

## Q&A with James Hansen

By [John Rennie](#)

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While working for NASA back in 1988, James Hansen became one of the first climatologists to sound the alarm about global warming and industrially-driven climate change. A quarter century later, his affiliation has changed—he is now an adjunct senior research scientist at the Earth Institute of Columbia University and an adjunct professor of earth and environmental science—but he is still one of the most prominent and outspoken advocates for climate reform.

Hansen is the lead author on a paper published today by PLOS ONE, “Assessing Dangerous Climate Change: Required Reductions of Carbon Emissions to Protect Young People, Future Generations and Nature” (doi: [10.1371/journal.pone.0081648](https://doi.org/10.1371/journal.pone.0081648)). The study makes unsettling arguments about the need to keep the maximum amount of warming below 2 °C. and about how rapidly fossil fuel use must decrease to prevent disastrous warming. More about the study can be read here and [here](#).

I spoke with Hansen in November before the paper’s publication. Below are excerpts from our conversation, edited for clarity.

**John Rennie: When I take a look at the paper, the big message that jumps out at me is, if we take the dangers of future global warming seriously, then nothing seems to be more important than to immediately begin significant annual reductions in CO<sub>2</sub> emissions through a switch away from the fossil fuels to non-carbon energy sources. Does that seem like a fair summary?**

*James Hansen:* Yes, and that’s because of the lifetime of the carbon in the system. You know, there’s this notion that we could do some other things more easily, by acting on the non-CO<sub>2</sub> forcings and reforestation. But those things work on a shorter time scale, and it doesn’t really matter so much when we do them. What’s crucial is that we not put stuff in the atmosphere which is going to stay in the climate system forever. For all practical purposes, that’s what it does.

**At first glance there are a lot of messages in the paper that people could say they’ve heard before. We’ve heard before, obviously, that we need to reduce CO<sub>2</sub> emissions. We’ve heard before that there’s a danger of moving the climate out of the conditions seen in the Holocene. How does your paper move those messages past what we’ve heard previously?**

I think it’s more persuasive. It’s based fundamentally on observations, on studies of earth’s energy imbalance and the paleoclimate rather than on climate models. Although I’ve spent decades working on [climate models], I think there probably will remain for a long time major uncertainties, because you just don’t know if you have all of the physics in there. Some of it, like about clouds and aerosols, is just so hard that you can’t have very firm confidence. So yes, while you could say most of these [messages] you can find one place or another, but we’ve put the whole story together. The idea was not that we were producing a really new finding but rather that we were making a persuasive case for the judge.

One thing that is a little new is the conclusion that 2 °C is probably dangerous, and the common inference that

[the cumulative release of] something on the order of 1,000 gigatons of carbon would therefore be extremely dangerous, too.

Another thing is that we say you really have to separate fossil fuel carbon from these other [forcings]. What was fundamentally wrong with the Kyoto protocol was it has got this messy conglomeration of carbon offsets and mixing-in of non-CO<sub>2</sub> forcings, which just allows excuses to continue with fossil fuel use. You really can't do that. That's why I think it's so important to separate these, because of their different time scales.

**Let me take a step back. Could you tell me something about how you and your coauthors, who have fairly diverse backgrounds, came together to work on this paper?**

We really started about three years ago. I called up people who I felt were needed. I always considered Jim Zachos to be one of the top paleo people and Eelco Rohling was for sea level. Then we needed someone on Earth's energy imbalance, and Karina von Schuckmen has done a complete analysis of this Argo float data [monitoring heat content in the deep ocean], so she was a logical person. And we needed someone for the economics, and Shi-Ling Hsu wrote the book *The Case for a Carbon Tax*, in which he did objective comparisons of cap and trade and carbon tax, so he was a logical guy to ask. And Frank Ackerman is someone who has worked with the IPCC, and been the principal person on the economic part. Valerie Masson-Delmotte is extremely good on paleoclimate, but she's also just a broad thinker. And so on. I just called these people and asked if they were willing to contribute to a paper intended for legal cases, and they agreed to do that.

**So this was intended as a kind of amicus curiae brief for future lawsuits against governments failing to act on climate?**

Yes. You know, the remarkable thing is that there are lots of governments that say we have a climate crisis, and yet they are allowing and even encouraging going after every fossil fuel they can find. I mean right now the Democrats and Republicans are fighting over who should get the credit for all this. *[Laughs.]*

So there's just a disconnect between what they're saying about climate and what they're doing about fossil fuels, so we have to really make it crystal clear that we just can't burn much more fossil fuel. And you know I realize that this is being said and has been said in a number of papers, but somehow *[laughs]* we need to say it as clearly as possible in a way that a judge can appreciate. So it's a little less technical than most of the papers you'll find even in *Nature* or *Science*, although it does reference the scientific literature in a comprehensive way.

**Going back to the paleoclimate data, is there much doubt at all about the temperature reconstructions and how they relate to past sea levels? Is that a fairly solid base of information there, or is there much uncertainty?**

It's pretty solid now, and actually that's one of the reasons that the paper was delayed. I did twice interrupt the process to complete a paper that contributed to the analysis. One of those was the paleoclimate paper in which we initially had used a simple prescription to relate deep ocean temperature to surface temperature. It really wasn't good enough, and we realized that our estimate for the Eemian, 120,000 years ago, was not accurate. So we went back and did [another paleo paper](#), which came out a few months ago in *Philosophical Transactions in the Royal Society*. But we referenced a number of papers that looked specifically at the Eemian, and so it's pretty solid that [the Eemian epoch] was only about 2 °C warmer than the main Holocene [the past 10,000 years]. So I don't think we will get any flack on that.

