My Reply to John Cook's *Scientific Guide to Global Warming Skepticism* and skepticalscience.com

Norman Rogers 27 January 2011 (Updated 29 January and 6 February 2011)

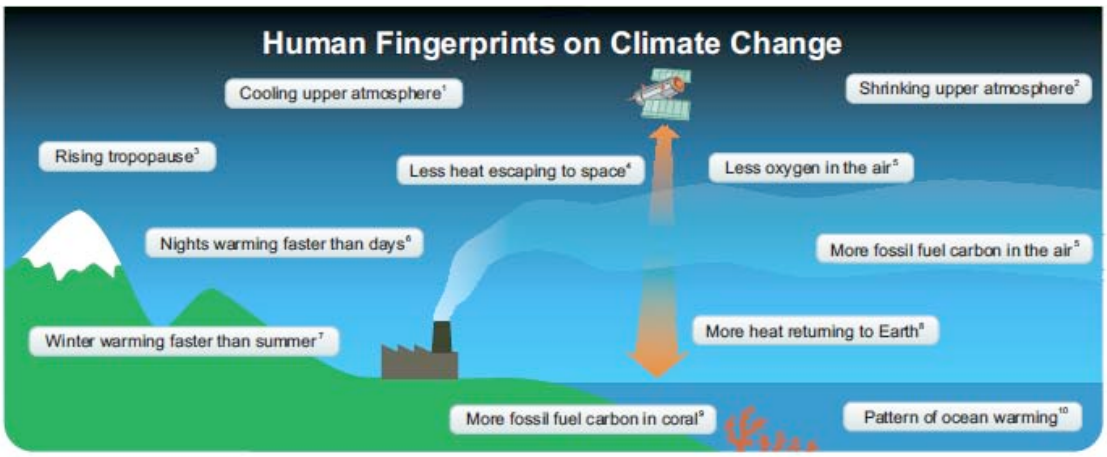
John Cook claims:

> The evidence for human caused global warming is not just based on theory or computer models but on **many independent, direct observations made in the real world**.

But Cook is wrong - the only clear evidence, which isn't very convincing, is indeed based on computer climate models. The IPCC explains it as follows (AR4 FAQ 9.2 p.701)

When the effects of increasing levels of greenhouse gases are included in the models, as well as natural external factors, the models produce good simulations of the warming that has occurred over the past century. The models fail to reproduce the observed warming when run using only natural factors. When human factors are included, the models also simulate a geographic pattern of temperature change around the globe similar to that which has occurred in recent decades.

Cook gives a number of "Human Fingerprints on Climate Change."



The trouble with Cook's fingerprints is that they are fingerprints of increased CO2 or fingerprints of a warming climate, neither of which is disputed by skeptics. The "pattern of ocean warming" fingerprint is interesting because, contrary to global warming theory, the ocean has not been warming since about 2003.[1]

Cook says:

Humans are raising CO_2 levels

When you look through the many arguments from global warming 'skeptics', a pattern emerges. They tend to focus on small pieces of the puzzle while neglecting the bigger picture. A good example of this is the argument that human carbon dioxide (CO_2) emissions are tiny compared to natural emissions.

Cook is doing cherry picking. Responsible skeptics don't make this argument. We understand that the vast seasonal flows of CO2 should not be confused with the long term trend. If I said that Al Gore implies that sea level may rise by 18 feet (true) and then spent a lot of time rebutting that stupid claim I would be cherry picking the easy pickings, just like Cook.

Cook shows on page 3 of his document that his grasp of science is quite weak. One wonders why his scientist advisors didn't help him avoid his many mistakes.

Carbon dioxide traps infrared radiation (commonly known as thermal radiation). This has been proven by laboratory experiments[16] and satellites which find less heat escaping out to space over the last few decades[4] (see *Human Fingerprint #2*). This is direct evidence that more CO_2 is causing warming.[5]

Everybody agrees that CO2 does absorb (not trap) some infrared radiation. Skeptics agree that if everything else is the same that more CO2 would warm the Earth. The real argument is about feedbacks, is the warming amplified by positive feedbacks or reduced by negative (stabilizing) feedbacks?

