

Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters
By Stephen E. Koonin
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Review by David K. Levine¹

Stephen E. Koonin started his career as a theoretical physicist and subsequently moved on to be a science advisor: he was the chief scientist at BP and subsequently undersecretary for science at the U.S. Department of Energy under President Obama. He has written on the climate debate and this book represents a detailed account of his views.

It is difficult to review a book like this without a few words about the fraught debate over climate change. There is a lot of uncertainty about what the human impact on climate change has been and what it will be. The best scientific consensus is represented by the Intergovernmental Panel on Climate Change (IPCC) assessments which are generally cautious. We are confident that atmospheric CO₂ has increased substantially and this is primarily due to CO₂ emissions. We are confident that temperature and sea levels are rising and that that increased CO₂ in the atmosphere has contributed to that. We are less confident about the quantitative impact of CO₂ on these rises.

At this point let me put on my hat as an economist trained in risk assessment. We have on the one hand our best guess about the quantitative impact of CO₂ emissions on temperature and sea level rise and this is substantial and concerning. We have as well a great deal of uncertainty about this best guess and this uncertainty is not well reported in the media – there is a substantial probability that the true situation is much better than the IPCC's best guess - and a substantial probability that it is much worse. As I shall indicate this does not pose a problem for risk assessment - if there is no uncertainty there is no risk - nor for assessing policies. It does however pose a problem for the debate because the evidence is not strong enough to convince optimists that the situation is as bad as the IPCC's best guess, nor is it strong enough to convince pessimists that the situation is as good as the IPCC's best guess. This results in a hugely emotional debate in which optimists point to the tremendous costs of policies designed to reduce emissions and the pessimists believe that without immediate and strong action catastrophe will ensue. The evidence is not strong enough to declare that either side is wrong.

Koonin does an excellent job in documenting the uncertainties about our current knowledge of climate and how it is misrepresented in the media. I can recommend this book for that discussion. However: Koonin is an optimist. While you will find a great deal of discussion of why things might be much better than the IPCC's best guess, you will find no discussion of why things might be much worse. Here is what he says in his introduction to part I of the book:

The earth has warmed during the past century, partly because of natural phenomena and partly in response to growing human influences. These human influences (most importantly the accumulation of CO₂ from burning fossil fuels) exert a physically small

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effect on the complex climate system. Unfortunately, our limited observations and understanding are insufficient to usefully quantify either how the climate will respond to human influences or how it varies naturally. However, even as human influences have increased almost fivefold since 1950 and the globe has warmed modestly, most severe weather phenomena remain within past variability. Projections of future climate and weather events rely on models demonstrably unfit for the purpose.

Perhaps the best way to view this book is in light of his proposal in Chapter 11 to have a “red team” review of the IPCC - analyzing carefully where there are weaknesses in their arguments. It is clear that by red team he means a red team of optimists, and this book can be regarded as his own informal red team review. His proposal lacks an important dimension: the need also for a “green team” review, which is to say a team of pessimists, and he does not seem to have much interest in the very real possibility that things are much worse than the IPCC’s best guess. The book should be read with this in mind, as well as the point I shall return to - that Koonin’s lack of understanding of risk assessment leads his policy analysis astray.

With this in mind let me run through some of the things Koonin has to say. The book has two parts: The first focused on the science of climate change, emphasizing how uncertain we are; the second part focuses on policy, although the last two chapters of the first part are also about policy. Given his background as a scientist it is perhaps not surprising that the first part of the book is stronger than the second.

In discussing the science Koonin does a good job of explaining how the IPCC works, what their assessments mean in terms of strength of evidence, uncertainty and consensus. He explains the basic facts of the science of climate change and the facts of measuring temperature and what has happened with it over time, both long and short. There are some deficiencies in this discussion. He argues that overall human impact on the climate is necessarily small, and viewed through the lens he uses this is correct. He says, for example “human influences currently amount to only 1 percent of the energy that flows through the climate system.” That may be true but he then indicates that this “has important implications.” To which I would say “not really.” The point is that while our influence on climate may be pretty small in the sense that changing the temperature by 3 degrees is not a lot in the scale of the climate history of the earth, it may be large from a human well-being perspective which is the relevant scale. Much later in the book he does refer to estimates by economists of the damages from changes of this magnitude which are relatively modest - but also subject to substantial uncertainty.

Koonin also occasionally attacks straw men which, despite his long discussions of the importance of scientists remaining neutral, give the book the flavor of advocacy rather than science. For example, he attacks percentage change in temperature as meaningless. This is surely true and I have a hard time imagining any reader of the book who would think otherwise. As a test of this I went on Google to look up percentage change in temperature and the only things I could find all indicated that the idea is nonsensical.

From a production point of view, I should say also that attributing facts only in notes and putting all the notes at the end of the book makes it very costly for the reader to try to verify what Koonin says or understand what his sources are. Spot checking, I found things to be fine, but I cannot recommend this style.

A surprisingly large part of the book is devoted to extreme weather events. As extreme weather events are relatively rare, and there is a lot of natural variation independent of climate change, it is extremely hard to tell whether the frequency and severity of these events has increased and if so whether it has something to do with human activity. Like Koonin I find the media discussion of this maddening, as if the fact that this year in Death Valley, California it is the hottest it has been in thirteen years has a necessary connection to climate change.

On this topic Koonin quotes the IPCC:

Here are some (perhaps surprising) summary statements from the IPCC's AR5 WGI report, indicating what we know (or don't know) about a few such trends:

“ . . . low confidence regarding the sign of trend in the magnitude and/or frequency of floods on a global scale.”

