

Melting Greenland glacier heightens fears of rising seas

Malavika Vyawahare, Environment & Energy Publishing, 11-14-15

A glacier in northern Greenland that holds enough fresh water to raise sea levels by 18 inches is melting, and it is doing so faster than expected, a new study in *Science* has found.

The paper, published yesterday, intensified concerns about the impact of climate change on the Greenland ice sheet, which is the second-largest body of ice on the planet after the Antarctic ice sheet.

Northeast Greenland, which is generally colder than the rest of Greenland, has long been considered stable in the face of warming. But the new research conducted by scientists at the University of California, Irvine, which tracks the retreat of the Zachariæ Isstrøm glacier in northern Greenland, confirms recent findings that ice loss is occurring there, too.

The ice mass loss from Zachariæ Isstrøm was first observed in 2002-03, when summer temperatures in Greenland shot up. But since 2012, the rate of retreat has accelerated, said Jeremie Mouginot, a climate scientist at UC Irvine and lead author of the study. The glacier is now shedding 5 billion tons of ice every year, according to the research.

These findings add to the growing body of knowledge showing that the effects of climate change are linked to ice loss all over Greenland. The Greenland ice sheet is estimated to spread across 656,000 square miles, which is about four times the area of California. Along with the Antarctic ice sheet, almost 99 percent of the freshwater ice on the planet is stored here.

"The future of the ice sheets is probably the most important issue for humans and sea-level rise," said Richard Alley, a glaciologist at Pennsylvania State University.

Alley and other experts said that the results from this glacier fuel concerns that the northeast basin could emerge as the biggest contributor to ice mass loss from Greenland in the near future.

"Northeast started to become unstable in 2002-03; however, this new important study shows that the region experienced further glacier speedup and increased mass loss in 2012," said Shfaqat Abbas Khan, an associate professor at the Technical University of Denmark who published a paper last year that reached similar conclusions.

Losing a tongue, with dire consequences

Mouginot explained that glacial mass can diminish through two key pathways: through the melting of the ice on the surface of the glacier and also from ice breaking off from the glacial shelf into the ocean.

The rise in average atmospheric temperatures due to global warming melts ice from the top of glaciers, and the intrusion of warm ocean water is believed to be eroding the glacier from below. The authors of the current study argue that the acceleration of ice loss is due to more ice breaking off from the glacial shelf.

"We reconstructed the dynamics and geometry of the glacier over 40 years using data from six different space agencies," Mouginot said of the work, which was funded by NASA's Cryospheric Sciences Program.

Their data showed that overall, the Zachariæ Isstrøm glacier has been thinning. But the thinning and weakening of the portion of the glacier that extends onto ocean water actually aggravated the problem of ice loss.

Ice sheets spread under their own weight, taking snowfall from central regions to low-elevation coastal regions to melt or break off in order to make icebergs, Alley explained. In many places, the ice does not immediately break off to make icebergs when it reaches water deep enough to float the ice, instead making attached floating extensions called ice shelves.

Zachariæ Isstrøm has what is called an ice tongue, an elongated extension of glacial ice into the sea. The retreat of this ice tongue because of ice loss is especially dangerous because it buttresses the glacier that is upstream.

"When the ice tongue is removed, the glacier is more free to flow, so it flows faster into the ocean," Mougnot said. This translates into a rising rate of ice discharge.

It is something similar to a cork in a bottle, Tad Pfeffer, a glaciologist at the University of Colorado, Boulder, said of the erosion of the ice shelf.

'Splashy' glaciers not always key to sea-level rise

Khan said the linking of ice sheet destabilization in northeast Greenland to warmer air and ocean temperatures is worrying because the Arctic is expected to warm faster than the global mean.

The fear is that other glaciers in the region, which are not currently losing mass and are not on the radar of climate scientists, may be headed the same way as Zachariæ Isstrøm.

Pfeffer, however, cautioned against the tendency to focus too much attention on "big, splashy glaciers" like this one, and called for a "careful assessment" of all of the significant sources of ice loss.

"There is still a lot of work to be done before we can come up with meaningful estimates about how this might ultimately feed into sea-level rise," he said.

The contribution of this glacier to global sea-level rise in itself is not significant, Mougnot said, echoing Pfeffer's note of caution.

But he insisted that, including in future Intergovernmental Panel on Climate Change reports, scientists should pay closer attention to what is happening in this sector of Greenland.