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ENVIRONMENT CLIMATE CHANGE EXTREME WEATHER

Past Antarctic ice melt reveals potential for 'extreme sea-level rise'

By **Peter Hannam**
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In numbers

3.4 metres
Rise in sea levels each century in last melt

60 metres
Rise in sea levels if Greenland and Antarctic ice melted

Sea levels rose as much as three metres per century during the last interglacial period as Antarctic ice sheets melted, a pace that could be exceeded in the future, given the turbo-charged potential of human-led climate change.

A study led by Australian National University researchers, published in *Nature Communications,* found sea-level increases during the last major melt of about 130,000 years ago were faster than models have factored in, even though the "climate forcing" from greenhouse gases is much stronger today.

The Larsen ice shelf in Antarctica began to break up in the 1990s. Others are expected to follow, particularly those with large exposure to the warming Southern Ocean. FDC

Using evidence ranging from Red Sea sediments to fossil corals, the scientists reconstructed the ancient climate. They showed how ocean circulation slowed, leading the Southern Hemisphere to warm up and triggering the Antarctic and then Greenland ice sheets to melt.

At its fastest – about 125,000 years ago when temperatures were about a degree warmer than now – sea levels rose as much as 3.4 metres per 100 years for several centuries.

"We don't predict the future, but we show what nature can do even without human interference in the climate," Eelco Rohling, the paper's lead author and a professor at ANU's College of Science, said. "Nature knows how to go much quicker than we thought."

Fiona Hibbert, the paper's second author and also at ANU, said the findings reveal Antarctica's "really, really big contribution" to sea-level rise, a finding that was "potentially quite startling" for its implications.

"The rate of warming is much faster this time – the warming is more extreme – and it's happening at both poles at the same time," Dr Hibbert said.

The research will reignite debate over whether the general consensus that sea levels will rise only about one metre by 2100 - as argued in the latest paper by the Intergovernmental Panel on Climate Change - is too conservative.

"They calculate very much the sea-level rise without ice sheet contribution," Professor Rohling said.

"Some really fast things have happened in the past," he said. "We need to go to fully coupled models with ice sheets, and have all the physics represented that could be activated."

Waves engulf the Seaham Lighthouse in Durham, England, in early 2016. Sea-level rises may be a lot more than currently predicted by climate models because they largely exclude ice sheet contribution. PA

If all the ice in the Greenland and Antarctic ice sheets melted, sea levels would rise about 60 metres, he said.

"As soon as it's more than four metres, all of the big coastal cities are going to have to be moved," Professor Rohling said.

Taryn Noble, a marine geochemist at the Institute of Marine and Antarctic Studies at the University of Tasmania, said the paper was "a really important contribution. It shows us what the natural system is capable of."

The paper revealed complex systems "can change more rapidly than we thought", Dr Noble said, adding "we've not yet seen the full impact of the temperature changes that we have set off".

Professor Rohling said some of the processes that were part of the earlier melt are already evident. For instance, the flush of fresh water from melting Greenland ice had started to slow the Gulf Stream in recent decades.

"We are seeing the first responses ... and we're really worried about it," he said.

Even without any further "forcing" from extra greenhouse gas emissions, temperatures will rise about half a degree by 2100 and a further degree by 2200 as slow-warming areas such as the deep sea and ice caps catch up, Professor Rohling said.

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