Ice melt speeds up sea level rise

Scientists have found evidence suggesting that melting icecap water from the interior of Greenland is adding to sea level rise faster than previously realised.

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There is enough ice and snow packed deep over 1.7 million square kilometres of Greenland that, were it all to melt, would cause a rise in global sea levels of about six metres. Image: Shutterstock

Water may be flowing from the Greenland icecap and into the sea more quickly than anybody expected.

It doesn't mean that global warming has got conspicuously worse: rather, researchers have had to revise their understanding of the intricate physiology of the northern hemisphere's biggest icecap.

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Climate calculations

Since the icecap is melting as the atmospheric levels of the greenhouse gas carbon dioxide rise, and global temperatures rise with them, as a consequence of the human combustion of fossil fuels, the rate at which summer meltwater gets into the oceans becomes vital to climate calculations.

The latest rethink begins not with the pools of water that collect on the surface each summer, or the acceleration of the glaciers as they make their way to the ocean, but with a granular layer of snow just below the surface, called firn.

This is old snow in the process of being compacted into glacier ice, and covers the island in a layer up to 80 metres thick.

Until now, researchers have understood this firn layer as a kind of sponge that absorbs meltwater and holds it, thus limiting the flow of melting ice into the sea.

But a new study in Nature Climate Change by researchers from the US, Denmark and the University of Zurich suggests that earlier assumptions may be wrong.

However, the findings are not definitive, and they deliver a picture more of science in progress, rather than any long-term conclusion.

To work out how much meltwater might be stored within the pores of the firn, the scientists set up camp in 2012, 2013 and 2015 on the ice cap to use radar and to drill a series of holes 20 metres deep into the porous firn layer – also choosing sites where samples had been taken 20 years ago.

The conclusion was that meltwater is being released faster than anticipated.

Horst Machguth, a research associate in the Department of Geography at theUniversity of Zurich, says: "Basically, our research shows that the firn reacts fast to a changing climate. Its ability to limit mass loss of the ice sheet by retaining meltwater could be smaller than previously assumed."

Storage capacity

An extreme melt in 2012 left a sheet of solid ice, several metres thick, on top of the porous firn, in some places.

"In subsequent years, meltwater couldn't penetrate vertically through the solid ice layer, and instead drained along the ice sheet surface towards the ocean," says William Colgan, assistant professor in the Department of Earth and Space Science and Engineering at York University in Toronto, Canada.

"It overturned the idea that the firn can behave as a nearly bottomless sponge to absorb meltwater. Instead, we found that the meltwater storage capacity in the firn could be capped off relatively quickly."

The implication is that sea level rise from Greenland's icecap is liable to be higher than predicted. Just how much higher is unknown, and the next step is to confirm the latest findings and incorporate the research so far into climate models.

Since detailed research in a hostile environment is always a challenge, any clear answer may take a few years more to emerge.

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