



2018-IP08: Extent of underwater melting of Antarctic ice causes concern

A new study published in Nature Geosciences (<https://www.nature.com/articles/s41561-018-0082-z>) has indicated that:

- Hidden underwater melt-off in the Antarctic is doubling every 20 years and could soon overtake Greenland to become the biggest source of sea-level rise, according to the first complete underwater map of the world's largest body of ice.
- Warming waters have caused the base of ice near the ocean floor around the South Pole to shrink by 1,463 square kilometres – an area the size of Greater London – between 2010 and 2016.

The results suggests climate change is affecting the Antarctic more than was previously believed and is likely to prompt global projections of sea-level rise to be revised upward. Until recently, the Antarctic was seen as relatively stable. Viewed from above, the extent of land and sea ice in the far south has not changed as dramatically as in the far north.

However, the new study found even a small increase in temperature has been enough to cause a loss of five metres every year from the bottom edge of the ice sheet, some of which is more than 2km underwater. In effect, the Antarctic is being melted away from its base the researchers involved in the study suggest¹.

The study measured the Antarctic's "grounding line" – the bottommost edge of the ice sheet across 16,000km of coastline. This is done by using elevation data from the European Space Agency's CryoSat-2 and applying Archimedes' principle of buoyancy², which relates the thickness of floating ice to the height of its surface.

The greatest declines were seen in west Antarctica. At eight of the ice sheet's 65 biggest glaciers, the speed of retreat was more than five times the rate of deglaciation since the last ice age. In east Antarctica, where some scientists had previously believed ice might be increasing based on surface area, glaciers were at best stable and at worst in retreat when underwater ice was taken into account.

The results should prompt an upward revision of sea-level rise projections. 10 years ago, the main driver was Greenland. It is understood that more recently, the Antarctic's estimated contribution has been raised by the Intergovernmental Panel on Climate Change (IPCC)³. However, the forecasts the IPCC raised were based on measurements from the two main west Antarctic glaciers – Thwaites and Pine Island – a sample that provides an overly narrow and conservative view of what is happening when compared with the new research.

In an analysis of the IPCC estimates of global sea level rise, Carbon Brief indicate that the contribution of the Antarctic ice sheet ranks only as the 4th largest contributor after: thermal expansion, glaciers and the Greenland ice sheet⁴. If as this latest research suggests the contribution of the Antarctic ice sheet is underestimated, then also the IPCC projection of average sea level rise is also underestimated. Note, based on different scenarios the IPCC AR5 report suggest estimates seas will rise between 26

¹ https://www.theguardian.com/environment/2018/apr/02/underwater-melting-of-antarctic-ice-far-greater-than-thought-study-finds?CMP=Share_iOSApp_Other

² https://en.wikipedia.org/wiki/Archimedes%27_principle

³ https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter13_FINAL.pdf

⁴ <https://www.carbonbrief.org/what-the-new-ipcc-report-says-about-sea-level-rise>



and 82cms by 2100. The higher estimate reflects a business as usual scenario, whilst the lower estimate assumes net zero emissions are achieved by the end of the century. These estimates were a significant increase over those published in AR4.

This research comes on top of a research study published last year that the Greenland ice sheet is melting faster than expected, see:

http://www.ieaghg.org/docs/General_Docs/Publications/Information_Papers/2017-IP46.pdf.

A further published study increases projections for global sea-level rise, which takes into account all sources of melting including the Arctic. Their new minimum estimates are now almost double those issued by the Intergovernmental Panel on Climate Change (IPCC) in 2013 for some emissions scenarios. In fact, the latest calculations suggest that the IPCC's middle estimates for sea-level rise should now be considered minimum estimates. See:

<https://www.nature.com/news/huge-arctic-report-ups-estimates-of-sea-level-rise-1.21911>

Comment

Taken together, these studies suggest it is likely that sea level rise estimates will increase gain significantly in AR6. The social and economic consequences of sea level rise across the globe is considered significant but if sea level rise is going to be higher than predicted than its impact on coastal regions and island communities will increase.

John Gale
04/04/2018