

The fire through the smoke: Working for transparency in climate projections

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A composite image of the Western hemisphere of the Earth. Credit: NASA

The government of a low-lying island nation is considering the construction of a seawall to protect its capital and economic hub from the rising seas brought on by climate change. The length and expense of the project depends on how high the wall needs to be—3 feet? Four?

A wall that's too high would be needlessly expensive and intrusive. One that is too low would make the effort to protect the soon-to-be inundated city in vain, sapping resources that could have been put toward other preventative measures. Doing nothing could be disastrous.

Policymakers such as those in that island nation have little room for error when it comes to responding to the [climate crisis](#). Yet they must take specific measures based on numerous projections of the Earth's future climate that are drawn from the work of thousands of researchers around the world. Political leaders may be left to wonder how all that work was vetted and condensed—and who exactly put in the work, in order to have confidence in the result.

For that reason, a group of preeminent climate scientists have evaluated the consequences of the most recent projections from the world's foremost climate-science organization, the Intergovernmental Panel on Climate Change (IPCC), as to how the impact of [climate change](#) would be felt if Earth's temperature rises to more than 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial levels. Their aim was to elucidate the inevitable expert judgments that go into an assessment of such a sprawling and uncertain aspect of science.

In a report published Jan. 4 in the journal *Nature Climate Change*, the researchers examine the scientific work and expert judgments that went into the five-part framework—known as "reasons for concern"—the IPCC used to gauge the potential ecological, social, economic and meteorological repercussions of climate change. The scientists examined the framework from the IPCC Fifth Assessment Report released in

October 2014. The IPCC, which is under the auspices of the United Nations, periodically evaluates the current and potential effects of climate change based on thousands of scientific studies. Its analyses are published for policymakers and the public as "assessment reports."

The researchers found that even when they updated the report with findings from the past two years, and identified the limitations in how the report was initially compiled, the judgments by and large remained valid.

Transparency in the name of more effective policy was the driving force, said Michael Oppenheimer, second author of the paper and Princeton's Albert G. Milbank Professor of Geosciences and International Affairs and the Princeton Environmental Institute. Oppenheimer and his co-authors of the *Nature Climate Change* paper were all authors on the Fifth Assessment Report.

Decision makers can act more decisively in response to climate change if they understand how the hundreds of scientists writing the assessment reports reached certain conclusions about the future climate, he said.

"The process by which scientists give advice to policymakers should be the exact opposite of the climactic scene in 'Wizard of Oz'—we want them paying attention to the people behind the curtain," Oppenheimer said.

"The driving question was, how can we make what we're doing understandable enough so people can use it to make good decisions," he said. "We want them to have a hand in their own fate and not just trust experts congregating in a closed room. Policymakers facing crucial decisions related to climate change need to have confidence that these issues were looked at carefully."

As new data comes in quickly—and policymakers have presumably less time to respond to impending climate crises—there needs to be absolute clarity as to how that information is being analyzed so that scientists and politicians can work together quickly and efficiently, Oppenheimer said. (Oppenheimer co-authored a perspective piece published Dec. 16 in the journal *Science* examining recent, rapid changes in the Antarctic ice sheet that calls on the public policy and research sectors to cooperate in protecting coastal areas from rising sea levels.)

"Our knowledge is expanding fast, but changes to parts of the climate system are expanding faster—that's why there are always surprises," he said. "The climate keeps throwing things up at us that we need to try to understand."

First author Brian O'Neill, a senior scientist at the National Center for Atmospheric Research, said that the paper provides a "fuller, more detailed accounting of how the judgments were arrived at, where we have a lot of confidence in those judgments and where the evidence base needs to be strengthened."

An obstacle in communicating climate change science is that policymakers ultimately are interested in the risks to people and the ecosystems that society depends on, O'Neill said. Most scientific studies, however, focus on future changes to the climate system and stop short of the consequences to human populations.

"The science related to how climate change will affect society is improving every year, but we still have fewer studies than we'd like that project, for example, how many people might die from extreme heat and where, as opposed to just projecting how many heat waves there might be," O'Neill said.

"That's hard because these risks are affected not just by climate change,

but also by how vulnerable or resilient a society is," he said. "These kinds of challenges of assessing future risk make it even more important that we're clear on how expert judgments are made."

Introduced in the Third Assessment Report in 2001, the five reasons for concern relate to specific areas that will be most affected as the global temperature rises. These areas are:

- Risks to unique and threatened ecosystems.
- The occurrence of extreme weather events.
- The uneven distribution of negative climate effects on poor countries and disadvantaged peoples.
- Combined global losses such as the economic costs of natural disasters and the loss of species biodiversity.
- An increase in large-scale singular events such as sea-level rise, the rapid disintegration of ice sheets and changes in ocean circulation.

A temperature threshold for detecting impacts—and subsequent repercussions—is identified for each of the reasons for concern. From those assessments, policymakers have established an overall temperature limit beyond which the planet begins to experience environmental upheaval.

These areas have been used to produce what is known as the "burning embers" diagram, a color-coded scale that shows the risk in each area relative to the increase in global temperature. For instance, risks to unique and endangered ecosystems are high at 1 degree Celsius above preindustrial temperatures, whereas the risk from large-scale singular events becomes high around 3 degrees.

The authors also assess recent additions to the burning embers scale: the impact on species and ecosystems by the rate of climate change; the

consequences for marine life of ocean acidification caused by carbon dioxide emissions; and the risk to coastal settlements and natural areas from sea-level rise.

At the UN [climate change conference](#) in November 2015, the five reasons for concern contributed to the policy discussions that resulted in countries establishing the goal of limiting warming to less than 2 degrees Celsius above preindustrial temperatures, which is integral to the Paris Agreement that went into effect Nov. 4.

Now, Oppenheimer said, the same framework is prompting some countries to call for lowering the preindustrial-temperature threshold to 1.5 degrees Celsius. In the Fifth Assessment Report, the risk for each of the five reasons for concern was shown to move from neutral to moderate or high between 1 and 2 degrees Celsius.

"This further buttresses the argument that the 2 degree target might be too high," Oppenheimer said. "But attaining either objective will be very, very difficult without immediate, comprehensive and focused action."

More information: Brian C. O'Neill et al, IPCC reasons for concern regarding climate change risks, *Nature Climate Change* (2017). [DOI: 10.1038/nclimate3179](https://doi.org/10.1038/nclimate3179)

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