

# 24 percent of West Antarctic ice is now unstable: study

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Iceberg at Marguerite Bay, Antarctic Peninsula. Credit: Andrew Shepherd

By combining 25 years of European Space Agency satellite altimeter

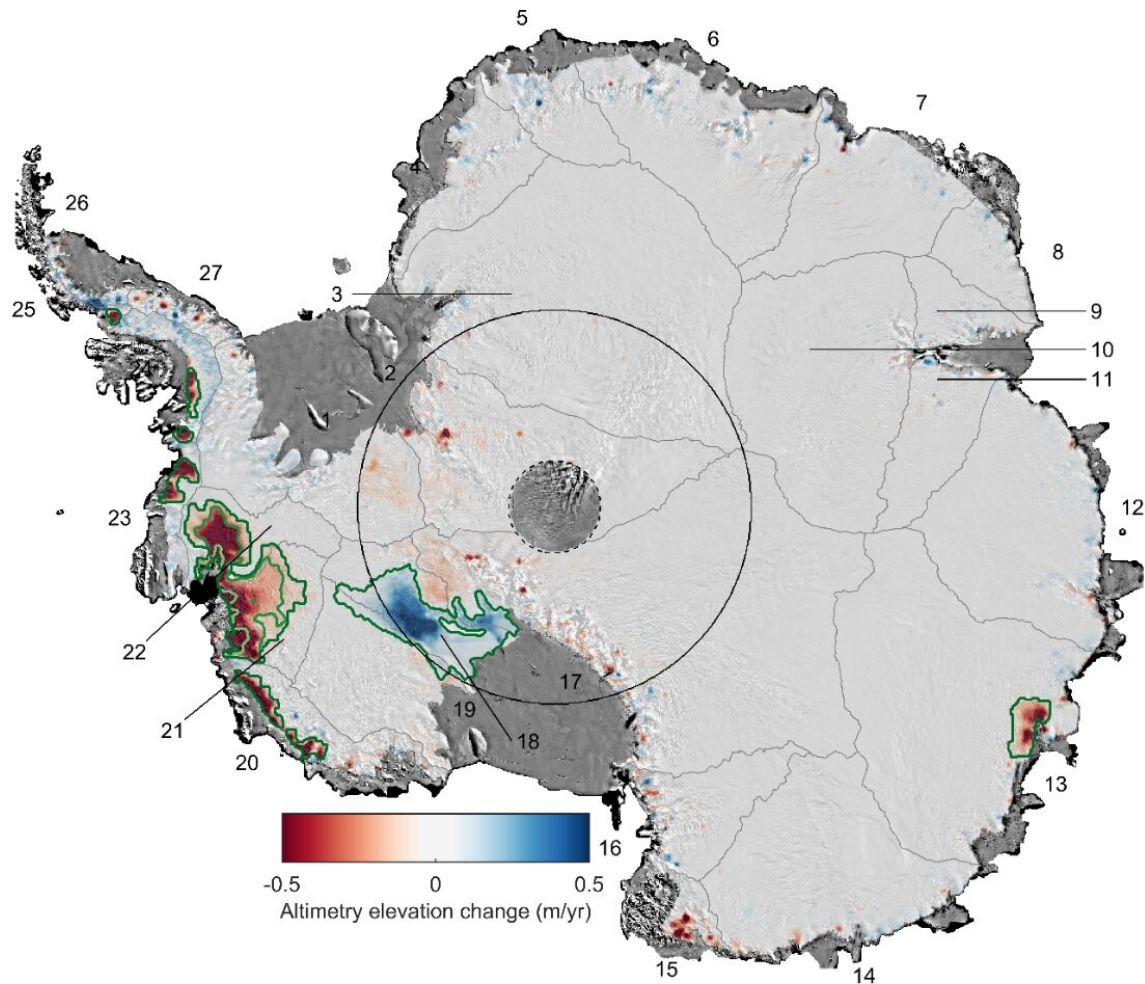
measurements and a model of the regional climate, the UK Centre for Polar Observation and Modelling (CPOM) have tracked changes in snow and ice cover across the continent.

A team of researchers, led by Professor Andy Shepherd from the University of Leeds, found that Antarctica's ice sheet has thinned by up to 122 metres in places, with the most rapid changes occurring in West Antarctica where ocean melting has triggered glacier imbalance.

This means that the affected glaciers are unstable as they are losing more mass through melting and iceberg calving than they are gaining through snowfall.

The team found that the pattern of glacier thinning has not been static. Since 1992, the thinning has spread across 24% of West Antarctica and over the majority of its largest ice streams—the Pine Island and Thwaites Glaciers—which are now losing ice five times faster than they were at the start of the survey.

The study, published today in *Geophysical Research Letters*, used over 800 million measurements of the Antarctic ice sheet height recorded by the ERS-1, ERS-2, Envisat, and CryoSat-2 satellite altimeter missions between 1992 and 2017 and simulations of snowfall over the same period produced by the RACMO regional climate model.



