Warm water undermining Antarctica's ice shelves

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The seemingly inevitable collapse of the West Antarctic ice sheet and the associated sea-level rise are happening faster than previously thought.

Earlier this year, two papers revealed that several glaciers on the West Antarctic ice sheet seemed to be on an unstoppable retreat into the sea and will collapse completely in the next 200 to 1000 years, raising sea levels by about 60 centimetres.

Because the glaciers help to stabilise the ice sheet, that could mean the whole sheet is doomed, causing around 4 metres of sea-level rise.

Now, Sunke Schmidtko from the Helmholtz Centre for Ocean Research in Kiel, Germany, and his colleagues have revealed some of the processes that are driving the melting.

And it turns out they weren't being produced by climate models that predict future melting, meaning the process is happening faster than thought.

"Climate models would get future sea-level-rise predictions wrong," says Schmidtko. "They would likely underestimate them."

Under the shelf

Schmidtko's team combined a range of data sets measuring seawater properties such as salinity – which drops when ice melts nearby – and temperature at different locations and depths, going back to 1975. They found that western Antarctica has in recent years seen warmer, saltier water being driven under the shelf – the part of the ice sheet that sticks out over the ocean.

The warmer water comes from the deep and is pushed up under the ice shelf by changing wind patterns, some of which are in turn driven by global warming.

Until now, it wasn't clear exactly what processes were driving the melting, says Sarah Gille from Scripps Institution of Oceanography in San Diego, California. It could have been caused by water moving faster and thus carrying heat faster, for example.

The results are "transformative", Gille says. "They tell us to focus on temperature or water-mass changes rather than velocity changes." And, she adds, they are a step towards developing a better understanding of the physics of ice shelves and towards making better climate-change projections.

Exactly how the new results will change models isn't clear, but Schmidtko says it's likely to be bad news because the existing models do not take this warmer water into account.

"So any Antarctic ice-cap loss associated with this process is likely underestimated," he

concludes.

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