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Greenland Melting? Satellite to Help Find Answer

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Today the world's ice is restless. Warmer temperatures are melting ice and eroding glaciers from Greenland to Antarctica. But scientists do not know how global warming may affect Earth's two major ice sheets, in Greenland and Antarctica, which hold 77 percent of the world's fresh water—enough to potentially raise the sea level approximately 225 feet (70 meters).

In early December, NASA plans to launch ICESat, a satellite dedicated to the study of ice and how it moves.

ICESat will use lasers to measure the surface elevation of the Greenland and Antarctic ice sheets, which cover 700,000 and 5.3 million square miles (1.7 million and 13.7 million square kilometers), respectively.

These two ice sheets alone, which average 8,000 feet (2,500 meters) thick, cover 10 percent of Earth's land surface.

The new satellite, with a three- to five-year life span, will enable scientists to get a global perspective on how ice sheets grow and shrink.

A Place by the Icebergs

For the residents of Ilulissat, on the west coast of Greenland, ice is part of the landscape. About 10 percent of all Greenland's icebergs come from Ilulissat, which means "place by the icebergs."

A nearby glacier called Sermeq Kujalleq—the most prolific glacier in the Northern Hemisphere and the source of the icebergs—produces 22 million tons of ice each day.

But now, residents of the town say the ice is changing.

"I remember when I was navigating around and the icebergs were so big," says Thorvald Jensen, a former fisherman and skipper of the *Esle,* a fishing boat converted for tours. "We had one, we called it Matterhorn, and it was measured to be 104 meters [342 feet]. But we don't see them any more. They are not so tall."

Ilulissat's people have an intimate relationship with ice. They fight it and they love it. Melting ice enriches the sea with fresh water and oxygen, which attracts an abundance of fish and fosters a thriving fishing industry. The ice's beauty lures tourists, who pay guides to take them for boat rides amid the icebergs.

Sermeq Kujalleq is about 3,300 feet (1,000 meters) tall, but only 300 feet (100 meters) rise above the water. The glacier breaks up in a fjord near Ilulissat, birthing bergs that drift past the town like visiting mountains.
Scientists, too, have been reporting thinning glaciers at the edge of Greenland's ice sheet. So the question is not whether things are changing, but why and how quickly.

On the Greenland ice sheet, a team of NASA glaciologists is collecting data.

On Thinning Ice

Scientists have long known that "meltwater" helps narrower mountain glaciers, for example, move faster in the summer. By contrast, the vast continental ice sheets were thought to move slowly and consistently, which implied that it would take centuries for a warming climate to affect them.

But a new study reveals that large ice sheets can respond to warm weather in a matter of weeks, with implications for sea levels, and seashores, worldwide.

In 1996, scientists were skeptical when Jay Zwally, a glaciologist based at NASA's Goddard Space Flight Center in Greenbelt, Maryland, started taking GPS measurements to gauge whether the Greenland ice sheet moved faster during the summer.

"They said, 'It's just going to show the same thing all the time,'" Zwally recalls.

Zwally's team mounted GPS equipment at the Swiss Camp—90 miles (140 kilometers) east of Ilulissat—that recorded the ice's position at about ten-day intervals for five years.

Zwally and his colleagues found that when temperatures were warmer, the massive ice sheet indeed moved faster. Their study was published in the July 12 issue of *Science.*

"It was surprising, and we were quite excited when we saw [the results]," Zwally says.

Rising Sea Levels?

Under the summer sun, he explains, regions of surface ice turn into brilliant blue puddles and lakes of "meltwater." The meltwater pours through large channels called "moulins" until it reaches the base of the ice sheet—the interface between ice and bedrock.

As the water squeezes between the rock and ice, it behaves like a lubricant and allows the ice sheet to slide faster toward the sea.

"These [ice sheets] are tremendous reservoirs of ice that could cause the sea level to rise," says co-author of the study Waleed Abdalati, a glaciologist and manager of NASA's Cryospheric Sciences Program, also in Washington.

If the Greenland ice sheet melted, sea level could potentially rise by 23 feet (7 meters), and the Antarctic ice sheet by 200 feet (61 meters), according to the U.N.-affiliated Intergovernmental Panel on Climate Change.

But this doesn't necessarily mean we're all going to get wet. In a warmer climate, more snow may fall.

"In that case, Greenland may actually gain ice in its high center," Zwally says. "It's a race between increased melting at the edges and increased snowfall in the center."

ICESat is a significant new research tool to understand the meteorological mysteries. After December, as the ice melts and freezes, an eye in the sky will be watching.

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