By combining 25 years of ESA satellite data, scientists have discovered that warming ocean waters have caused the ice to thin so rapidly that 24% of the glaciers in West Antarctica are now affected. A paper published in *Geophysical Research Letters* describes how the UK Centre for Polar Observation and Modelling (CPOM) used over 800 million measurements of the height of the Antarctic ice sheet recorded by radar altimeter instruments on ESA's ERS-1, ERS-2, Envisat, and CryoSat satellite missions between 1992 and 2017. They used simulations of snowfall produced by the RACMO regional climate model to identify changes that were due to glacier dynamics alone (green contours). In

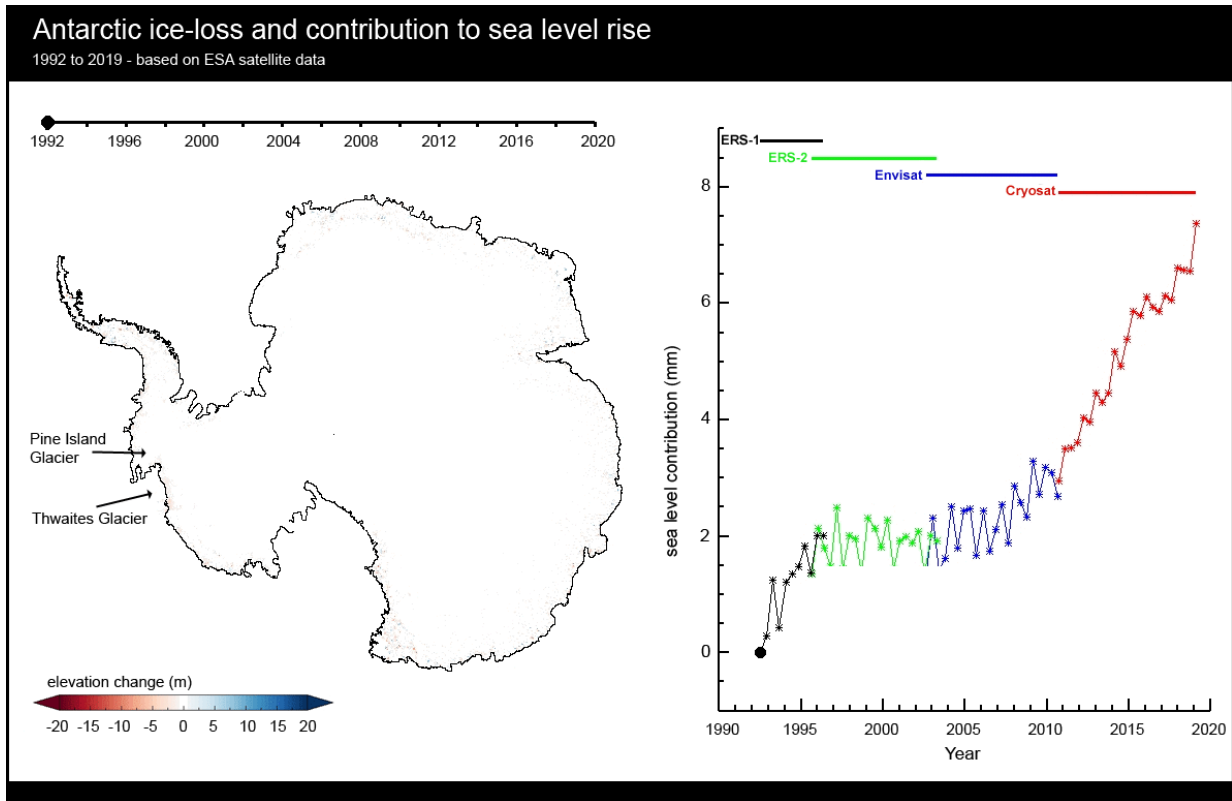
some places, the glacier thinning has spread far inland during the survey period.  
Credit: CPOM

Together, these measurements allow changes in the ice sheet height to be separated into those due to [weather patterns](#), such as less snowfall, and those due to longer term changes in climate, such as increasing ocean temperatures that eat away ice.

Lead author and CPOM Director Professor Andy Shepherd explained: "In parts of Antarctica the [ice sheet](#) has thinned by extraordinary amounts, and so we set out to show how much was due to changes in climate and how much was due to weather."

To do this, the team compared the measured surface height [change](#) to the simulated changes in snowfall, and where the discrepancy was greater they attributed its origin to glacier imbalance.

They found that fluctuations in snowfall tend to drive small changes in height over large areas for a few years at a time, but the most pronounced changes in ice thickness are signals of glacier imbalance that have persisted for decades.



Time sequence of Antarctic glacier ice thickness change (left) and associated contribution to sea level rise (right) between 1992 and 2017. Credit: CPOM

Professor Shepherd added: "Knowing how much snow has fallen has really helped us to detect the underlying change in glacier ice within the satellite record. We can see clearly now that a wave of thinning has spread rapidly across some of Antarctica's most vulnerable [glaciers](#), and their losses are driving up sea levels around the planet.

"Altogether, ice losses from East and West Antarctica have contributed 4.6 mm to global sea level rise since 1992."

Dr. Marcus Engdahl of the European Space Agency, a co-author of the study, added: "This is an important demonstration of how satellite

missions can help us to understand how our planet is changing. The polar regions are hostile environments and are extremely difficult to access from the ground. Because of this, the view from space is an essential tool for tracking the effects of climate change."

**More information:** Trends in Antarctic Ice Sheet Elevation and Mass, *Geophysical Research Letters*, 16 May 2019. [DOI: 10.1029/2019GL082182](https://doi.org/10.1029/2019GL082182)

Provided by University of Leeds

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