

Six-fold jump in polar ice loss lifts global oceans

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Greenland and Antarctica are shedding six times more ice than during the 1990s

Greenland and Antarctica are shedding six times more ice than during the 1990s, driving sea level rise that could see annual flooding by 2100 in regions home today to some 400 million people, scientists have

warned.

The kilometres-thick ice sheets atop [land masses](#) at the planet's extremities sloughed off 6.4 trillion tonnes of mass from 1992 through 2017, adding nearly two centimetres (an inch) to the global watermark, according to an assessment by 89 researchers, the most comprehensive to date.

Last summer's Arctic heatwave will likely top the 2011 record for polar ice sheet loss of 552 billion tonnes, they reported in a pair of studies, published Wednesday in *Nature*.

That is roughly the equivalent of eight Olympic pools draining into the ocean every second.

While less visible than climate-enhanced hurricanes, [sea level rise](#) may ultimately prove the most devastating of global warming impacts.

Indeed, it is the added centimetres—perhaps added metres by the 22nd century—that make storm surges from climate-enhanced [tropical cyclones](#) so much more deadly and destructive, experts say.

"Every centimetre of sea level rise leads to coastal flooding and coastal erosion, disrupting lives around the planet," said University of Leeds professor Andrew Shepherd, who led the analysis along with Erik Ivins from NASA's Jet Propulsion Laboratory.

"If Antarctica and Greenland continue to track worst-case climate warming scenarios, they will cause an extra 17 centimetres of sea level rise by the end of the century," he said in a statement.



Almost all of the ice lost from Antarctica, and half of that from Greenland, has been triggered by warming ocean water speeding the movement of glaciers toward the sea

'Irrefutable evidence'

That's about a third of the rise forecast for 2100 by the UN's climate science advisory panel (IPCC) under a scenario midway between a rapid drawdown of global greenhouse gases—seen by many as overly optimistic—and the unbridled expansion of fossil fuel use, also seen as unlikely.

Melting glaciers and the expansion of ocean water as it warms accounted

for most sea level rise through the 20th century, but ice sheet melt-off has become a major driver over the last decade.

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Oceans help humanity by absorbing more than 90 percent of the excess heat from global warming.

The remainder of Greenland's ice losses is due to rising air temperature, which creates roaring rivers of ocean-bound melt-water in summer.



The kilometres-thick ice sheets atop land masses at the planet's extremities sloughed off more than 6.4 trillion tonnes of mass from 1992 to 2017

The combined rate of mass loss from both ice sheets rose six-fold from 81 to 475 billion tonnes per year over less than three decades, the studies reported.

The findings are grounded in decades of satellite data, in situ measurements, and computer modelling.

"Satellite measurements provide prima facie, irrefutable evidence," said Ivins.

Point of no return

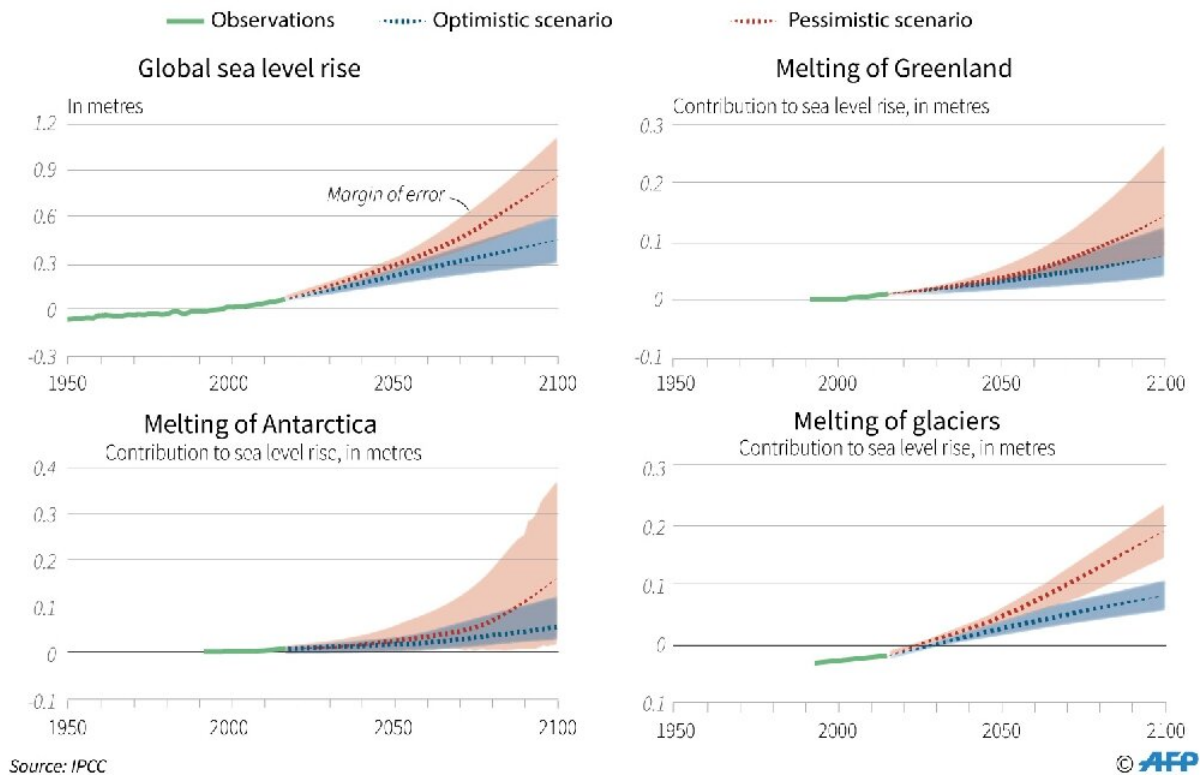
The IPCC forecasts about half-a-metre of sea level rise by 2100 under the middle-of-the-road emissions scenario known as RCP4.5.

If humanity defies the odds and achieves "[carbon neutrality](#)" by mid-century—which means any remaining emissions are somehow offset—sea level will likely be capped at 43 cm.

The "worst case" pathway—which assumes [carbon emissions](#) continue unabated, or that Earth itself will begin to boost greenhouse gas concentrations—would see an 84 cm increase, according to an IPCC special report on oceans released in September.

Rising sea levels

Even in the most optimistic scenario, rising sea levels could eventually displace 280 million people



Over the last decade, sea level has risen about four millimetres per year

Over the last decade, sea level has risen about four millimetres per year. But moving into the 22nd century, the waterline is likely to go up ten times faster, even under an optimistic emissions scenario.

Earth's [average surface temperature](#) has warmed one degree Celsius over preindustrial levels, but [polar regions](#) have heated up twice as much.

Greenland and West Antarctica—which many scientists say has already passed a point-of-no-return and will shed all its ice eventually—together support enough frozen water to lift oceans about 13 metres.

The rest of Antarctica, which is more stable, sits underneath more than 50 metres-worth of sea level rise.

More information: Mass balance of the Greenland Ice Sheet from 1992 to 2018, *Nature* (2019). [DOI: 10.1038/s41586-019-1855-2](https://doi.org/10.1038/s41586-019-1855-2)

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