

# Glacial melting in Antarctica may become irreversible

Thwaites glacier is likely to thaw and trigger 50cm sea level rise, US study suggests

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An aerial view of Thw



aites glacier,

which shows growth of gaps between the ice and bedrock. Photograph: Nasa/OIB/Jeremy Harbeck/Handout/EPA

Antarctica faces a tipping point where glacial melting will accelerate and become irreversible even if global heating eases, research suggests.

A Nasa-funded study found instability in the Thwaites glacier meant there would probably come a point when it was impossible to stop it flowing into the sea and triggering a 50cm sea level rise. Other Antarctic glaciers were likely to be similarly unstable.

Recent research found the rate of ice loss from five Antarctic glaciers had doubled in six years and was five times faster than in the 1990s. Ice loss is spreading from the coast into the continent's interior, with a reduction of more than 100 metres in thickness at some sites.

The Thwaites glacier, part of the West Antarctic ice sheet, is believed to pose the greatest risk for rapid future sea level rise. Research recently published in the *Proceedings of the National Academy of Sciences* journal found it was likely to succumb to instability linked to the retreat of its grounding line on the seabed that would lead to it shedding ice faster than previously expected.

Alex Robel, an assistant professor at the US Georgia Institute of Technology and the study's leader, said if instability was triggered, the ice sheet could be lost in the space of 150 years, even if temperatures stopped rising. "It will keep going by itself and that's the worry," he said.

Modelling simulations suggested extensive ice loss would start in 600 years but the researchers said it could occur sooner depending on the pace of global heating and nature of the instability.

Hélène Seroussi, a jet propulsion laboratory scientist at Nasa, said: "It could happen in the next 200 to 600 years. It depends on the bedrock topography under the ice, and we don't know it in great detail yet."

Antarctica has nearly eight times more land-based ice than Greenland and 50 times more than all mountain glaciers combined. The Thwaites glacier alone contains enough ice to increase global sea levels by about 50cm. Sea level rise linked to warming has already been linked with increased coastal flooding and storm surges.

The researchers found a precise estimate of how much ice the glacier would shed in the next 50 to 800 years was not possible due to unpredictable climate fluctuations and data limitations. However, 500 simulations of different scenarios pointed to it

losing stability. This increased uncertainty about future sea level rise but made the worst-case scenarios more likely.

A complete loss of the West Antarctic ice sheet would be expected to increase global sea levels by about five metres (16ft), causing coastal cities around the world to become submerged.



'Precipitous' fall in Antarctic sea ice since 2014 revealed

<https://www.theguardian.com/world/2019/jul/01/precipitous-fall-in-antarctic-sea-ice-revealed>

A **separate study last week** in the same journal found the expanse of sea ice around **Antarctica** had suffered a “precipitous” fall since 2014. Satellite data showed Antarctica lost as much sea ice in four years as the Arctic lost in 34 years.

Unlike the melting of ice sheets on land, sea ice melting does not raise sea levels but the loss of the reflective white ice leads to more of the sun’s heat being absorbed in the ocean, increasing the pace of heating.

Antarctic sea ice had been gradually increasing during 40 years of measurement and reached a record maximum in 2014, before falling markedly. The cause of the abrupt turnaround has not been established.

## Extraordinary thinning’ of ice sheets revealed deep inside Antarctica

**New research shows affected areas are losing ice five times faster than in the 1990s, with more than 100m of thickness gone in some places**

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The Antarctic’s Thwaites glacier. More than 50% of the Pine Island and Thwaites glacier basins have been affected by thinning in the past 25 years. Photograph: PA

Ice losses are rapidly spreading deep into the interior of the Antarctic, new analysis of satellite data shows.

The warming of the Southern Ocean is resulting in glaciers sliding into the sea increasingly rapidly, with ice now being lost five times faster than in the 1990s. The West Antarctic ice sheet was stable in 1992 but up to a quarter of its expanse is now thinning. More than 100 metres of ice thickness has been lost in the worst-hit places.

A complete loss of the West Antarctic ice sheet would drive global sea levels up by about five metres, drowning coastal cities around the world. The current losses are doubling every decade, the scientists said, and sea level rise are now running at the extreme end of projections made just a few years ago.

The research, published in the journal *Geophysical Research Letters*, compared 800m satellite measurements of ice sheet height from 1992 to 2017 with weather information. This distinguished short-term changes owing to varying snowfall from long-term changes owing to climate.

“From a standing start in the 1990s, thinning has spread inland progressively over the past 25 years – that is rapid in glaciological terms,” said Prof Andy Shepherd, of Leeds University in the UK, who led the study. “The speed of drawing down ice from an ice sheet used to be spoken of in geological timescales, but that has now been replaced by people’s lifetimes.”

He said the thinning of some ice streams had extended 300 miles inland along their 600-mile length. “More than 50% of the Pine Island and Thwaites glacier basins have been affected by thinning in the past 25 years. We are past halfway and that is a worry.”

Researchers already knew that **ice was being lost from West Antarctica**, but the new work pinpoints where it is happening and how rapidly. This will enable more accurate projections to be made of sea level rises and may aid preparations for these rises.

In the recent past, snow falling on to Antarctica’s glaciers balanced the ice lost as icebergs calved off into the ocean. But now the glaciers are flowing faster than snow can replenish them.

“Along a 3,000km [1,850-mile] stretch of West Antarctica, the water in front of the glaciers is too hot,” he said. This causes **melting of the underside of the glaciers** where they grind against the seabed. The melting lessens the friction and allows the glaciers then to slide more quickly into the ocean and therefore become thinner.

“In parts of **Antarctica**, the ice sheet has thinned by extraordinary amounts,” Shepherd said.

Separate research **published in January** found that ice loss from the entire Antarctic continent had increased six-fold since the 1980s, with the biggest losses in the west. The new study indicates West Antarctica has caused 5mm of sea level rise since 1992, consistent with the January study’s findings.

The expansion of the oceans as they warm and the vast melting in Greenland are the main current causes of the rising oceans, but Antarctica is the biggest store of ice. The East Antarctic ice sheet contains enough ice to raise sea levels by about 60 metres. It had been considered stable, but research in December found even this stronghold was **showing signs of melting**.

Without rapid cuts in the carbon emissions driving global warming, the melting and rising sea level will **continue for thousands of years**.

“Before we had useful satellite measurements from space, most glaciologists thought the polar ice sheets were pretty isolated from climate change and didn’t change rapidly at all,” Shepherd said. “Now we know that is not true.”