Why More Carbon Dioxide Makes Little Difference

A mistake in the climate model architecture changes everything—trapped energy just reroutes to space on another path

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Short version of the dam analogy

Dr David Evans earned six degrees related to modeling and applied mathematics over ten years, including a PhD from Stanford University. He was instrumental in building the carbon accounting system Australia uses to estimate carbon changes in its biosphere, for the Australian Greenhouse Office.

There are serious architectural errors in the basic climate model. When fixed, it shows future warming due to carbon dioxide will be a fifth to a tenth of official estimates. Less than 20% of the global warming since 1973 was due to increasing carbon dioxide.

Increasing carbon dioxide "thickens the blanket", reducing the heat radiated to space by carbon dioxide. In reality, the blocked heat mainly just reroutes out to space by being radiated from water vapor instead, all in the upper atmosphere. In the current climate models, however, that blocked heat travels down to the Earth's surface where it is treated like extra sunlight.

This discovery debuted recently on blogs, withstanding detailed public scrutiny, and is in a paper currently undergoing peer review.

Like most scientists, I am convinced carbon dioxide is a greenhouse gas and causes some global warming. I agree that carbon dioxide levels have been rising. My dissent is about *how much* warming it causes.

Basic Climate Model

The basic climate model, used to calculate the Earth's sensitivity to carbon dioxide, dates back to 1896. It is the cornerstone of the carbon dioxide theory of global warming. Predating computer simulations, it applies "basic physics" to the climate.

The idea that "it's the physics" makes the carbon dioxide theory impregnable in the minds of the establishment.

Despite the numerous mismatches between theory and climate observations to date, many climate scientists remain convinced that increasing carbon dioxide causes dangerous warming essentially because of the basic model, rather than because of the huge opaque computer models. The basic model ignited concern about carbon dioxide; without it we probably wouldn't be too worried.

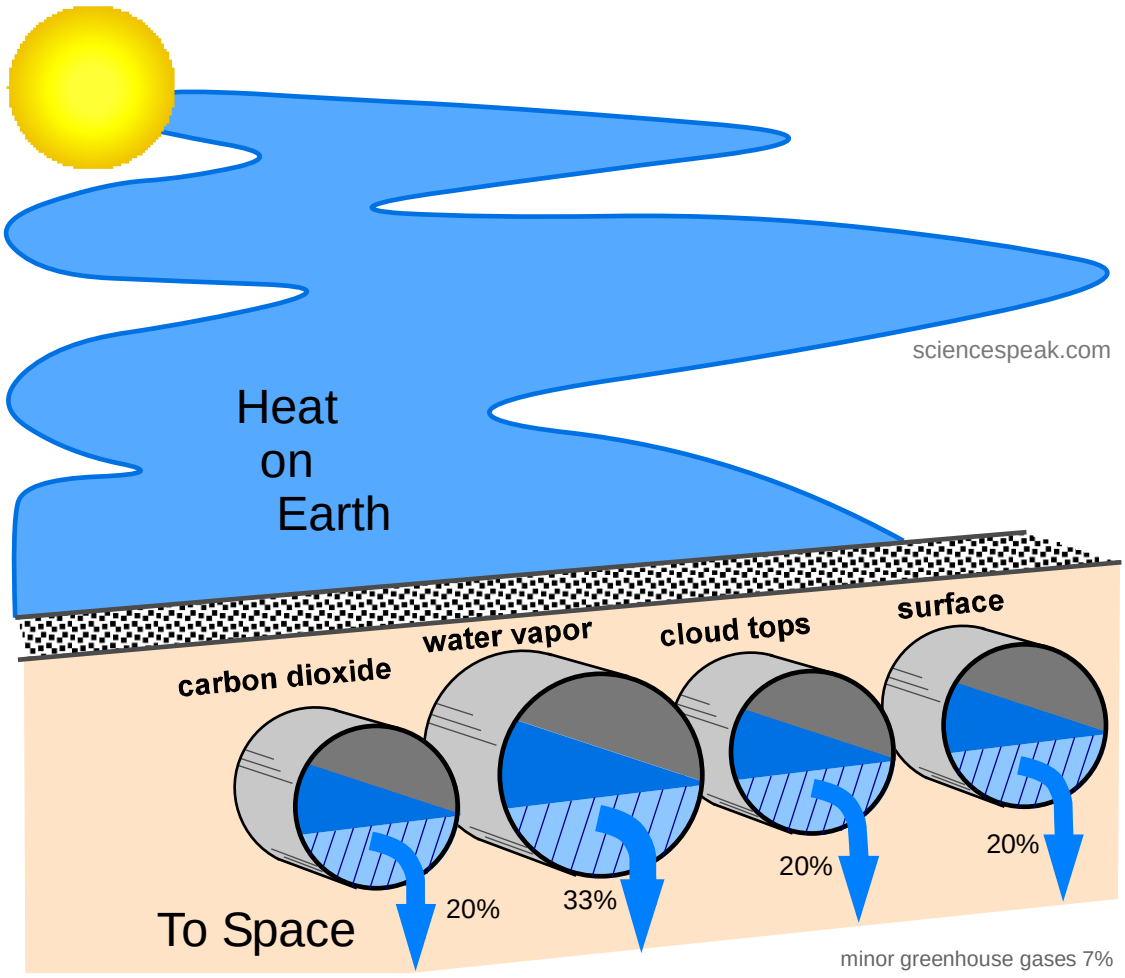
There is no empirical evidence that rising levels of carbon dioxide will raise the temperature of the Earth's surface as fast as the UN's Intergovernmental Panel on Climate Change (IPCC) predicts. The predictions are entirely based on calculations with models.

