

New understanding of Antarctic's weight-loss

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(Phys.org)—New data which more accurately measures the rate of ice-melt could help us better understand how Antarctica is changing in the light of global warming.

The rate of global [sea level change](#) is reasonably well-established but understanding the different sources of this rise is more challenging. Using re-calibrated scales that are able to 'weigh' [ice](#) sheets from space to a greater degree of accuracy than ever before, the international team led by Newcastle University, UK, has discovered that Antarctica overall is contributing much less to the substantial sea-level rise than originally thought.

Instead, the large amount of water flowing away from [West Antarctica](#) through ice-melt has been partly cancelled out by the volume of water

falling onto the continent in the form of snow, suggesting some past studies have overestimated Antarctica's contribution to fast-[rising sea levels](#).

Using Gravity Recovery and [Climate Experiment](#) (GRACE) [satellite data](#), the team calculated ice sheet [mass loss](#) by more accurately mapping and removing the mass changes caused by the flow of rock beneath Earth's surface.

Publishing their findings today in the academic journal *Nature*, project lead Professor Matt King said the data meant we were at last close to understanding how Antarctica is changing.

"We have tried to weigh the ice in the past but GRACE only measures the combined effect of the ice changes and the land mass changes occurring beneath the Earth's surface," explains Professor King, Professor of Polar [Geodesy](#) at Newcastle University. "The step forward we have made is to provide a better calculation of the [land mass](#) changes so we can correct the [satellite measurements](#) to more accurately calculate the changes in ice mass alone.

"Our ice change calculations rely heavily on how well we can account for these important changes taking place beneath the Earth's surface. While the land beneath the ice is moving by no more than a few millimetres-per-year – the thickness of a fingernail – that seemingly small effect significantly alters the rate at which we estimate the ice is changing.

"By producing a new estimate of the land motion we're effectively recalibrating the scales – in this case the GRACE satellite – so we can more accurately weigh the ice. And what we've found is that present [sea level rise](#) is happening with apparently very little contribution from Antarctica as a whole."

Because most of the Antarctic land surface is covered by ice it has been incredibly difficult to determine where it is rising and falling and by how much. That has meant GRACE data hasn't been able to contribute as much as it could to help scientists understand if Antarctica was growing or shrinking.

"We're now confident it is shrinking," says Professor King, currently on secondment at the University of Tasmania, Australia. "Our new estimate of land motion helps us narrow the range and shifts the best estimate to the lower end of the ice melt spectrum.

"Worryingly, though, the rate of shrinking has sped up in some important locations. The parts of Antarctica that are losing mass most rapidly are seeing accelerated mass loss and this acceleration could continue well into the future."

"The sea level change we're seeing today is happening faster than it has for centuries with just a small contribution from the massive [Antarctic ice](#) sheet. What is sobering is that sea levels will rise even faster if Antarctica continues to lose increasingly more ice into the oceans."

The research is part of a £600,000 project funded by the Natural Environment Research Council (NERC) to investigate the changing mass of the Antarctic Ice Sheet.

Ice sitting on the Antarctic continent at the peak of the last ice age 20,000 years ago forced the rock beneath to deform and slowly flow away. After that time ice levels generally reduced and the rock within the Earth's mantle more than 100km below the surface has been slowly flowing back in. That change affects the GRACE satellites in exactly the same way as ice moving into and out of the continent.

Since their launch in 2002, the GRACE satellites allow scientists to map

Earth's gravity field every 30 days, mapping changes as mass moves around the Earth's surface as well as below it.

Newcastle University's Dr Rory Bingham adds: "There are lots of measurements that tell us something about the recent state of the Antarctic Ice Sheet, but none of those measurements gives the complete picture.

"This research starts to pull that picture together, providing the most accurate GRACE estimate so far of Antarctica's contribution to [sea level](#) as a whole, as well as identifying which regions are changing and which are not.

Professor Mike Bentley, of Durham University, UK, who was part of the project team said, "This project brought together a range of scientists including geologists, geodesists and computer modellers to work out the contribution of the Antarctic ice sheets to [global sea level](#) rise. We have shown that the Antarctic contribution is smaller than some previous estimates, but the [ice sheet](#) is changing very rapidly in some key regions".

More information: "Lower satellite-gravimetry estimates of Antarctic sea-level contribution" M A King, R J Bingham, P Moore, P L Whitehouse, M J Bentley and G A Milne. *Nature*.

Provided by Newcastle University

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