

Sudden onset of ice loss in Antarctica detected

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Research vessel deploying instruments on an Antarctic ice shelf. Credit: Jonathan L. Bamber

A group of scientists, led by a team from the University of Bristol, UK has observed a sudden increase of ice loss in a previously stable region of Antarctica. The research is published today in *Science*.

Using measurements of the elevation of the Antarctic [ice sheet](#) made by a suite of satellites, the researchers found that the Southern Antarctic Peninsula showed no signs of change up to 2009. Around 2009, multiple glaciers along a vast coastal expanse, measuring some 750km in length, suddenly started to shed ice into the ocean at a nearly constant rate of 60 cubic km, or about 55 trillion litres of water, each year.

This makes the region the second largest contributor to sea level rise in Antarctica and the [ice loss](#) shows no sign of waning.

Dr Bert Wouters, a Marie Curie Fellow at the University of Bristol, who lead the study said: "To date, the glaciers added roughly 300 cubic km of water to the ocean. That's the equivalent of the volume of nearly 350,000 Empire State Buildings combined."

The changes were observed using the CryoSat-2 satellite, a mission of the European Space Agency dedicated to remote-sensing of ice. From an altitude of about 700km, the satellite sends a radar pulse to Earth, which is reflected by the ice and subsequently received back at the satellite. From the time the pulse takes to travel, the elevation of the ice surface can retrieved with incredible accuracy. By analysing roughly 5 years of the data, the researchers found that the ice surface of some of the glaciers is currently going down by as much as 4m each year.

The ice loss in the region is so large that it causes small changes in the gravity field of the Earth, which can be detected by another satellite mission, the Gravity Recovery and Climate Experiment (GRACE).

"The fact that so many glaciers in such a large region suddenly started to lose ice came as a surprise to us," continued Dr Wouters. "It shows a very fast response of the ice sheet: in just a few years the dynamic regime completely shifted."

Data from an Antarctic climate model shows that the sudden change cannot be explained by changes in snowfall or air temperature. Instead, the team attributes the rapid ice loss to warming oceans.

Many of the glaciers in the region feed into ice shelves that float on the surface of the ocean. They act as a buttress to the ice resting on bedrock inland, slowing down the flow of the glaciers into the ocean. The westerly winds that encircle Antarctica have become more vigorous in recent decades, in response to climate warming and ozone depletion. The stronger winds push warm waters from the Southern Ocean poleward, where they eat away at the glaciers and floating ice shelves from below.

Ice shelves in the region have lost almost one-fifth of their thickness in the last two decades, thereby reducing the resisting force on the glaciers. A key concern is that much of the ice of the Southern Antarctic Peninsula is grounded on bedrock below sea level, which gets deeper inland. This means that even if the glaciers retreat, the warm water will chase them inland and melt them even more.

Dr Wouters said: "It appears that sometime around 2009, the ice shelf thinning and the subsurface melting of the [glaciers](#) passed a critical threshold which triggered the sudden ice loss. However, compared to other regions in Antarctica, the Southern Peninsula is rather understudied, exactly because it did not show any changes in the past, ironically.

"To pinpoint the cause of the changes, more data need to be collected. A detailed knowledge of the geometry of the local [ice shelves](#), the ocean floor topography, [ice](#) sheet thickness and glacier flow speeds are crucial to tell how much longer the thinning will continue."

More information: 'Dynamic thinning of glaciers on the Southern Antarctic Peninsula' by Bert Wouters, Alba Martin-Español, Veit Helm,

Thomas Flament, Melchior van Wessem, Stefan Ligtenberg, Michiel van den Broeke and Jonathan Bamber in *Science*:

[www.sciencemag.org/lookup/doi/ ... 1126/science.aaa5727](http://www.sciencemag.org/lookup/doi/10.1126/science.aaa5727)

Provided by University of Bristol

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