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Greenland ice loss 'accelerating'

By Richard Black

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The Ilulissat glacier has retreated by approximately 15km over the past decade

The Greenland ice sheet is losing its mass faster than in previous years and making an increasing contribution to sea level rise, a study has confirmed.

Published in the journal *Science*, it has also given scientists a clearer view of why the sheet is shrinking.

The team used weather data, satellite readings and models of ice sheet behaviour to analyse the annual loss of 273 thousand million tonnes of ice.

Melting of the entire sheet would raise sea levels globally by about 7m (20ft).

For the period 2000-2008, melting Greenland ice raised sea levels by an average of about 0.46mm per year.

“ If you multiply these numbers up it puts us well beyond the IPCC estimates for 2100 ”

Professor Roger Barry

Since 2006, that has increased to 0.75mm per year.

"Since 2000, there's clearly been an accelerating loss of mass [from the ice sheet]," said lead researcher Michiel van den Broeke from Utrecht University in the Netherlands.

"But we've had three very warm summers, and that's enhanced the melt considerably.

"If this is going to continue, I cannot tell - but we do of course expect the climate to become warmer in the future."

In total, sea levels are rising by about 3mm per year, principally because seawater is expanding as it warms.

Sea change

Changes to the Greenland sheet and its much larger counterpart in Antarctica are subjects commanding a lot of interest within the scientific community because of the potential they have to raise sea levels to an extent that would flood many of the world's major cities.

CLIMATE CHANGE GLOSSARY

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Boxer-Kerry bill
Business as usual
Cap and trade
Carbon capture and storage (CCS)
Carbon dioxide (CO₂)
Carbon dioxide (CO₂) equivalent
Carbon intensity
Carbon leakage
Carbon neutral
Carbon offsetting
Carbon sequestration
Certified Emission Reduction (CER)
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Climate change
CFCCO₂
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Dangerous climate change
Deforestation
Emission Trading Scheme (ETS)
EU Burden-sharing agreement
Fossil_fuels
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Global average temperature
Global energy budget
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Global warming
Greenhouse gases (GHGs)
Greenhouse effect
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The 2007 Intergovernmental Panel on Climate Change (IPCC) report projected a sea level rise of 28-43cm during this century.

But it acknowledged this was almost certainly an underestimate because understanding of how ice behaves was not good enough to make reliable projections.

By combining different sources of data in the way it has, and by quantifying the causes of mass loss, the new study has taken a big step forwards, according to Roger Barry, director of the World Data Center for Glaciology at the University of Colorado in Boulder, US.

"I think it's a very significant paper; the results in it are certainly very significant and new," he said.

"It does show that the [ice loss] trend has

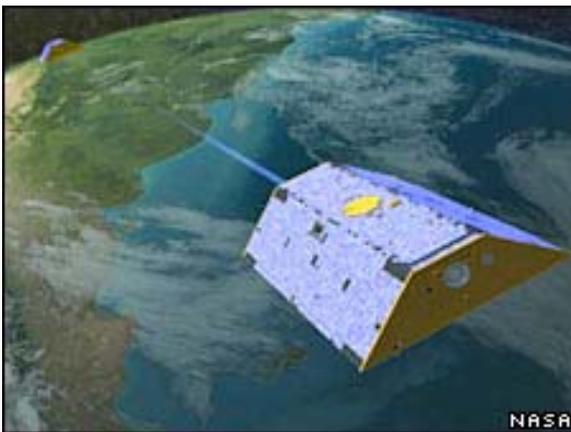
accelerated, and the reported contribution to sea level rise also shows a significant acceleration - so if you multiply these numbers up it puts us well beyond the IPCC estimates for 2100."

Professor Barry was an editor on the section of the IPCC report dealing with the polar regions.

On reflection

An ice sheet can lose mass because of increased melting on the surface, because glaciers flow more quickly into the ocean, or because there is less precipitation in the winter so less bulk is added inland.

The new research shows that in Greenland, about half the loss comes from faster flow to the oceans, and the other half from changes on the ice sheet itself - principally surface melting.



The Grace satellites provide a twin eye on gravity at the Earth's surface

Another analysis of satellite data, published in September, showed that of 111 fast-moving Greenland glaciers studied, 81 were thinning at twice the rate of the slow-moving ice beside them.

This indicates that the glaciers are accelerating and taking more ice into the surrounding sea.

Melting on the ice sheet's surface acts as a feedback mechanism, Dr van den Broeke explained, because the liquid water absorbs more and reflects less of the incoming solar radiation - resulting in a heating of the ice.

"Over the last 10 years, it's quite simple;

warming over Greenland has caused the melting to increase, and that's set off this albedo feedback process," he told BBC News.

"Quite likely the oceans have also warmed, and it's likely that explains the [acceleration of] outlet glaciers because they're warmed from below."

Data provided over just the last few years by the Grace satellite mission - used in this study - is giving researchers a closer view of regional variations across the territory.

Grace's twin satellites map gravity at the Earth's surface in unprecedented detail; and it is now possible to tease out from the data that most of the mass is being lost in the southeast, southwest and northwest at low elevations where the air will generally be warmer than at high altitudes.

Professor Barry cautioned that the Grace mission, which has produced valuable data about Antarctica as well as Greenland, has only a further two years to run, and that no replacement is currently scheduled.

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