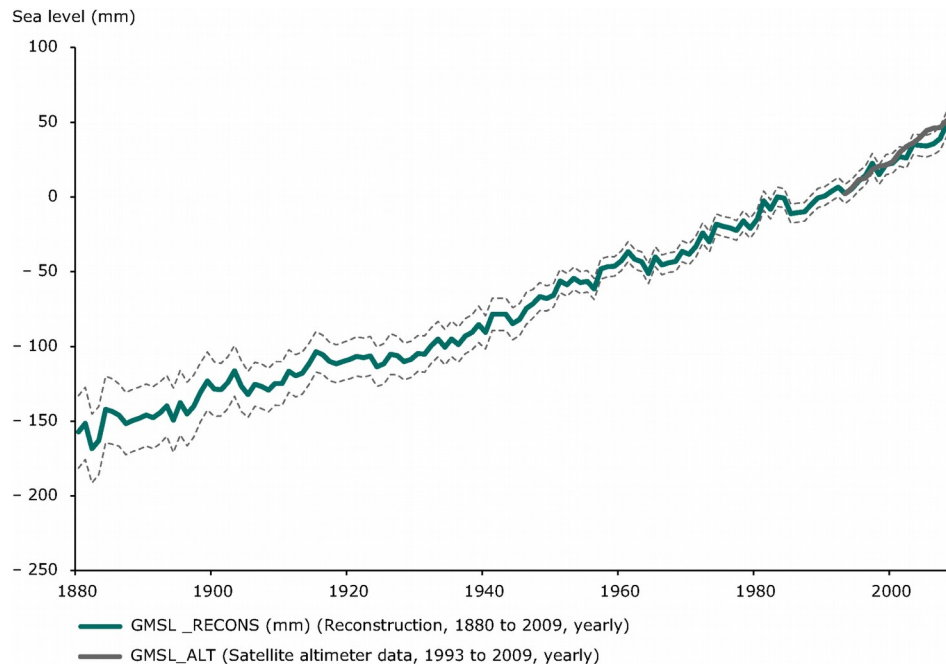
“ . . . low confidence in a global-scale observed trend in drought or dryness (lack of rainfall) since the middle of the 20th century . . . ”

“ . . . low confidence in trends in small-scale severe weather phenomena such as hail and thunderstorms . . . ”

“ . . . confidence in large scale changes in the intensity of extreme extratropical cyclones [storms] since 1900 is low.”

In the next chapter he gets more specific, and this well represents the strength of the book. He discusses a “USA Today article [that] says unequivocally: ‘Human-caused global warming has strengthened the wind speeds of hurricanes, typhoons and cyclones around the globe.’” However, what the study actually says is that they “found a short-term trend toward more intense storms in the North Atlantic basin and ... there are many factors that contribute to the characteristics and observed changes ... and this work makes no attempt to formally disentangle all of these factors. In particular, the significant trends identified in this empirical study do not constitute a traditional formal detection, and cannot precisely quantify the contribution from anthropogenic factors.” Like Koonin I find this kind of reporting maddening. I should however add a caveat that Koonin does not: the fact that the data is too weak to tell if extreme weather events are increasing in frequency does not mean it is not true - it means we do not know, and this is a rather different matter.

There is also a long section on sea level rise, apparently dating back to an article he wrote for the *Wall Street Journal* that was criticized by other scientists. For the record here is overall sea level rise, more or less the same graph he has in his book.



Now as Koonin says “there are variations from decade to decade” so comparing particular decades does not mean a great deal. This contradicts his main argument that this century long trend could not be due to human activity because the sea level is already rising in the first two decades “well before there were significant human influences on the climate” which is also not true, as those familiar with the history of the industrial revolution will be aware. The best I can say about his discussion about sea level rise is that he has a particular bee in his bonnet about it, and that here his optimism is at the very extreme end of what can be supported by the data, and perhaps the chapter should not be taken too seriously.

The final part of the book is devoted to policy and prognostication. I find the policy analysis rather weak - although he does have a good set of red flags for distinguishing serious discussion from propaganda - and largely agree with his prognostication.

His bottom line runs roughly as follows. Early in the book he says: “In short, the science is insufficient to make useful projections about how the climate will change over the coming decades, much less what effect our actions will have on it.” He subsequently elaborates on this to say

The uncertainties in modeling of both climate change and the consequences of future greenhouse gas emissions make it impossible today to provide reliable, quantitative statements about relative risks and consequences and benefits of rising greenhouse gases to the Earth system as a whole, let alone to specific regions of the planet.

This is wrong. We have a best guess about what the consequences and benefits are and we have a pretty good idea of how much uncertainty surrounds that guess. Integrated assessment models by economists that I have seen all take account of the uncertainty both in the science

and in the economics. None of them indicate it is a good idea to do nothing, and all of them indicate the modest and effective measures taken now will have *expected* benefits that substantially exceed the costs. I would especially like to draw attention to the work of Hassler, J., Krusell, P., and Olovsson, C. [2018]: "The consequences of uncertainty: climate sensitivity and economic sensitivity to the climate," Annual Review of Economics 10: 189-205. Here they show that if Koonin is correct and we have little to worry about, the modest measures they propose will have little cost, while if Koonin is wrong and the pessimists right it will have substantial benefits. This is the unfortunate fact about the optimists: it may be that the chances of disaster are small but that does not mean they can be ignored. Airplanes rarely crash, but this does not mean they should not be inspected and repaired.

The truth is, however, that Koonin never actually makes a recommendation for action or inaction although the latter seems to be the implication of his claims. He does give a good discussion of measures that are being proposed and argues that if implemented these will be costly without much good effect. As this view is shared by economists working on climate change, it is hard for me to disagree with this, and even thoughtful progressives such as the blogger Kevin Drum find little to like in the various measures being proposed and implemented. Koonin's bottom line is that we will probably not take effective action and I am afraid that I agree, I only hope that he is correct in thinking that things will turn out okay never-the-less.