Greenland ice in no hurry to raise seas

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Good news is rare when it comes to the Greenland ice sheet. Yet a model that accurately mimics the way the ice responds to rising temperatures by slipping and sliding into the sea suggests the resulting rise in sea levels may be smaller than feared.

In its 2007 forecasts of sea-level rise, the Intergovernmental Panel on Climate Change famously excluded contributions from the Greenland and Antarctica ice sheets because the physics were too poorly understood and complex to model. As a result, the IPCC's estimate that seas could rise by 18 to 59 centimetres by 2100 is almost certainly too low. Indeed, levels are already rising faster than the models predicted.

Using data from the last decade, Stephen Price of the Los Alamos National Laboratory in New Mexico has shown that his modelled ice sheet moves in the same way as the real one does. In particular, the model accurately reproduces how disruptions to the edge of the ice sheet leads to a large initial movement, which is followed by several decades of smaller movement.

Best guess

Price has calculated that changes which the ice sheet experienced between 1997 and 2007 in response to a thermal disruption in the early 2000s will eventually lead to a rise of 0.6 centimetres. Assuming that similar thermal disruptions happen every decade, the moving ice sheet will raise sea levels by about 4.5 centimetres by 2100.

That is about half of a widely quoted previous estimate of 9 centimetres, calculated by Tad Pfeffer at the University of Colorado at Boulder, and colleagues. But Pfeffer's study was a worst-case scenario, in which all the processes driving sea-level rise were pushed to their absolute limits (*Science*, DOI: 10.1126/science.1159099).

Pfeffer says Price's study is a more plausible estimate of what might actually happen. "They use a much more realistic scenario," he says, "and their model is really grounded in physics."

Wonderful leap

The model is "a wonderful leap forward," says Richard Alley of Pennsylvania State University in University Park. But he says the study does not come up with an upper limit on the sea-level rise, as Pfeffer's worst-case scenario model did.

"In a warming future the [thermal] perturbations might become bigger, or even more frequent," he says – something that Price's model doesn't consider.

Pfeffer counters that, while the pulses of warm seawater disrupting the ice sheet may well become warmer later in the century as global temperatures rise, that doesn't necessarily mean they will have a bigger effect on the ice. "The response is dictated by what the glaciers are capable of doing," he explains. "You can yank the plug out harder but it doesn't make the water run out any faster."

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