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## Scientists try to solve puzzle of shrinking glaciers

By Matt Volz  
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**JUNEAU, Alaska** - Fewer than 10 minutes after lifting off from the airport, the helicopter entered the frozen world suspended above Alaska's capital.

Snowcapped mountains rose on either side as the small team of scientists and students peered down at a jagged blue carpet of ice below. The pilot turned up one arm of Mendenhall Glacier only to find the way blocked by a wall of fog. The storm was moving in; the work would have to be done quickly.

Hydrologist Eran Hood used a hand-held global positioning system to guide the pilot higher up the ice field on a clearer path. Circling low, the scientists spotted what they were after: A tiny pyramid of wire nearly invisible in the field of white.

In this lonely corner of an ice field larger than Rhode Island, the packed snow crunching under their boots, the group set up shop. They were about to find out just how much this part of the glacier had melted over the summer and how fast it was moving.

Hood and physicist Matt Heavner, his colleague at the University of Alaska Southeast, measured at least 10 feet of ice loss since May there and at two other spots on the glacier.

Rain was beating down on the tourists at the glacier's terminus below. The year's consistently bad weather has been dreary for the visitors, but something of a reprieve for the melting Mendenhall Glacier.

"It's a good summer to be a glacier," Hood said.

There haven't been too many, judging by the rate at which Southeast Alaska's rivers of ice are melting.

Most of the glaciers stretching from Yakutat Bay to the Stikine Icefield, which goes into northwestern British Columbia, are thinning at twice the rate that was previously estimated, according to a new study co-authored by Hood's mentor, glaciologist Roman Motyka of the University of Alaska Fairbanks' Geophysical Institute.

Comparing radar mapping data from a space shuttle mission six years ago with air photos taken between 1948 and 1979, Motyka, UAF colleague Chris Larsen and three other scientists pinpointed the extent of the glaciers' volume change.

They found that 95 percent of Southeast Alaska's glaciers are thinning. Some glacier surface elevations had dropped as much as 2,100 feet since 1948, such as the Muir Glacier in the popular Glacier Bay National Park and Preserve.

With the more precise data, they figured the rate of thinning was greatly underestimated from the last study done in 2002.

The scientists calculated that an average of 3.5 cubic miles of glacier ice melts each year in the region due to a combination of climate change and glacier dynamics. They say even that may be an understatement of the actual rate of melting.

Mendenhall Glacier is a relatively small river of ice compared with the rest of Southeast Alaska's extensive network, but it stands out. It is Alaska's most visited glacier, drawing 367,000 people to the U.S. Forest Service's visitor center last year.

The glacier is rapidly shrinking up the mountainside -- as rapidly as glaciers can, anyway. Visitors who have observed the glacier see the change themselves. Motyka estimated that the glacier's terminus will pull out of Mendenhall Lake entirely within 10 years.

Hikers can trek up the side of the glacier along craggy rock that was under a deep layer of ice just two years ago. They can poke around in ice caves that weren't there at the beginning of the summer -- and which will be gone by the season's end.

"We don't want to spend too much time underneath," Hood said in one such cave, as water from the blue roof dripped all around. "These are all pretty ephemeral."

Southeast Alaska's glaciers are very sensitive to climate change because of their large surface areas at low elevations. In Juneau, the winters have been getting warmer and rainier -- 6.8 degrees warmer compared to 50 years ago, according to Laurie Craig, a naturalist for the Tongass National Forest.

Those warmer temperatures can disrupt a glacier's surface mass balance, the balance achieved between the melting period of summer and accumulation period of winter.

For many Alaska glaciers at lower elevations, warmer temperatures are causing the equilibrium line that separates the accumulation zone from the melting zone to rise. Yakutat Glacier, for example, has lost nearly all of its accumulation zone.

"This Ice field will likely disappear completely under current conditions," the authors of the new study wrote.

While climate change causes equilibrium shifts and thinning, it isn't the only reason Alaska's tidewater glaciers are retreating from lakes and the sea. The retreat may be triggered by warmer temperatures, but then the dynamic cycle of a tidewater glacier takes over.

The speed of the glacier increases, drawing down the ice from above at a faster rate and increasing calving below. In Southeast Alaska, the ice loss at their terminus can cause tidewater glaciers to retreat more than half a mile a year -- and that loss can't be directly attributed to climate change, the scientists say.

"Once initiated, these calving losses are largely independent of climate change and can be an order of magnitude greater than ice losses driven solely by climate change," they wrote.

Then there are the anomalies. Five percent of the glaciers studied, such as the Taku in the Juneau Ice Field, are expanding and thickening.

Many of these glaciers extend higher in elevation, giving them a larger zone where snow can accumulate.

Glacier dynamics have the opposite effect with these glaciers. Their accumulation zones are expanding and their melting zones are shrinking. The result is a different kind of imbalance, one that causes the glaciers to advance.

Motyka said scientists will have a better understanding of what has happened to the glaciers since the 2000

space shuttle data once new photos taken this summer are analyzed. With the last analysis showing glaciers melting at twice the rate previously thought, he said he expects more of the same.

"Presumably, things have accelerated," he said.

#### **ONLINE**

- University of Alaska Fairbanks Geophysical Institute: <http://www.gi.alaska.edu/>
- University of Alaska Southeast: <http://www.uas.alaska.edu/>
- Tongass National Forest: <http://www.fs.fed.us/r10/tongass/>