It's Like a Dam with Four Pipes

The architectural flaws in the basic climate model can be illustrated by a simple analogy.

The amount of heat on Earth is like the amount of water in a dam. There is only one inflow to the dam—a river of absorbed sunlight from the Sun (sunlight reflected by clouds and ice does not heat the Earth). Water flows out of the dam through four pipes, one for each of the main sources of emission of heat to space.

Importantly, the pipes are only partly full; they could carry more if the water level in the dam rose. When the dam is in its normal "steady state", neither filling nor emptying, the inflow from the Sun is equal to the outflow through all four pipes.



More Sunlight

If absorbed sunlight steps up to a new level, more water would flow into the dam, so the water level would rise. Soon the total outflow would match the new inflow (the new steady state) but there would be more water in the dam—so more heat on Earth.

More Carbon Dioxide

If the concentration of atmospheric carbon dioxide increases, things are quite different. This is like impeding the flow of heat to space through the carbon dioxide pipe with a partial blockage.

The input to the dam does not change. So, in the new steady state, the total outflow remains the same as it was. The effect of increasing carbon dioxide is to *redistribute* the heat radiating to space—less from carbon dioxide, more from the other pipes.

What matters to us is the surface. How much will it warm? Hotter objects emit more heat, and it's the same at the sources of emission for the pipes. More energy flowing to space through the surface pipe means more emissions to space from the surface. So the surface must be warmer, which means a

higher “global temperature”—the average temperature of the air at the surface, where we live.

The basic climate model dates back to 1896, when climate data was sparse. While the response to increased sunlight could be estimated almost entirely from lab-based data, those lab-based principles weren’t enough to directly estimate what would happen if the radiation to space was merely redistributed.

So a fateful piece of reasoning was applied: *blocking an outflow was assumed equivalent to increasing the inflow by the same amount.* The amount of water in the dam would be the same in either case, so it appears logical, doesn’t it?

So the basic climate model calculates the surface warming due to increased carbon dioxide as equal to *the surface warming due to increased absorbed sunlight*, where the increase in absorbed sunlight is the same as the reduction in emissions of heat to space by carbon dioxide.

It’s effectively the same in the large computerized climate models—the GCMs. While the GCMs treat an increase in absorbed sunlight differently to an increase in carbon dioxide by taking many more factors into account, the end results are similar. The GCMs apply mainly the same responses (“feedbacks”) to extra carbon dioxide as to extra absorbed sunlight, and calculate a similar surface warming.

GCMs are bottom-up models, trying to take everything into account. But they are tuned to reproduce the warming of the 1970s to 1990s—which is assumed to be entirely due to increasing carbon dioxide, because the observed rate of warming roughly matches the rate calculated by the basic climate model. So, ultimately, the GCMs are tweaked to match the basic model.

But hang on! How can redistributing the outflow between the pipes be equivalent to adding more water into the dam? The amount of outflow is different! Also, more sunlight mainly heats the surface while extra carbon dioxide blocks some heat from being radiated to space from the upper atmosphere—they seem pretty different.

Generations of climate scientists have convinced themselves this logic is correct. What if they got it wrong?

The dam analogy instead suggests that if the carbon dioxide pipe is blocked a little then the water would just back up a fraction then flow out the other pipes. The response of the heat is to reroute through the other pipes.

This way of looking at the climate problem is apparently novel. The “rerouting feedback”, in which the atmosphere responds to increasing carbon dioxide mainly by increasing the radiation to space from water vapor, is currently in a paper undergoing peer review.

The rerouting feedback cannot even exist in the conventional basic climate model because in that model a “feedback” can only be in response to surface warming—the rerouting feedback is in the blindspot of the conventional models.

Climate Data

An alternative basic model has been developed that fixes the architectural errors in the conventional basic model. It allows for rerouting, and instead of applying the increased-sunlight response to the influence of carbon dioxide it applies a response specifically for carbon dioxide.

There is far more climate data available now than in 1896. When the alternative model is fitted with the data, it finds a much lower sensitivity to carbon dioxide—the UN's IPCC overestimated future warming by a factor of five to ten.

Conclusion

It appears that the alarm over carbon dioxide is rooted in a modeling error made long ago when climate data was scarce.

The error is to assume that blocking outgoing heat with increased carbon dioxide is equivalent to more incoming heat from sunlight. You don't need a PhD in physics to know this doesn't make much sense.

This modeling error went unnoticed for a hundred years presumably because people focused on the values of the parameter values in the model—such as how much heat is trapped by increasing carbon dioxide—rather than on how the model combines them to estimate future warming.