

Melting ice in west Antarctica could raise seas by 3m, warns study

Nasa research finds ice in the region has gone into 'irreversible retreat' and claims effect is 'unstoppable'



The Thwaites glacier in western Antarctica. Photograph: AFP/Getty

Agence France-Presse in Miami

Monday 2 November 2015 22.30 GMT

Last modified on Tuesday 3 November 2015 02.22 GMT

A key area of ice in west Antarctica may already be unstable enough to cause global sea levels to rise by 3m, scientists said on Monday.

The study follows research published last year, led by Nasa glaciologist Eric Rignot, warning that ice in the Antarctic had gone into a state of irreversible retreat, that the melting was considered "unstoppable" and could raise sea level by 1.2m.

This time, researchers at Germany's Potsdam Institute for Climate Impact Research pointed to the long-term impacts of the crucial Amundsen Sea sector of west Antarctica, which they said "has most likely been destabilised."

In May 2015, Nasa warned that an the Antarctic ice shelf known as Larsen B will completely disintegrate over the next few years

While previous studies "examined the short-term future evolution of this region, here we take the next step and simulate the long-term evolution of the whole west Antarctic ice sheet," the authors said in the Proceedings of the National Academy of Sciences.

They used computer models to project the effects of 60 more years of melting at the current rate.

This "would drive the west Antarctic ice sheet past a critical threshold beyond which a complete, long-term disintegration would occur."

In other words, "the entire marine ice sheet will discharge into the ocean, causing a global sea level rise of about 3m," the authors wrote.

"If the destabilisation has begun, a 3m increase in sea level over the next several centuries to millennia may be unavoidable."

Even just a few decades of ocean warming can unleash a melting spree that lasts for hundreds to thousands of years.

"Once the ice masses get perturbed, which is what is happening today, they respond in a non-linear way: there is a relatively sudden breakdown of stability after a long period during which little change can be found," said lead author Johannes Feldmann.

The authors noted that Antarctica's situation presents the largest uncertainty in sea level projections for the coming centuries, and that studying the vast region poses many challenges.

And indeed, just days before the PNAS study was released, another scientific paper used Nasa satellite data from 2003 to 2008 to show that Antarctic ice had gained mass, and had packed on enough to exceed the amount lost in other areas.

Global warming: it's a point of no return in West Antarctica. What happens next?

Eric Rignot

"We're essentially in agreement with other studies that show an increase in ice discharge in the Antarctic peninsula and the Thwaites and Pine Island region of west Antarctica," said a statement by Jay Zwally, a glaciologist with Nasa Goddard Space Flight centre whose study was published on 30 October in the Journal of Glaciology.

"Our main disagreement is for east Antarctica and the interior of west Antarctica – there, we see an ice gain that exceeds the losses in the other areas."

According to climatologist Michael Mann, who was not involved in either study, the use of older satellite data could be the cause for the disconnect.

"It sounds to me as if the key issue here is that the claims are based on seven-year-old data, and so cannot address the finding that Antarctic ice loss has accelerated in more recent years," he told AFP.

Antarctic coast meltdown could trigger ice-sheet collapse

Computer simulations suggest that unstable ice at continent's edges eventually leads to metres of sea-level rise.

- [Alexandra Witze](#)



NASA images by Jeff Schmaltz, LANCE/EOSDIS Rapid Response.

Icebergs float in Antarctica's Pine Island Bay, at the edge of Pine Island Glacier.

Antarctica's Amundsen Sea region is ground zero for climate scientists worrying about melting ice. This part of western Antarctica is home among others to the Pine Island and Thwaites glaciers, which are some of the fastest-shrinking ice-streams on the continent.

Now, a pair of researchers at the Potsdam Institute for Climate Impact Research in Germany say they have determined that ice loss in the Amundsen Sea region might irrevocably lead to melting of the bigger West Antarctic Ice Sheet. *Nature* explains the duo's modelling study¹, published on 2 November, which forecasts the amount of sea-level rise caused by the melting ice — and explores whether the frozen continent has already crossed a tipping point.

What does the study show?

If ice in the Amundsen Sea has begun to destabilize — as many cryosphere scientists [think is the case](#) — then the rest of the West Antarctic Ice Sheet is doomed to follow. That would put global sea levels on course to rise more than 3 metres over the next couple of centuries, or perhaps even millennia.

Study co-authors Johannes Feldmann and Anders Levermann, both climate researchers at the Potsdam Institute, reached this conclusion by using a computer model that calculates physical stresses in different parts of an ice sheet — from ice shelves floating atop ocean waters, to flowing glaciers, to ice held fast by bedrock. When stress levels change in one of these regions — say, if part of an ice shelf collapses into the sea — it affects how ice moves elsewhere. The Parallel Ice Sheet Model simulates these interconnected ice dynamics, assuming that rates of melting stay similar to those of today.

Didn't we already know that the ice sheet was headed for meltdown?

The latest work is the first to look specifically at how losses in the Amundsen Sea could affect the entire ice sheet in the long term. In other words, it takes the region that most concerns researchers and links it to the future of ice in the continent's frozen interior.

When will all this happen?

The simulation suggests that if melting continues at current rates, the Amundsen Sea region will be permanently destabilized six decades from now. After that, the interior of the ice sheet would also destabilize, shifting its ice towards the oceans and ultimately adding to global sea-level rise. So another 60 years of melting would be sufficient to kick off potentially millennia of change.

But isn't sea ice growing around Antarctica?

At its peak in 2012, 2013 and 2014, Antarctica was surrounded by record amounts of sea ice. This year's maximum, reached on 6 October, was not quite as large, but it still slightly exceeded the average for 1981–2010.

[Computer simulations show](#) that ice melting on Antarctica's land can feed sea-ice growth around the continent. Researchers are most concerned about land ice because it is the permanently frozen reservoir that, when it melts, will add to sea-level rise — which floating sea ice does not do.

What should people do about it?

It is not yet clear whether melting in the Amundsen Sea is linked to global warming from greenhouse-gas emissions, or whether natural year-to-year changes are driving it. But “by increasing the temperature of the planet, we increase the risk that the scenario of our paper will unfold”, says Levermann.

Sea-level rise “does not have to be a threat to people”, he adds. “But it will be a threat to things.” Levermann, a [long-time advocate](#) of adapting to climate change, says that officials can prepare by developing plans to abandon certain coastal areas or by building up dikes and sea walls.

Nature

doi:10.1038/nature.2015.18688

References

1. Feldmann, J. & Levermann, A. Proc. Natl Acad. Sci. USA <http://dx.doi.org/10.1073/pnas.1512482112> (2015).