Ice Age lesson predicts a faster rise in sea level

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If the lessons being learned by scientists about the demise of the last great North American ice sheet are correct, estimates of global sea level rise from a melting Greenland ice sheet may be seriously underestimated.

Writing this week (Aug. 31) in the journal *Nature Geoscience*, a team of researchers led by University of Wisconsin-Madison geologist Anders Carlson reports that sea level rise from greenhouse-induced warming of the Greenland ice sheet could be double or triple current estimates over the next century.

"We're not talking about something catastrophic, but we could see a much bigger response in terms of sea level from the Greenland ice sheet over the next 100 years than what is currently predicted," says Carlson, a UW-Madison professor of geology and geophysics. Carlson worked with an international team of researchers, including Allegra LeGrande from the NASA Center for Climate Systems at Columbia University, and colleagues at the Woods Hole Oceanographic Institution, the California Institute of Technology, University of British Columbia and University of New Hampshire.

Scientists have yet to agree on how much melting of the Greenland ice sheet — a terrestrial ice mass encompassing 1.7 million square kilometers — will contribute to changes in sea level. One reason, Carlson explains, is that in recorded history there is no precedent for the influence of climate change on a massive ice sheet.

"We've never seen an ice sheet disappear before, but here we have a record," says Carlson of the new study that combined a powerful computer model with marine and terrestrial records to provide a snapshot of how fast ice sheets can melt and raise sea level in a warmer world.

Carlson and his group were able to draw on the lessons of the disappearance of the Laurentide ice sheet, the last great ice mass to cover much of the northern hemisphere. The Laurentide ice sheet, which encompassed large parts of what are now Canada and the United States, began to melt about 10,000 years ago in response to increased solar radiation in the northern hemisphere due to a cyclic change in the orientation of the Earth's axis. It experienced two rapid pulses of melting — one 9,000 years ago and another 7,600 years ago — that caused global sea level to rise by more than half an inch per year.

Those pulses of melting, according to the new study, occurred when summer air temperatures were similar to what are predicted for Greenland by the end of this century, a finding the suggests estimates of global sea level rise due to a warming world climate may be seriously underestimated.

The most recent estimates of sea level rise due to melting of the Greenland ice sheet by the Intergovernmental Panel on Climate Change (IPCC) suggest a maximum sea level rise during the next 100 years of about 1 to 4 inches. That estimate, Carlson and his colleagues note, is based on limited data, mostly from the last decade, and contrasts sharply with results from computer models of future climate, casting doubt on current estimates of change in sea level due to melting ice sheets.

According to the new study, rising sea levels up to a third of an inch per year or 1 to 2 feet over the course of a century are possible.

Even slight rises in global sea level are problematic as a significant percentage of the world's human population — hundreds of millions of people — lives in areas that can be affected by rising seas.

"For planning purposes, we should see the IPCC projections as conservative," Carlson says. "We think this is a very low estimate of what the Greenland ice sheet will contribute to sea level."

The authors of the new Nature Geoscience report were able to document the retreat of the Laurentide ice sheet and its contributions to changes in sea level by measuring how long rocks once covered by ice have been exposed to cosmic radiation, estimates of ice retreat based on radiocarbon dates from organic material as well as changes in ocean salinity.

Source: University of Wisconsin-Madison

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