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FP Comment

Overheated claims; Scientists advocating for action are overselling the predictive capabilities of climate models

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The famous physicist Niels Bohr is attributed with saying that "Prediction is very difficult, especially about the future." Anyone who pays attention to weather forecasts or economic predictions knows how true this is. But given that the future can't be predicted with perfect accuracy, seeing predictions fail is actually an important part of their usefulness. Whether one is faced with evacuating from a possible hurricane landfall or investing in a mutual fund, decision-making is improved when uncertainties are readily understood.

On the highly politicized issue of climate change, however, understanding uncertainties is made difficult when scientists advocating for action oversell the predictive capabilities of climate models, such as those of the United Nations Intergovernmental Panel on Climate Change (IPCC). But action on climate change makes sense even if many climate scientists oversell predictive capabilities.

Scientists oversell the predictive capacity of climate models when they claim that the most recent weather events occurring around the world are consistent with predictions from climate models. For example, last fall a scientist who had contributed to the most recent IPCC reports said that the intense southern California wildfires occurring at the time "are consistent with what the latest modeling shows." Similarly, in 2006 a Berkeley professor and climate change expert asserted that "the current heat waves throughout much of North America and Europe are consistent with the predictions of our global climate models." A quick Internet search will reveal countless scientists who have made such claims about the predictive prowess of climate models.

But what does it mean to say that some weather events are "consistent with" climate model predictions? The implication of such statements of course is that models are reliable and offer accurate predictions that have been borne out by experience. But unfortunately, the real answer is that saying that any recent weather events are "consistent with" model predictions is an empty statement.

All of these claims of consistency between recent weather and model-based predictions

might lead one to ask, in principle, what observations of weather events would be inconsistent with predictions from climate models. Guess what? It turns out that nothing that could be observed over a time period less than a decade or more -- short of abrupt and unprecedented climate change, like an ice sheet advancing on New York -- would be inconsistent with climate model predictions.

There are good reasons for why predictions of climate models are not useful on short time periods of less than a few decades. Urs Neu, a climate scientist from Switzerland, says that climate models are not designed to tell us anything about the evolution of the climate system in the short term; rather, they "are designed to simulate the long-term behaviour as accurately as possible. Long-term behaviour means the trend over at least 20-30 years." Similarly, two climate modelers, Claudia Tebaldi and Reto Knutti, observed in a research paper that "it is important to note that climate projections, decades or longer in the future by definition, cannot be validated directly through observed changes. Our confidence in climate models must therefore come from other sources."

If climate models are designed to make predictions about trends in the global climate system over several decades, then there is nothing that can be said about a model's accuracy on time scales of less than a decade, much less one fire season, or a few heat waves, or any other transient phenomena. Consequently, any claim that recently observed weather events are "consistent with" predictions is actually quite misleading.

On a longer term, more can be said about predictive accuracy of climate model predictions. The first IPCC projections of future climate were issued in 1990, and with more than 17 years of observations since that prediction we can confidently state that the IPCC's 1990 "best guess" overstated the global temperature increase as well as sea level rise for the subsequent two decades. But such retrospective evaluations are typically dismissed because those predictions were made using outdated models based on earlier understandings. The IPCC issues predictions for 20-to 30-year periods into the future, and updates them every 6-7 years, so in practice its current predictive capabilities can never be evaluated against real world data. As Tebaldi and Knutti observe, "climate projections, decades or longer in the future by definition, cannot be validated directly through observed changes."

So in the debate on what to do about climate change, what are we to make of the overstated claims of predictive accuracy offered by many scientists?

Not surprisingly, the reason for overstated claims lies in the bitter and contested politics of climate change. Myanna Lahsen, an anthropologist who has studied climate modelers, finds that many of these scientists are acutely aware of the fact that any expressed "caveats, qualifications and other acknowledgements of model limitations can become fodder for the anti-environmental movement." She documents how, more than a decade ago, a prominent climate scientist warned a group of his colleagues at the National Center for Atmospheric Research, home of one of the main U. S. climate modeling efforts that informs the IPCC, to "Choose carefully your adjectives to describe the models. Confidence or lack of confidence in the models is the deciding factor in whether or not there will be policy response on behalf of climate change."

I witnessed this dynamic in practice while I was waiting to testify on climate policy before the U. S. Congress in 2006. A prominent climate scientist testifying on the panel appearing before mine was asked by a member of Congress about uncertainties in predictions from climate models. The scientist replied, enthusiastically and accurately, that

there are a range of important uncertainties coming from scenario inputs and choices in parameterization schemes, instantly overwhelming his congressional audience with technical detail. Much later, and after a long break, the scientist requested an opportunity to clarify his earlier comments, and this time he said, "I would like to give you a little more direct answer to the question on reliability of climate models. I think they are reliable enough to be a very useful guide into the future."

Lost in the Manichean debate over climate change is the real significance of what climate models really are telling us: We should act on climate mitigation and adaptation not because we are able to predict the future, but because we cannot. The academic literature, far from public view, contains a much more realistic perspective on the uncertain predictive capabilities of climate models. Oxford University's David Frame and colleagues, all climate modelers, explain that "Rather than seeing models as describing literal truth, we ought to see them as convenient fictions which try to provide something useful."

They are useful because the predictions from models suggest that the climate patterns experienced in the past century or so may not be a useful guide to the future -- but exactly how change might occur is uncertain. Ten years ago Simon Shackley and his colleagues warned that "The impression that climate change can be so predicted and managed is not only misleading, but it could also have negative repercussions should policy makers act on this assumption." By this they meant that "the societal perception that the 'climate change problem' is being adequately handled could inhibit the emergence of, and support for, creative social, policy and economic responses to the challenge of coping with a possibly inherently unpredictable system such as climate."

The reality is that the future state of the climate is uncertain, and as such it represents a type of risk management problem. In 2002 Steve Schneider, a climate scientist at Stanford University and long-time advocate for action on climate change, explained "uncertainties so infuse the issue of climate change that it is still impossible to rule out either mild or catastrophic outcomes." Combatants in the climate debate congregate around the extremes, emphasize either mild or catastrophic outcomes as is convenient and overstate the certainty of such outcomes.

When scientists advocating action overstate the certainty of predictions, and policy-makers commit political and other resources based on those claims, they find themselves in a difficult situation because, according to Frame and colleagues, "they are likely to face strong criticism if they revise up their estimates of uncertainty in the relatively near future." Scientists who oversell the predictive capacity of climate models provide a basis for legitimate criticism by their political opponents, and in the process, actually create obstacles to action on climate change.

I have been asked by some of my colleagues why I raise these points, since action on climate change is a good thing and those questioning climate models typically are opposed to action. So what, I am told, if action on climate change is based on some exaggerations and false claims to certainty, isn't the end goal important enough to justify bending the truth just a bit? After all, those opposed to action often show no hesitation toward exaggeration and hyperbole.

My short answer to such questions is that false claims to certainty were exactly what got us into the Iraq war. A somewhat longer reply involves explaining how both science and democracy flourish when we are open and honest about what science can actually deliver. Effective action on climate change is more likely when we fully appreciate what science

can, and cannot, do. We should expect more from our scientific community. - Roger Pielke, Jr. is a professor in the environmental studies program at the University of Colorado and a former director of its Center for Science and Technology Policy Research.

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