Cook's point about satellites finding less heat escaping is just nonsense. First of all the satellites do not have the measurement accuracy to detect the difference in infrared radiation between 1970 and 1996. The papers he cites merely show an change in certain spectral areas related to CO2, methane, etc. This is nothing surprising.

The Earth does not emit only infrared radiation, it also reflects sunlight or short wave radiation. This is very important. To a good approximation, the radiation absorbed by the Earth is equal to the radiation emitted by the Earth unless the ocean is warming, in which case the earth emits less energy than it receives (Or if the ocean is cooling more). So any difference in the radiation emitted by the Earth between 1970 and 1996 would be a signal of a change in ocean heat storage.

If we consider just infrared radiation, not including the short wave sunlight reflected by the Earth, then a change in infrared radiation is probably due to a change in the albedo of the earth, or the amount of short wave radiation reflected. Albedo is controlled by cloudiness. Radiation absorbed by the earth equals short wave reflected plus infrared emitted except for the energy moved to or from the oceans. Just looking at infrared radiation proves nothing.

There cannot be a persistent imbalance in the radiation because as long as the imbalance persists the earth would continually warm or cool. The oceans are the only accessible repository for energy that can accommodate a persistent imbalance for a period of time. The imbalance consistent with changes in ocean temperature is extremely small, around 1 part in 1000 of the radiation falling on the Earth. As a body warms it emits more radiation which is why the Earth is in very close balance all the time.

Cook gets feedbacks and ice ages muddled.

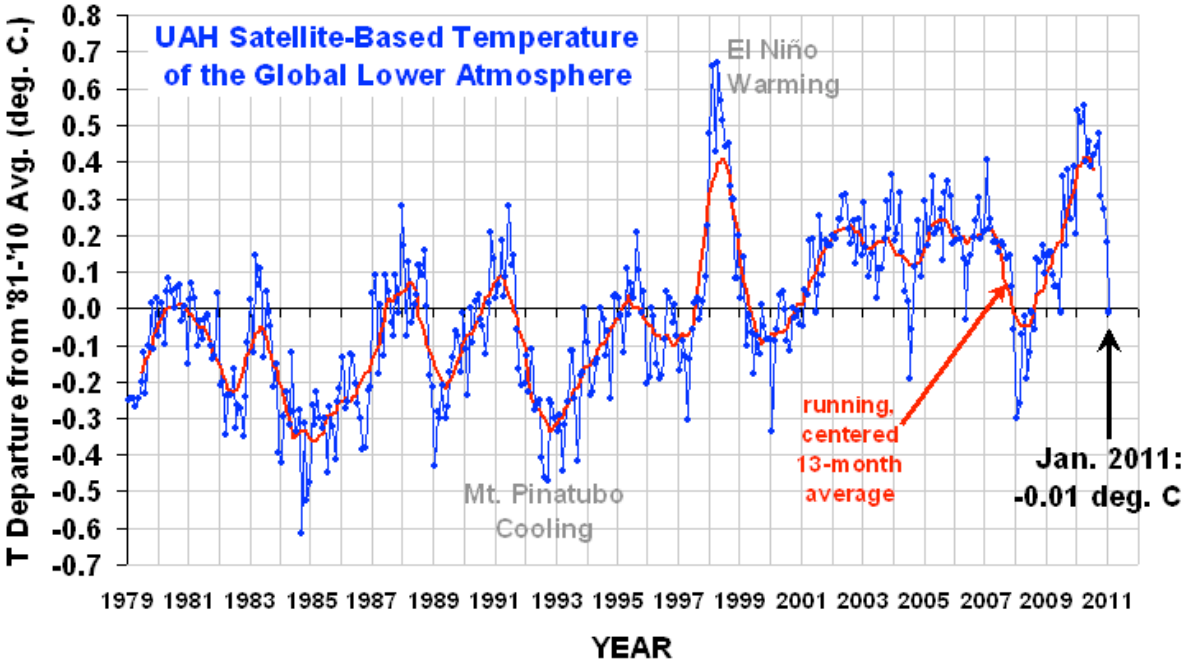
> The past also tells an interesting story. Ice cores show that in the Earth's past, CO_2 went up ***after*** temperature initially increased. This "CO_2 lag" means temperature affects the amount of CO_2 in the air. So warming causes more CO_2 and more CO_2 causes extra warming. Put these two together and you get positive feedback. Positive or negative feedback don't necessarily mean good or bad. Positive feedbacks strengthen any climate change already underway while negative feedbacks suppress (weaken) any climate change.

