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Models underestimate global warming impacts
A spate of research finds the effects of warming racking up faster than scientists had predicted.

It used to be that climate scientists worried about how to make the public care about changes that might not happen for a century. Today they have a bigger problem: some of the changes aren't waiting around that long.

Following the latest projections by the UN's Intergovernmental Panel on Climate Change (IPCC), new research shows that models in the report underestimate some changes that are already under way. Sea ice is melting and sea level is rising faster than models had predicted, and one brake on warming, the uptake of CO2 by oceans, appears not to be working as well as scientists had thought.

Results published in Geophysical Research Letters in May show that ice-free summers could be even more likely this century than estimated in February's IPCC report. Julienne Stroeve of the National Snow and Ice Data Center led a group that analyzed nearly 60 years of sea ice records from satellites, ships, and airplanes, concluding that ice has disappeared at an average rate of 7.8% per decade since 1953, compared with 2.5% per decade in computer simulations.

And the Southern Ocean is not exactly doing its part, taking up less CO2—5–30% less per decade—than expected, according to a study published online May 17 in Science. Models hadn't accounted for increased winds that push currents to bring deep carbon to the surface, where it percolates back into the atmosphere.

Stefan Rahmstorf, a climatologist at Potsdam University (Germany), points out that models tend to underestimate sea level rise, too. "As climatologists, we're often under fire because of our pessimistic message, and we're accused of overestimating the problem," he says. "But I think the evidence points to the opposite—we may have been underestimating it."
Disappearing Arctic sea ice is one of several changes happening faster than models predict.
Peter West/National Science Foundation

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Modelers don't purposely err on the conservative side, says Marika Holland of the National Center for Atmospheric Research, but some processes "are just not well understood, and because of that have not been incorporated into climate models." Holland has published model results on the fate of sea ice and coauthored the recent paper showing that ice is melting faster than models predicted. There are many reasons for the underestimates, she says. For example, models don't fully capture heat transport between ocean and atmosphere, or faster warming as reflective ice gives way to darker, heat-absorbing waters.

But Rahmstorf says that modelers might unwittingly make models more conservative by applying "one-sided filters", weeding out models that clearly overestimate the changes seen so far, but hanging onto ones "where everything is too well behaved and stable."

In January, Rahmstorf published sea-level-rise predictions in Science, noting that the actual rise tracks the uppermost limits of 2001 IPCC projections. Despite the previous underestimate, this year's IPCC report gave even smaller sea-level-rise projections, partly because authors omitted any estimate of accelerating ice flow. "There's absolutely no reason to assume sea level rise is going to be lower than previously thought," Rahmstorf says.

The underestimates started to become clear last year, when Eric Rignot of NASA's Jet Propulsion Laboratory used new satellite techniques to track a decline in Greenland's ice. Within months, satellite results showed the Antarctic ice sheet losing mass, too. Before those data came out, scientists had assumed polar ice sheets were in balance for lack of better information. In 2001, the IPCC said that loss of ice sheets, leading to faster sea level rise, was "very unlikely during the 21st century." The latest IPCC report abandons that position, concluding that the Antarctic ice sheet is already contributing to sea level rise.

"Unfortunately the story gets worse the more data we collect," says climate scientist Brenda Ekwurzel of the Union of Concerned Scientists, an environmental advocacy group. She notes that the

public may become more motivated as climate change moves from models to the backyard.

“We need more creative thinking, because we’re going to see this happening more rapidly than we had thought,” says Joel Smith, vice president of Stratus Consulting and lead author of a climate change impacts chapter in the recent IPCC report. “I wouldn’t advise people to take the IPCC literally and assume the upper end [of sea level rise] reported there is really the upper limit,” he says. “Don’t overreact,” he adds, “but ask a lot of questions.” —ERIKA ENGELHAUPT