

SCIENCE

## Climate Science Is Settled *Enough*

The *Wall Street Journal's* fresh face of climate inaction.

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OCT 01, 2014 • 2:36 PM



A man scoops fish from a partially dried-up pond in China's Zhejiang province on Aug. 13, 2013. It's true that the climate has always changed and always will, but does that mean we should just shrug at situations like these?

Photo by William Hong/Reuters

When the *Wall Street Journal* publishes yet another argument for doing nothing about global warming, it's just a dog-bites-man story. So why should anybody get particularly exercised by the *Journal's* latest incarnation of this fixed idea, in the form of an extended essay by Steve Koonin? It was to be expected that the *Journal* would try to take some pre-emptive action on the eve of the opening of the United Nations Climate Summit in New York and the world's largest climate-action rally. What makes Koonin's piece noteworthy more than anything else is the messenger.

Steve Koonin is the answer to a troublesome question facing the *Journal's* opinion page editors: What you do if you want to continue obstructing progress on global warming pollution, but your usual stable of tame skeptics is starting to die off ([Fred Seitz](#)), retire from active research ([Dick Lindzen](#)), or discredit itself through serial scientific errors ([John Christy](#)) or by taking fanatical and manifestly untenable positions ([Heartland Institute](#))? That puts the editors in quite a pickle. The *Wall Street Journal* evidently has high hopes for promoting Koonin as a prominent new voice for inaction, having lavished on him 2,000 words and front-page Saturday exposure outside the *Journal's* payroll.

### Who is Steve Koonin and why should we care?

Koonin has constructed a narrative that is calculated to make people take notice even if they wouldn't ordinarily trust anything the *Wall Street Journal* published on global warming: I'm a physicist bringing my brilliance and outside perspective to the backwater of climate science! (He was a professor of physics, and later provost, at Caltech.) I'm green! (He was chief scientist for BP, the oil firm that likes to tout itself as the "beyond petroleum" company, and he was involved with renewables there, among other things.) I've got true-blue Democratic credentials! (He was undersecretary for science in the Department of Energy during Obama's first term.)

But there are flaws in this narrative. Being a smart physicist can just give you more elaborate ways to delude yourself and others, along with the arrogance to think you can do so without taking the time to really understand the subject you are discussing. [Freeman Dyson](#) is a famous example. Koonin's role in the Department of Energy was marginal and largely powerless, leading ultimately to his [resignation](#). BP's "beyond petroleum" vision evidently includes tar sands (both [extraction](#) and [refining](#)) and [petcoke](#) (arguably the worst fossil fuel of all). And anyway, how green can you be if you're the company that gave us the [Deepwater Horizon](#) disaster?

Koonin is currently director of New York University's [Center for Urban Science and Progress](#), which was formed in partnership with New York City under former Mayor Michael Bloomberg. One of the missions of the center is to increase urban resilience, and there is hardly any aspect of urban resilience that is unaffected by climate change. This is highlighted prominently in the center's roster of [research interests](#), which states: "The effects of Hurricane Sandy on NYC and surrounding regions highlighted the combined danger of extreme weather events and the reality of global climate change." Can somebody with Koonin's evident misconceptions about climate science and its policy implications really be trusted to provide effective leadership for such an institution? If I were the

president of NYU, or indeed Mayor Bill de Blasio, I would be having a lot of second thoughts right now.

The American Physical Society is currently reviewing its policy statement on climate change, and Koonin has had a substantial hand in that five-year process. He was a member of the society's Panel on Public Affairs, which has responsibility for vetting policy statements, and is still listed as chair-elect. He was a member of the subcommittee charged with overseeing the statement revision, and appears to have been the organizer of a hearing on climate science conducted at the Center for Urban Science and Progress, his current home institution in Brooklyn. The full transcript of this hearing is available here.

The choice of its drafting committee indicates some serious problems with the APS process for its climate change statement, as the committee did not include a single physicist who was actually doing work in the area of climate science. Given that, one might think the committee would avail itself of the opportunity to become better educated through hearing from the best and most representative experts the field has to offer. The panel of experts it consulted did include three scientists with impeccable track records of contributions to the field: Isaac Held, Ben Santer, and Bill Collins. But these experts were "balanced" with people picked disproportionately from the tiny wing of climate skeptics: Dick Lindzen, Judy Curry, and John Christy. One participant in the process described it to me as being set up as "a show trial of the IPCC"—that is, the Intergovernmental Panel on Climate Change—rather than an educational event aimed at probing the deeper questions concerning global warming. If you expose a panel of physicists who are ignorant of climate science to 50 percent wisdom and 50 percent nonsense, one cannot hold out much hope for a good outcome.

