SCAR Inlet: Lessons from an ice shelf on the brink of collapse
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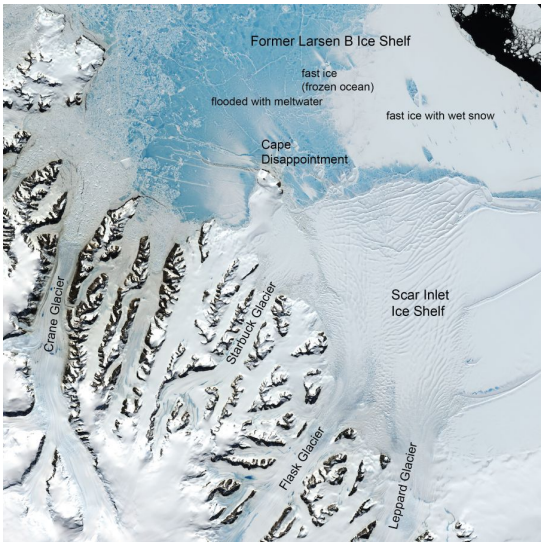
13 - it's not a lucky number, especially not this week. 13 feet is the amount sea levels will rise following the melting of the East Antarctic ice shelf, which scientists say is much more unstable than previously thought.

In a new paper in the journal Nature Communications, scientists used sophisticated ice shelf models to predict that the East Antarctic ice sheet, which is a vast area the size of California, could start to deteriorate in the next few decades.

“The [Antarctic] system has been in the state of having these large ice sheets in front of it for several thousand years,” said Ted Scambos, a glaciologist at NSIDC (National Snow & Ice Data Center). “If you remove them then you’ve reduced the stress quite a bit and the glaciers pick up speed.”

Scambos and his team have been studying the remnants of an ice shelf on the Antarctic Peninsula known as Larsen B. Before it broke apart in 2002, it was the size of Boulder County. The team is using satellite imagery and ground-based instruments to investigate the remaining chunk, known as the SCAR (named after the Science Committee on Antarctic Research).

The SCAR offers important lessons on hydro-fracturing affects ice sheets and the glaciers that they support. Hydro-fracturing is key with the recent study; when hydro-fracturing is incorporated into the model, scientists found that the East Antarctic ice sheet is prone to breakup.



[Caption: A Landsat 8 image from the summer of 2016 of the SCAR Inlet ice shelf. *Image Credit: Ted Scambos*]

“It destabilized the front part of the glacier and started to stretch it out,” Scambos says of the hydro-fracturing that led to the breakup of Larsen B. “All these fractures appeared and it was a very rapid initial acceleration.”

Because they are floating on the water, ice shelves do not contribute directly to sea level rise. But they do act as buttresses that prevent larger glaciers from flowing directly into the ocean.

After the Larsen B ice shelf broke up, the Crane glacier accelerated and lost tens of meters of altitude. This altitude loss contributed to fractions of a millimeter of sea level rise worldwide, according to Scambos. Although the breakup of ice shelves on the Antarctic Peninsula *is only a tiny drop in the ocean*, studying this area is critical for understanding the future impact of climate change on the polar regions.

“The Antarctic peninsula provides an example of how other systems in Antarctica are likely to respond,” said Scambos.

In February of 2016, Scambos and team visited the SCAR ice shelf again. In hopes of capturing a possible breakup of the SCAR ice shelf during the warmer El Niño year, they installed several instruments around the area. They monitored the weather, glacier movements, and snow and ice temperatures, sending the data back to Boulder via satellite telephone.

“We’re hoping that we get to witness this large breakup of this SCAR inlet and then we’re in a good position to monitor what will happen to the glaciers afterwards,” said Scambos.

Despite all the disaster training, crevasse-crossing, and ice camping, Scambos did not get to witness the breakup of the remnant ice shelf. However, he was able to study hydro-fracturing in depth.

In the warmer summer months, when temperatures rise just above freezing, some areas of the ice shelf begin to melt and little lakes of water form on top of the ice.

“Going from an average temperature of 29 or 30 degrees to 31 or 32 degrees for the month of January has a huge impact because you’re melting the surface,” Scambos says. “That destabilizes it because the hydro-fracture process causes it to break away.”

Melting at the surface can form cracks. Meltwater rushing into cracks can force them even further apart, leading to cracks that extend far into the ice sheet. These cracks eventually lead to the fragmentation of the ice sheet.

Although the ice shelf and the surrounding transient ocean ice, called “fast ice,” did not break up in 2016, Scambos will continue the monitoring process during this southern summer in hopes of learning about how climate change will shape the rest of Antarctica.

Notably, the entire western and eastern hemispheres of Antarctica.

“Wave your hand a little bigger,” said Scambos as he had me locate the West Antarctic ice sheet during a visit to NSIDC. I’m waving my hand over an area about ⅓ the size of Antarctica.

“That area’s vulnerable [to melting] over the next decades to centuries. That’s like the southwestern U.S. in terms of size,” said Scambos.

Likewise, as scientists recently learned, the East Antarctic sheet, which is an even larger area, is also vulnerable to hydro-fracturing and subsequent disintegration.

The acceleration of the glaciers in these areas over the next few decades will contribute two to three meters of sea level rise worldwide, according to Scambos. Two meters could easily swamp island nations such as the Marshall Islands (the average height above sea level is seven feet).

But what does the near future entail for the SCAR ice shelf?

“That fast ice will break away in big pieces if there’s both a wind and a slope from the tide pushing it out from the coast. When that has happened if there are melt ponds on the surface of the ice shelf, all this stuff here is going to break away pretty much immediately,” said Scambos as he indicates the front part of the ice shelf.

If conditions are right, the ice shelf may break away all the way up to its base where it joins the glacier. The ice here is up to 1000 meters thick. One big question is whether the glacier will sink all at once or accelerate in sections once the buttressing ice shelf is removed. This will affect the speed of melting.

So will this austral summer be the one for Ted Scambos and his crew to observe the breakup of the SCAR ice shelf? We’ll have to wait and see.