And you know that's basically all we can do: look at the Holocene and compare that with the Eemian. We can't really say, "What if we're just a little bit above the Holocene, is that dangerous or not?" That's getting to be too fine and specific. But clearly if you go all the way to the Eemian, then we're well into dangerous change. And

furthermore, when we talk about 2 °C either from our calculations or from IPCC calculations, you're really not including all these slow feedbacks. So it would really be hitting the planet to temperatures beyond the Eemian if you allow the emissions that would get [to 2 °C] via just fast feedbacks.

**It was interesting to see that point in the paper, that we can't find anything in the geological climate record that even corresponds to the kind of forcings and the rate of warming that we're looking at right now. So it's impossible to make any precise comparison to something that's happened before.**

Yes. The PETM [Paleocene-Eocene Thermal Maximum more than 55 million years ago] was an order of magnitude slower, and that's about the fastest thing we know about. There are asteroid impacts or big volcanoes [that cooled the earth over the short term] but not anything which caused a huge bracket of warming. Those just don't change the composition of the atmosphere enough. You need a lot of gas in order to get a forcing of that magnitude, and there aren't many examples we know of.

**With your paleoclimate methodology, you largely sidestepped the problem of having to deal with climate models.**

We're not entirely avoiding models. We're taking any [estimates of] climate sensitivity from the paleoclimate. And then we're doing a very simple calculation with that. But it's largely avoiding climate models.

**Your paper talks about nuclear power as a more or less inescapable part of the solution if we're to achieve these CO<sub>2</sub> reductions. Is it clear whether even under the most optimistic and permissive regulatory scenarios that the supply of nuclear power could build up fast enough?**

I think that we could because where it is needed most is China and to a lesser extent India, where they can build power plants quite rapidly. And in particular, if we would come up with an accepted standard design for a modular version of the nuclear power plant, then so you can just churn them out in factories and then ship them to the sites. You know, you can compare it to the building of ships and aircraft in World War II. Once we decide this is a crisis, it can be done quite rapidly.

The U.S. still has some technology capabilities that exceed those in China, and China would love to have the stamp of approval of the NRC [U.S. Nuclear Regulatory Commission]. They don't want to start churning out reactors and have them be less safe than is possible. So we really should cooperate with them, and I think there's some hope that could happen. Nuclear power is not something that Republicans object to. It's really the Democrats that have been the problem in slowing down the R&D.

**What you have in mind are third- and fourth-generation reactors that are more modular and theoretically safer. A concern with the advanced reactors is that they would be reprocessing fuel, which could have an impact on the risk of nuclear terrorism. But I think you have said that we need to deal with terrorist issues separately, is that right?**

Yes. For the U.S. to bail out on the most advanced R&D is not helpful in terms of assuring that nuclear power will be as safe as possible. Because the U.S. bailing out is not going to cause the rest of the world to turn its back on nuclear. And the problems have not been originating from nuclear power plants—there are rogue states that are going after weapons right from the beginning.

**What would be the major points of scientific uncertainty within your study's data or your analysis?**

There's always this question about sea level, and how fast do ice sheets disintegrate. And whether you're going

to say, “Well, if it’s going to be 500 years or something, then maybe we don’t care.” Well, you know, the paleo data doesn’t allow you to see a discernible lag between the global temperature changes and the sea level changes, so it doesn’t give you any confidence that there’s going to be a big lag.

As long as people are saying, “Oh, it’s going to be some centimeters less than a meter by the end of the century,” then people don’t get very worried about that. But now there’s [an interesting paper that just appeared today](#), in which the authors did a poll of 90 experts selected for their publications on ice sheet dynamics for sea level area. And it turns out that a majority of them think that sea level rise would be well over a meter a century and could be higher.

*[Note: The survey found that most of the scientists believed that sea level rise by 2100 is likely to be 40-60 centimeters if warming mitigation measures are strong but 70-120 centimeters without them. Stefan Rahmstorf, one of the survey’s authors, [discusses the findings at Real Climate](#). —JR]*

So the IPCC numbers seem to be very conservative relative to expert opinion. We don’t have any specifically relevant paleoclimate examples that would allow you to quantify this, so it does really depend on opinion. I think the public position of the [sea-level modeling] community, if that’s represented by the IPCC, is different from what people will tell you in the bathroom. *[Laughs.]*

### **How optimistic are you that people will read your paper and take the kind of actions that you have said would be appropriate?**

With the carbon price idea, if you give the money [collected from levies on CO<sub>2</sub>-emitting industries] to the public, I think that could happen. It’s a matter of getting public to be aware of this, and that’s why I support the [Citizens Climate Lobby](#), which is trying to argue for this. Most people would get more money in a dividend than they paid in increased prices, and a lot of the increased price effect [is something] they wouldn’t actually see very explicitly. So I think they would not object to prices going up, and I think you would get to the point where a lot of fossil fuels would become become less competitive. Right now, consumers don’t have much choice. But once we start moving in the right direction and have some alternatives, we will probably need to include nuclear power because electricity should become a bigger and bigger fraction of the total energy supply. And in fact it is becoming a bigger and bigger fraction, but if we’re going to move off fossil fuels, it’ll have to get even larger.

We have to pass those tipping points and then I think it will go very rapidly. At that point we’ll have cleaner energy and no reason to continue to try to dig deeper and deeper [after fossil fuels].

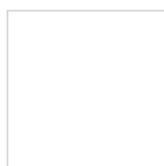
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