Koonin seems to have taken most of the talking points in his *Journal* essay from the presentations of the skeptics, ignoring or belittling the more considered assessment given by the other invited panelists. The word I have from inside APS is that Koonin has resigned from the Panel on Public Affairs to allow himself greater latitude to make public pronouncements on climate change, so we can expect to be hearing much more from him in the future. There is a lot of good will (and intelligence) on the remaining panel, so there is a good chance that it will be able to recover from an inauspicious beginning.

### **A litany of discredited arguments.**

Let's first gratefully acknowledge that in some ways this piece represents a material step forward in the annals of the *Wall Street Journal's* coverage of climate change: Koonin writes that the human influence on climate is "no hoax," and that "continually growing amounts of

greenhouse gases in the atmosphere, due largely to carbon-dioxide emissions from the conventional use of fossil fuels, are influencing the climate.” He affirms that “uncertainty need not be an excuse for inaction.” If all the economic heavy hitters who read the *Journal* subscribed to these views, that would represent progress of a sort.

But the nuggets of truth in Koonin’s essay are buried beneath a rubble of false or misleading claims from the standard climate skeptics’ canon. To pick a few examples:

- He claims that the rate of sea level rise now is no greater than it was early in the 20<sup>th</sup> century, but this is a conclusion one could draw only through the most shameless cherry-picking. In reality, according to the data, the sea level trend was .8 millimeters of rise per year from 1870 to 1924, 1.9 millimeters per year from 1925 to 1992, and 3.2 millimeters per year from 1993 to 2014—i.e., the rate has actually quadrupled since preindustrial times.
- He claims that the human imprint on climate is only “comparable” to natural variability, whereas multiple lines of research confirm that the climate signature of human-caused greenhouse gas increases has already risen well above the background noise level. Koonin’s claim also obscures the fact that human-induced greenhouse gas increases are the *only* influences that have been found to provide a significant drive for warming. The most prominent natural influences, such as volcanic eruptions and heat uptake by the ocean, only serve to offset some of the warming caused by human influences.
- He states that human additions to the greenhouse effect will shift the natural greenhouse effect by only 1 percent to 2 percent by the middle of the century. This is another variant of the standard skeptics’ arguments that attempt to make the human influence seem small, but, like all such arguments, requires a lot of creative accounting. In reality, a large part of the natural greenhouse effect is due to substances (mainly water vapor, and consequent cloudiness) that are in the atmosphere only because carbon dioxide keeps the Earth warm enough to prevent them from condensing out. Carbon dioxide is the main control knob for Earth’s climate, and if one looks at the effect of doubling carbon dioxide relative to the baseline carbon dioxide greenhouse effect, that amounts to a change of over 10 percent—and at the rate our fossil fuel burning is increasing, we could go well beyond doubling. Further, if one looks at fossil fuel burning in terms of the magnitude of our disruption of the natural carbon cycle, industrial civilization looks like a force of much more than geological proportions. Fossil fuel burning is adding carbon to the Earth system at a rate that is more than 100 times greater than the volcanic sources that drive the Earth’s natural long-term carbon cycle.
- He states that the effects of carbon dioxide will last “several centuries,” whereas “several millennia” would be closer to the truth. The carbon dioxide we emit while dithering about what to do will cause essentially irreversible changes to our climate.
- He does a lot of hand-wringing about the uncertainties in ocean behavior, but doesn’t seem to appreciate that oceans cannot be a *cause* of long-term warming because almost all of the mass of the oceans is colder than the lower atmosphere. Oceans can delay warming by taking up heat (indeed they are, as ocean observations confirm), but the warming will be made up with a vengeance once the oceans stop taking up heat, as they eventually must.

One could go on for a long time dissecting the flaws and misleading spin in Koonin's arguments. Most of the old chestnuts are there, including the dismissive statement that "climate has always changed and always will" (true enough, but not cause for complacency about human influences), the supposedly missing tropical "hot spot" (which Koonin badly garbles in multiple ways, but which is well-discussed by Carl Mears and by Steve Sherwood here), and the by-now-obligatory reference to the decadal "pause" in global warming. Without belaboring the point, let's just say that Koonin's arguments are not the sort of thing that would emerge from a period of deep reflection by some brilliant mind turning serious attention to the subject. Rather, they are the sorts of things one could pick up in a weekend surfing a few of the more willfully ignorant skeptic's blogs.

### **Climate science is not settled, but it's settled *enough*.**

Koonin's most seriously misleading claims concern uncertainty. There are two parts to his attack: first, that climate scientists systematically suppress discussion of uncertainty, especially when communicating with policymakers; and second, that climate science is too uncertain to provide a basis for policy decisions.

