured by the NASA satellites that have been measuring the earth's temperature since 1979, managed at the University of Alabama, Huntsville (UAH). Satellites measure the temperature 24/7 over broad swathes of land and ocean, across the whole world except the poles. While satellites had some initial calibration problems, those have long since been fully fixed to everyone's satisfaction. Satellites are mankind's most reliable, extensive, and unbiased method for measuring the earth's air temperature temperatures since 1979. This is an impeccable source of data, and you can download the data yourself from vortex.nsstc.uah.edu/data/msu/t2lt/uahncdc.lt (save it as .txt file then open it in Microsoft Excel; the numbers in the "Globe" column are the changes in MSU Global Monthly Mean Lower Troposphere Temperatures in °C).

[8] IPCC First Assessment Report, 1990, page xxii (www.ipcc.ch/ipccreports/far/wg_1/ipcc_far_wg_1_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 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)."

[9] "[Argo.](http://www.metoffice.gov.uk/argoproject/)" MetOffice.uk.gov.

[10] Ocean temperature measurements before Argo are nearly worthless. Before Argo, ocean temperature was measured with buckets or with bathythermographs (XBTs) – which are expendable probes lowered into the water, transmitting temperature and pressure 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 poor – for example the huge southern oceans were not monitored. XBTs do not go as deep as Argo floats, and their data is much less precise and much less accurate (for one thing, they move too quickly through the water to come to thermal equilibrium with the water they are trying to measure).

[11] The climate models project ocean heat content increasing at about 0.7×10^{22} Joules per year. See Hansen et al., 2005: "[Earth's Energy Imbalance: Confirmation and Implications.](https://www.sciencemag.org/doi/10.1126/science.1111757)" *Science*, 308, 1431-1435, p. 1432, 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/m² per year, which converts to 0.7×10^{22} Joules per year for the entire ocean as explained at [here](#).

[12] The ocean heat content down to 700m as measured by Argo is now available; you can download it [from here as a CSV file](#). The numbers are the changes in average heat for the three months, in units of 10^{22} Joules, seasonally adjusted. The Argo system started in mid-2003, so we started the data at 2003-6.

[13] 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. 

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?

[14] See previous note.

[15] Any climate model, for example, IPCC Assessment Report 4, 2007, ch. 9, p. 675, [which is also on the web](#) (figure 9.1, parts c and f). There was little warming 1959-1977, so the commonly available 1959-1999 simulations work as well.

[16] So the multiplier in the second box in figures 1 and 2 is at most 1.0.

[17] Lindzen and Choi 2009, Geophysical Research Letters, vol. 36. 

The paper was corrected after some criticism, coming to essentially the same result again in 2011. 

[18] In particular, we have not quoted results from land thermometers, or from sparse sampling by buckets and XBTs at sea. Land thermometers are notoriously susceptible to localized effects – see *Is the Western Climate Establishment Corrupt?* by the same author. 