Cook is venturing into Al Gore territory. Gore tried to imply that the correlation between CO2 and warming at the end of the ice age proved the warming effect of CO2. But Gore's argument became an embarrassment when it was noticed that the CO2 increase lagged the warming. It is believed that CO2 increased because the oceans became warmer and were less able to dissolve CO2. There is a huge amount of CO2 in the oceans. So, Cook is perfectly correct, the CO2 released by the oceans is probably a positive feedback. That's just begs the original question - how great is the effect of CO2. Another, probably more important, positive feedback during the ice ages was the replacement of ice and snow by vegetation. Ice and snow reflect sunlight. Trees absorb sunlight. (That's why cutting down forests fights global warming, especially in latitudes where snow persists into the spring. Cutting down forests also releases CO2 into the atmosphere if the wood is burned or rots.)

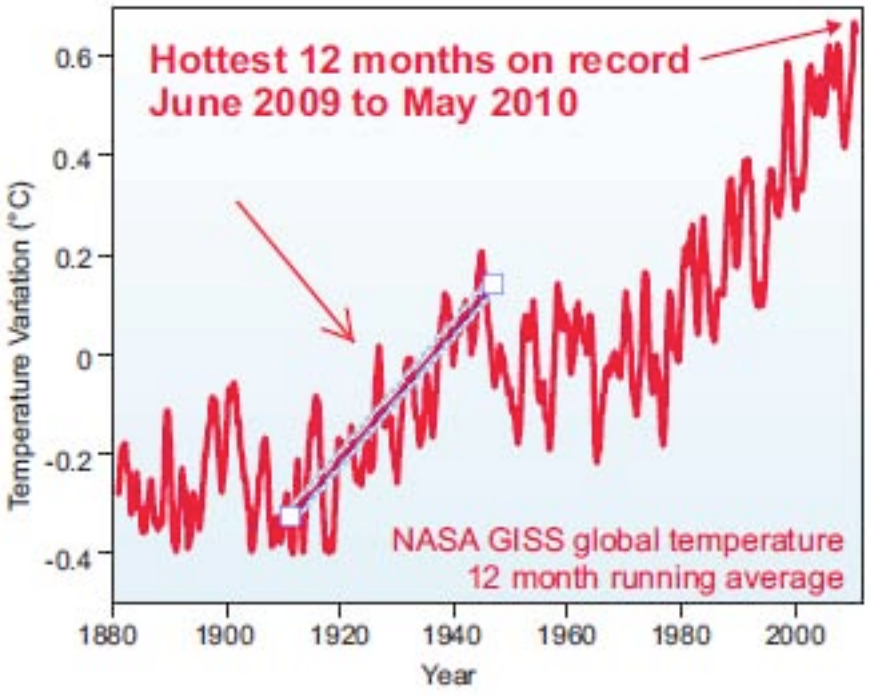
Cook spends a lot of time trying to prove that global warming is happening. It's not clear why since no one disputes that. He objects to the claim that global warming stopped in 1998.

> One 'skeptic' argument is so misleading, it requires three levels of cherry picking. This argument is "global warming stopped in 1998".
>
> The first cherry pick is that it relies on temperature records that don't cover the entire globe, such as data from the Hadley Centre in the U.K.[21] The Hadley Centre record doesn't include the Arctic region where the fastest warming on the planet is occurring.[22] Records covering the entire planet find the hottest calendar year on record is 2005. The hottest 12 months were June 2009 to May 2010.[23]

Since he doesn't like the surface record because allegedly it doesn't cover the arctic here is the lower troposphere satellite record (from www.drroyspencer.com) that covers the whole Earth. The temperature has shown very little change since 1998. The high excursions are due to El Ninos in the Pacific, periodic warming spells related to changes in the tropical Pacific.