To anybody with even a cursory familiarity with the climate science literature, the claim that it is impermissible to discuss uncertainties is laughable. There is hardly anything else scientists do, in climate science or elsewhere, besides dispute received wisdom and one another's findings. The reward structure in all of science favors those who overturn some widely accepted theory over those who just confirm or provide an elaboration on what is already known. A lot of these disputes (and I have been party to several myself) are more like bar fights than the secretive "hushed sidebar conversations" Koonin makes them out to be. Climate science has been refined in the fires of such disputes for well over a century now, and the constant turmoil of questioning still dominates the professional journals and meetings. Indeed, most of the uncertainties highlighted by Koonin were first identified and reported in professional journals by climate science "insiders" (in some cases even IPCC authors), and continue to be vigorously discussed there. For example, the case of the (possibly) missing tropical hot spot was first discussed in a paper by Dian Gaffen in 2000, and has been the subject of numerous other papers, including this recent one co-authored by Suki Manabe, one of the founding fathers of climate modeling. Climate sensitivity—the amount by which the global average temperature increases upon doubling of the amount of carbon dioxide in the atmosphere—is one of the key uncertain factors governing our climate future, and results on this key parameter are almost invariably presented in terms of a distribution of possible values.

Science is never settled, but it can be settled *enough*. Newtonian mechanics was not settled science—it was overturned by both relativity and quantum mechanics. Nonetheless, it was, and continues to be, settled enough to build bridges and design airplanes. It is in this spirit that the word *settled* is used sometimes in connection with climate science, and not in the cartoonish sense that Koonin fabricates in his straw-man argument. It is always easy to find gaps—even very significant gaps—in the understanding of a system as complex as the climate, but the issue on the table isn't whether our understanding is complete, but whether it is complete *enough* to justify the need for serious controls on carbon dioxide emissions. It's not the situation that the range of climate predictions runs from "pretty good" to "somewhat bad"—the truth is more like "bad" to "extremely bad," unless emissions growth is halted and eventually reversed.

Rickshaw pullers wade through a flooded road after heavy rains at Guwahati in the northeastern Indian state of Assam on June 27, 2014.

Photo by Utpal Baruah/Reuters

Let's imagine you are a smoker and go to the doctor with a variety of troubling physical complaints. She tells you, "Well, a lot of these troubles are typically associated with smoking, but you don't have cancer yet and the fact is we don't know everything about the precise biochemical pathways that connect smoking to cancer, and anyway there's always the chance you'll get emphysema before you get cancer." If you were to apply Koonin's



reasoning to this situation, your response would be, “OK, Doc, I’ll wait to give up smoking until you can tell me exactly how it will kill me and when.”

Climate science is settled *enough* to provide the policy guidance that matters most, namely that there is an urgent need for halting, and eventually reversing, the worldwide growth in carbon dioxide emissions. At a time when essentially nothing effective is being done, it is pointless to fret, as Koonin does, about exactly how much reduction is optimal—the clear answer from climate science is: “The more the better, the sooner the better, and whatever we actually do is apt to be less than what is really needed, though worth doing nonetheless.” Major policy decisions are routinely made in economic and national security areas in the face of far greater uncertainty than prevails in climate science.

The conclusion that climate science is settled *enough* proceeds from two well-established properties of the climate system: No. 1, most climate damages rise with the rise in global mean temperature, though the regional distributions of the damages are uncertain and vary from model to model; and No. 2, the peak global mean warming is approximately proportional to the total amount of carbon dioxide emitted up to the time such emissions cease completely. Given current rates of emissions growth, about 2.5 percent annually, we will exceed a threshold corresponding to 2 degrees Celsius of warming in a matter of a few decades, if climate sensitivity turns out to be in the middle of the uncertainty range. If we are lucky and climate sensitivity turns out to be at the lower end of the range of scientifically credible estimates, then given a 2.5 percent annual rate of growth of emissions, the good news would buy us only an extra 28 years beyond the perilously short time that would be allotted to us under midrange climate sensitivity. Given that we *really* should have started decarbonizing the economy 30 years ago, that’s not much justification for inaction; in fact, it would be nothing but good news since it would make the task more feasible.

But what if we are unlucky and climate sensitivity turns out to be at the high end of the range? In that case we would be locked into 4 degrees Celsius of eventual warming within the next few decades, even in the unlikely event we were able to stop using fossil fuels cold turkey. As Koonin rightly notes, the past 30 years of intensive research in climate science has not managed to narrow the uncertainty range in climate sensitivity. What he fails to note is that this uncertainty provides an argument for *more* rather than less action on emissions control, since it means that no scientifically credible argument advanced in the past several decades has been able to rule out the risk that climate sensitivity is at the high end of the range. In the face of that, the only way to avert the risk is to simply not emit so much carbon dioxide. And the millennial duration of the warming induced by carbon dioxide means that we don’t have the luxury of waiting a few more decades before taking action, in

the hopes that 30 more years of research will finally accomplish what the past 30 failed to do. As the Swedish cookbook pioneer Kajsa Warg is reputed to have said, “You cook with what you have.”

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