

Polar ice sheet melting records have topped during the past decade

The polar ice sheets have lost ice in every year of the satellite record, and the seven worst melting years have occurred during the past decade. They now account for a quarter of all sea level rise - a fivefold increase since the 1990's.

Global heating is melting the polar ice sheets, driving up sea levels and coastal flooding around our planet. Ice losses from Greenland and Antarctica can now be reliably measured from space by tracking changes in their volume, gravitational pull, or ice flow. The Ice Sheet Mass Balance Intercomparison Exercise ([IMBIE](#)) is funded by the European Space Agency ([ESA](#)) and the US National Aeronautical and Space Administration ([NASA](#)) to compile the satellite record of polar ice sheet melting. Their data are widely used, including by the Intergovernmental Panel on Climate Change (IPCC).

In their latest assessment, the IMBIE Team have combined 50 satellite surveys of Antarctica and Greenland to determine their rate of ice melting. Between 1992 and 2020, Earth's polar ice sheets lost 7,560 billion tonnes of ice - equivalent to an ice cube that would be 20 kilometres in height. The polar ice sheets have together lost ice in every year of the satellite record, and the seven highest melting years have occurred in the past decade.

2019 was the record melting year when the ice sheets lost a staggering 612 billion tons of ice. This was driven by an Arctic summer heatwave, which led to record melting from Greenland peaking at 444 billion tonnes that year. Antarctica lost 168 billion tons of ice - the sixth highest on record - due to the continued speedup of glaciers in West Antarctica and record melting from the Antarctic Peninsula. East Antarctic Ice Sheet remained close to a state of balance, as it has throughout the satellite era.

Melting of the polar ice sheets has caused a 21 mm rise in global sea level since 1992, almost two thirds (13.5 mm) of which is due to Greenland and one third (7.4 mm) to Antarctica. In the early 1990s, ice sheet melting accounted for only a small fraction (5.6 %) of sea level rise. However, there has been a fivefold increase in melting since then, and they are now responsible for more than a quarter (25.6 %) of all sea level rise. If the ice sheets continue to lose mass at this pace, the IPCC predicts that they will contribute between 148 and 272 mm to global mean-sea level by the end of the century.

Dr Inès Ootosaka, who led the study, said: "Ice losses from Greenland and Antarctica have rapidly increased over the satellite record and are now a major contributor to sea level rise. Continuously monitoring the ice sheets is critical to predict their future behaviour in a warming world and adapt for the associated risks that coastal communities around the world will face."

This is now the third assessment of ice loss produced by the IMBIE team, and is made possible thanks to continued cooperation between the space agencies and the scientific community. Over the past few years, ESA and NASA have made a dedicated effort to launch new satellite missions capable of monitoring the polar regions. The IMBIE project has taken advantage of these to produce more regular updates and, for the first time, it is now possible to chart polar ice sheet losses every year.

Professor Andrew Shepherd, Head of the Department of Geography and Environmental Science at Northumbria University and founder of IMBIE, said: "After a decade of work we are finally at the stage where we can continuously update our assessments of ice sheet mass balance as there are enough satellites in space monitoring them, which means that people can make use of our findings immediately."

This third assessment from the IMBIE Team involved a team of 68 polar scientists from 41 international organisations using measurements from 17 satellite missions - including for the first time from the GRACE-FO gravity mission. Importantly, it brings the records of ice loss from Antarctica and Greenland in line, using the same methods and covering the same period in time. The assessment will now be updated annually to make sure that the scientific community has the very latest estimates of polar ice losses.

Dr Diego Fernandez, Head of Research and Development at ESA, said “This is another milestone in the IMBIE initiative and represent an example of how scientists can coordinate efforts to assess the evolution of ice sheets from space offering unique and timely information on the magnitude and onset of changes. The new annual assessments represent an step forward in the way IMBIE will help to monitor these critical regions, where variations have reached a scale where abrupt changes can no longer be excluded.”

The study is published today in the journal *Earth System Science Data*, and the new dataset is publicly available at <https://doi.org/10.5285/77B64C55-7166-4A06-9DEF-2E400398E452>. The assessment was funded by the ESA and NASA.