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Faster Climate Change Feared

New Report Points to Accelerated Melting, Longer Drought

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The United States faces the possibility of much more rapid climate change by the end of the century than previous studies have suggested, according to a new report led by the U.S. Geological Survey.

The survey -- which was commissioned by the U.S. Climate Change Science Program and issued this month -- expands on the 2007 findings of the United Nations Intergovernment Panel on Climate Change. Looking at factors such as rapid sea ice loss in the Arctic and prolonged drought in the Southwest, the new assessment suggests that earlier projections may have underestimated the climatic shifts that could take place by 2100.

However, the assessment also suggests that some other feared effects of global warming are not likely to occur by the end of the century, such as an abrupt release of methane from the seabed and permafrost or a shutdown of the Atlantic Ocean circulation system that brings warm water north and colder water south. But the report projects an amount of potential sea level rise during that period that may be greater than what other researchers have anticipated, as well as a shift to a more arid climate pattern in the Southwest by mid-century.

Thirty-two scientists from federal and non-federal institutions contributed to the report, which took nearly two years to complete. The Climate Change Science Program, which was established in 1990, coordinates the climate research of 13 different federal agencies.

Tom Armstrong, senior adviser for global change programs at USGS, said the report "shows how quickly the information is advancing" on potential climate shifts. The prospect of abrupt climate change, he said, "is one of those things that keeps people up at night, because it's a low-probability but high-risk scenario. It's unlikely to happen in our lifetimes, but if it were to occur, it would be life-changing."

In one of the report's most worrisome findings, the agency estimates that in light of recent ice sheet melting, global sea level rise could be as much as four feet by 2100. The IPCC had projected a sea level rise of no more than 1.5 feet by that time, but satellite data over the past two years show the world's major ice sheets are melting much more rapidly than previously thought. The Antarctic and Greenland ice sheets are now losing an average of 48 cubic miles of ice a year, equivalent to twice the amount of ice that exists in the Alps.

Konrad Steffen, who directs the Cooperative Institute for Research in Environmental Sciences at the University of Colorado at Boulder and was lead author on the report's chapter on ice sheets, said the models the IPCC used did not factor in some of the dynamics that scientists now understand about ice sheet melting. Among other things, Steffen and his collaborators have identified a process of "lubrication," in which warmer ocean water gets in underneath coastal ice sheets and accelerates

melting.

"This has to be put into models," said Steffen, who organized a conference last summer in St. Petersburg, Russia, as part of an effort to develop more sophisticated ice sheet models. "What we predicted is sea level rise will be higher, but I have to be honest, we cannot model it for 2100 yet."

Still, Armstrong said the report "does take a step forward from where the IPCC was," especially in terms of ice sheet melting.

Scientists also looked at the prospect of prolonged drought over the next 100 years. They said it is impossible to determine yet whether human activity is responsible for the drought the Southwestern United States has experienced over the past decade, but every indication suggests the region will become consistently drier in the next several decades. Richard Seager, a senior research scientist at Columbia University's Lamont-Doherty Earth Observatory, said that nearly all of the 24 computer models the group surveyed project the same climatic conditions for the North American Southwest, which includes Mexico.

"If the models are correct, it will transition in the coming years and decades to a more arid climate, and that transition is already underway," Seager said, adding that such conditions would probably include prolonged droughts lasting more than a decade.

The current models cover broad swaths of landscape, and Seager said scientists need to work on developing versions that can make projections on a much smaller scale. "That's what the water managers out there really need," he said. Current models "don't give them the hard numbers they need."

Armstrong said the need for "downscaled models" is one of the challenges facing the federal government, along with better coordination among agencies on the issue of climate change. When it comes to abrupt climate shifts, he said, "We need to be prepared to deal with it in terms of policymaking, keeping in mind it's a low-probability, high-risk scenario. That said, there are really no policies in place to deal with abrupt climate change."

Richard Moss, who directed the Climate Change Science Program's coordination office between 2000 and 2006 and now serves as vice president and managing director for climate change at the World Wildlife Fund-U.S., welcomed the new report but called it "way overdue."

"There is finally a greater flow of climate science from the administration," Moss said, noting that the report was originally scheduled to come out in the summer of 2007. "It really is showing the potential for abrupt climate change is real."

The report is reassuring, however, on the prospects for some potentially drastic effects -- such as a huge release of methane, a potent heat-trapping gas, that is now locked deep in the seabed and underneath the Arctic permafrost. That is unlikely to occur in the near future, the scientists said.

"It's unlikely that we're going to see an abrupt change in methane over the next hundred years, but we should worry about it over a longer time frame," said Ed Brook, the lead author of the methane chapter and a geosciences professor at Oregon State University. "All of these places where methane is stored are vulnerable to leaking."

By the end the century, Brook said, the amount of methane escaping from natural sources such as the Arctic tundra and waterlogged soils in warmer regions "could possibly double," but that would still be

less than the current level of human-generated methane emissions. Over the course of the next thousand years, he added, methane hydrates stored deep in the seabed could be released: "Once you start melting there, you can't really take it back."

In the near term, Brook said, more precise monitoring of methane levels worldwide would give researchers a better sense of the risk of a bigger atmospheric release. "We don't know exactly how much methane is coming out all over the world," he said. "That's why monitoring is important."

While predictions remain uncertain, Steffen said cutting emissions linked to global warming represents one of the best strategies for averting catastrophic changes.

"We have to act very fast, by understanding better and by reducing our greenhouse gas emissions, because it's a large-scale experiment that can get out of hand," Steffen said. "So we don't want that to happen."

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