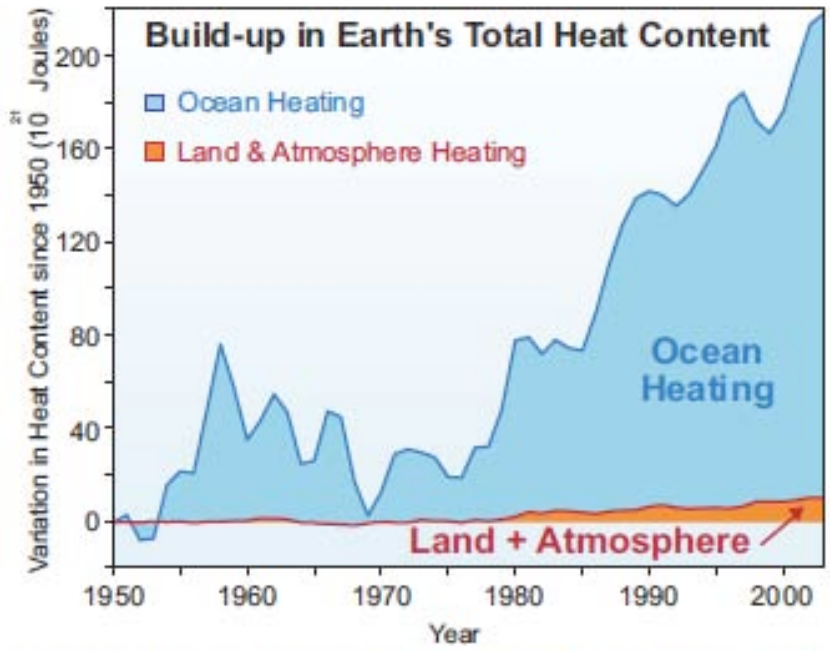
Cook includes a very instructive graph:



12 month running average of global temperature variations.[24]

I've highlighted the warming from 1910 to 1940 (my arrow points to it). This strong warming is unexplained and it can't have been caused by greenhouse gases because they weren't increasing much back then. The obvious question is how do we know that the warming in the late 20th century wasn't caused by the same unexplained thing that caused the early century warming?[2]

Here is another one of Cook's graphs showing the accumulation of heat in the ocean.



Cumulative heat for the Earth since 1950.[26] The rate of energy building up since 1970 is equivalent to 2.5 Hiroshima bombs every second.[27]

First of all this graph is out of date. Newer analysis have eliminated the bump at 1960.

Now, we have to say that this accumulation of heat in the ocean was not well measured until 2003 when the ARGO system of robotic floats was deployed. However it is a very small amount of heat compared to the radiation falling on the earth and it proves nothing. Clearly if the earth is warming we would expect the ocean to warm too. Once again, the dispute is about the effect of humans on the warming or cooling of the Earth, not whether it is warming. (There certainly is some dispute about how much it is warming.)

Cook keeps beating the dead horse of whether warming is taking place.

> Some claim that much of the measured global warming is due to weather stations positioned near air conditioners and car parks. We know this isn't true for several reasons. We can compare temperatures from well-placed weather stations to the poorly-sited weather stations. Both well-placed and poorly-sited sites show the same amount of warming.[28]

Cook's claim is silly on its face. We might as well put the weather stations in ovens. There are several papers giving convincing evidence that poorly placed stations are distorting the record. (Urban heat island effect.)

Cook continues to fall into traps of his own making with this:

> Another way to check thermometer measurements is to compare them to satellite data. Satellite measurements show a similar rate of global warming.[29] This is confirmation that thermometers are giving us an accurate picture.

He's right, satellite measurement show a similar rate of global warming. The only problem is that satellite temperatures, which relate to the temperature high in the atmosphere, are supposed to warm faster, but they aren't. Either something is wrong with the satellite temperatures or the surface temperatures. It could be that the surface temperature increase is exaggerated. The upper atmosphere is supposed to warm faster because the warmer air near the surface holds on the average more moisture and this moisture condenses releasing heat in the upper atmosphere. The effect is non linear with the upper atmosphere warming more than the surface. At least that is how it is supposed to work.

