

Thin clouds drove Greenland's record-breaking 2012 ice melt

April 3 2013, by Mark Hobson



Greenland's ice sheet saw a record melt in 2012

(Phys.org) —If the sheet of ice covering Greenland were to melt in its entirety tomorrow, global sea levels would rise by 24 feet.

Three million cubic kilometers of [ice](#) won't wash into the ocean overnight, but researchers have been tracking increasing melt rates since at least 1979. Last summer, however, the melt was so large that similar

events show up in ice core records only once every 150 years or so over the last four millennia.

"In July 2012, a historically rare period of extended surface melting raised questions about the frequency and extent of such events," says Ralf Bennartz, professor of atmospheric and [oceanic sciences](#) and scientist at the University of Wisconsin–Madison's Space Science and Engineering Center. "Of course, there is more than one cause for such widespread change. We focused our study on certain kinds of low-level [clouds](#)."

In a study to be published in the April 4 issue of the journal *Nature*, Bennartz and collaborators describe the moving parts that led to the melt, which was observed from the ICECAPS experiment funded by the National Science Foundation and run by UW–Madison and several partners atop the Greenland ice sheet.

"The July 2012 event was triggered by an influx of unusually warm air, but that was only one factor," says Dave Turner, physical scientist at the [National Oceanic and Atmospheric Administration](#)'s National Severe Storms Laboratory. "In our paper we show that low-level clouds were instrumental in pushing temperatures up above freezing."

Low-level clouds typically reflect solar energy back into space, and [snow cover](#) also tends to bounce [energy from the sun](#) back from the Earth's surface.

Under particular [temperature conditions](#), however, clouds can be both thin enough to allow solar energy to pass through to the surface and thick enough to "trap" some of that heat even if it is turned back by snow and ice on the ground.

While low, thin [cloud cover](#) is just one element within a complex

interaction of wind speed, turbulence and humidity, the extra heat energy trapped close to the surface can push temperatures above freezing.

That is exactly what happened in July 2012 over large parts of the Greenland ice sheet, and similar conditions may help answer climate conundrums elsewhere.

"We know that these thin, low-level clouds occur frequently," Bennartz says. "Our results may help to explain some of the difficulties that current global climate models have in simulating the Arctic surface energy budget."

Current climate models tend to underestimate the occurrence of the clouds ICECAPS researchers found, limiting those models' ability to predict cloud response to Arctic climate change and possible feedback like spiking rates of ice melt.

By using a combination of surface-based observations, remote sensing data, and surface energy-balance models, the study not only delineates the effect of clouds on ice melting, but also shows that this type of cloud is common over both Greenland and across the Arctic, according to Bennartz.

"Above all, this study highlights the importance of continuous and detailed ground-based observations over the [Greenland ice sheet](#) and elsewhere," he says. "Only such detailed observations will lead to a better understanding of the processes that drive Arctic climate. "

More information: [dx.doi.org/10.1038/nature12002](https://doi.org/10.1038/nature12002)

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