Greenland's melt mystery unfolds, at glacial pace

Associated Press

Thu Sep 10, 2:37 PM ET

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HELHEIM GLACIER, Greenland – Suddenly and without warning, the gigantic river of ice sped up, causing it to spit icebergs ever faster into the ocean off southeastern Greenland.

The Helheim Glacier nearly doubled its speed in just a few years, flowing through a rift in the barren coastal mountains at a stunning 100 feet (30 meters) per day.

Alarm bells rang as the pattern was repeated by glaciers across Greenland: Was the island's vast ice sheet, a frozen water reservoir that could raise the sea level 20 feet (6 meters) if disgorged, in danger of collapse?

Half a decade later, there's a little bit of good news — and a lot of uncertainty.

"It does seem that the very rapid speeds were only sustained for a short period of time, although none of these glaciers have returned to the 'normal' flow speeds yet," says Gordon Hamilton, a glaciologist from the University of Maine who's clocked Helheim's rapid advance using GPS receivers on site since 2005.

Understanding why Greenland's glaciers accelerated so abruptly in the first half of the decade — and whether they are now slowing down — is crucial to the larger question of how fast sea levels will rise as the planet warms.

The issue has gained urgency as scientists rush to supply their latest findings in time for negotiations on a new global climate pact, set for December in Copenhagen.

Scientists say the Greenland ice sheet, which is up to 2 miles (3 kilometers) thick and covers an area almost the size of Mexico, is losing about 7 billion cubic feet (200 million cubic meters) of ice a year — the equivalent of 80,000 Olympic-sized swimming pools.

That means snowfall on top of the ice sheet is not enough to replace what is lost through surface melting and ice chucked out in the fjords by faster-flowing glaciers. In the process, sea levels rise as towering icebergs plunge into the Atlantic Ocean and displace water — much like an ice cube dropped into a drink.

The dynamics of the ice sheet on Greenland — and the much larger ones on Antarctica — were not included in sea level rise projections by the U.N. expert panel on climate change in 2007 because the phenomenon was poorly mapped at the time.

The picture of what happened in Greenland is just starting to come together, and scientists are still in the dark about how the underlying causes were set in motion, how much was owed to natural variances and how much to man's tinkering with the global climate system.

"This is like medical science in the 15th century," says David Holland, director of the Center for Atmosphere Ocean Science at New York University. "It's going to take a while to find out what's going on with the patient here."

The most popular explanation is that the patient — Greenland's ice sheet — contracted its ailment not from warmer air, but a warmer ocean.

Scientists earlier believed that the biggest factor for the faster flow speeds was meltwater seeping down to the base of the glaciers, lubricating the bedrock. They're now shifting attention to ocean currents believed to have sent pulses of warmer water from southern latitudes to Greenland's glacial fjords.

Holland found that such water was reaching the edge of western Greenland's biggest glacier, the Sermeq Kujalleq. A team led by Fiamma Stranneo, of the Woods Hole Oceanographic Institution in Massachusetts, made a similar discovery last month with probes plunged into the chilly depths of Sermilik fjord, where the Helheim Glacier ends.

"We've had a confirmation that the waters are really coming up to the glacier," Stranneo says, her voice nearly drowned by engine noise aboard the Arctic Sunrise, a Greenpeace ship that offered her a chance to test her hypothesis. "This is the first time that we've seen it in these southeast glacial fjords."

In July, the world's oceans were the warmest in almost 130 years of record-keeping. Meteorologists say a combination of factors are at work, including a natural El Nino system, man-made global warming and a dash of random weather.

Coinciding with the shrinking of sea ice on the North Pole and the thawing of the Arctic permafrost, the discovery of Greenland's runaway glaciers earlier this decade raised a sense of urgency among scientists studying the impact of climate change on the frozen north.

It has also been used by advocacy groups like Greenpeace to stress the importance of reaching a deal in Copenhagen to limit global greenhouse emissions.

The U.N.'s top climate official, Yvo de Boer, said Friday that negotiations on fighting climate change are moving so slowly that it will be impossible to reach a comprehensive deal by December. He said the Copenhagen meeting should aim instead to agree on "key cornerstones" of emissions cuts and how to finance them.

Even a partial melt of the ice sheet could have a big impact on sea levels, with dire consequences for low-lying areas from Florida to Bangladesh.

The 2007 report by the Intergovernmental Panel on Climate Change projects a sea level rise of 7 to 24 inches (20 to 60 centimeters) this century. Adding the potential impact of ice sheets in Greenland and Antarctica, many scientists have estimated the rise will be double.

"It doesn't sound like a lot, but it's an important difference by the way you sort of deal with that issue," says Hamilton, taking a break from his GPS measurements on a plateau overlooking Helheim's styrofoam-like bed of jagged ice. "How you engineer for a sea level rise of 30 centimeters is quite different as to how you would ... deal with a sea level rise of 1 meter."

His latest measurements indicate that Helheim is flowing at 6.5 miles (10.5 kilometers) per year, slightly down from its peak in 2005 but still 50 percent faster than its normal pace.

Other researchers say some — but not all — of Greenland's glaciers have shown similar slowdowns in recent years, suggesting that a sudden, dramatic increase in flow speeds may not be such a cataclysmic and irregular phenomenon after all.

Still, the flows remain fast enough to yield a net loss of mass from the ice sheet. And if the world continues to warm, sudden spurts of glacial acceleration may become more frequent, draining the inland ice until it, eventually, collapses.

No one can say with certainty whether that will take 100 years, or 1,000.

"It's a little embarrassing to know so little," says Ian Howat, a glaciologist based at Ohio State University. "We won't know it's going until it's gone. It feels like that a little bit."