Cook enters the Hockey stick arena with this:

Hockey stick or hockey league?

The 'hockey stick' commonly refers to a reconstruction of temperature going back over the last millennium.[35] The steep warming in recent times is seen as the blade of the stick. However, there are many hockey sticks found in climate science. The amount of CO_2 emitted by humans, mostly through the burning of fossil fuels, has a distinct hockey stick shape over the last 1000 years.

Whole books and congressional investigations have come out of Michael Mann's original hockey stick graph. Rather than rehash that I'll just mention that there is one hockey stick graph that I wish Cook had put in his essay, that is the amount of government dollars going into climate science each year.

This gem is the straw man fallacy:

A common 'skeptic' argument is that "climate has changed naturally in the past and therefore recent global warming can't be caused by humans". This argument is like saying "forest fires have happened naturally in the past so any recent forest fires can't be caused by humans".

This is a skeptic argument that Cook made up so he could knock it down.

Cook devotes an entire page to trying to convince us the sensitivity of the climate to CO2 is well constrained because it can be computed using different approaches.

> Climate sensitivity has been determined using a variety of different techniques. Instrumental measurements, satellite readings, ocean heat, volcanic eruptions, past climate change and climate models have all been examined to calculate the climate's reaction to a build-up in heat. We have a number of independent studies covering a range of periods, studying different aspects of climate and employing various methods of analysis.[41]

The truth is that the IPCC uses climate models to determine climate sensitivity. Looking at volcanic eruptions won't work because we don't know how great the effect of the aerosols is on forcing. Looking at ice age doesn't work because we don't know the temperatures accurately and there are confounding feedbacks. So, it is the models. The amazing thing is that the models don't agree with each other. The 20 or so models used by the IPCC disagree about climate sensitivity by more than 2-1. The IPCC just takes the average and says that's the climate sensitivity. This is nothing but junk science.

One promising approach to determining climate sensitivity is Roy Spencer's approach using satellite data. His work suggests that climate sensitivity is extremely low. (see www.drroyspencer.com)

Cook parrots the doomsday claims of the global warmists:

> To claim that global warming will be good for humanity is to turn a blind eye to the many negative impacts. The most common argument along these lines is that carbon dioxide is 'plant food', implying that CO_2 emissions are a good thing. This ignores the fact that plants rely on more than CO_2 to survive. The "CO_2 fertilizer" effect is limited and will be quickly overwhelmed by the negative effects of heat stress and drought, which are expected to increase in the future.[48,49] Over the past century, drought severity has increased globally and is predicted to intensify in the future.[12] Plants cannot take advantage of extra CO_2 if they're dying of thirst.[50]

Before we think we are all going to starve think about this: Corn yields in Indiana. have gone from 25 bushels per acre in 1930 to 160 bushels per acre today. That's more than a 6 time increase.

Interestingly, extra CO2 makes plants more drought resistant. That's because they have to transpire less water to get the amount of CO2 they need to grow. In any case the notion that global warming is going to increase both droughts and floods is a bit too pat.

Finally, Cook claims that 97% of climate experts think humans are causing global warming. Well, I do too. The question is how much?

Mainstream climate scientists are asking for trouble if they become skeptics. They may lose their jobs, their papers may not be published and they may lose their grants. That's why most skeptics are older or retired or from outside of the mainstream - they are less vulnerable to retaliation.

More information is available on my website: www.climateviews.com

[1] The paper Assessing the globally averaged sea level budged on seasonal to interannual timescales by Josh K. Willis, et. al. Journal of Geophysical Research (2008) reports on steric sea level (ocean heat content) from 2003.5 to 2007.5. This is from the ARGO system of thousands of robotic floats that gather ocean temperature data profiles. We are still awaiting ocean heat content data for more recent years. It is quite remarkable that the ocean stopped warming since according to models and global warming theory ocean warming should be continuing because the ocean is supposed to lag the atmosphere by a lot.

[2] There are some attempts to explain the early warming by a change in solar activity. Those are totally speculative since no accurate measurements of the suns intensity from those times exist. There must be some reason for it, but we just don't know what it was.