

GLACIER—At right, a 12-passenger Sikorsky S-61 helicopter flies above Jakobshavn Isbrae glacier in Greenland. Below (from left), researchers Mark Fahnestock of the University of New Hampshire, Martin Truffer of the Geophysical Institute, Jed Kallen-Brown of the Swiss Federal Institute of Technology Zurich, and Jason Amundson of the Geophysical Institute at the study site.



photo by Martin Truffer



photo by Martin Truffer

Studying the World's Fastest Flowing Glacier

Geophysical Institute researchers have resumed studies of the world's fastest flowing glacier, Jakobshavn Isbrae glacier in Greenland.

Jakobshavn Isbrae glacier spills about 36 meters per day into the sea, pumping more than 50 billion tons of glacial ice into the ocean every year.

Associate Professor of Physics Martin Truffer spent spring and early fall of 2006 and 2007 making Global Positioning System measurements on and near the large Greenland glacier. Jakobshavn is "the biggest plug in the bathtub of West Greenland," Truffer said, draining 6.5 percent of the Greenland ice sheet.

Geophysical Institute Professor Emeritus Keith Echelmeyer made similar velocity measurements of

Jakobshavn in 1985 and 1986. The glacier started a dramatic retreat in 2001, when it lost its floating tongue. Since then, the ice flow velocity near the terminus has nearly doubled to about 13 kilometers each year.

Other Greenland glaciers, a few as large as Jakobshavn, also have doubled their speed, and scientists are wondering if the race to the sea is something that happens periodically or whether there's something about the present and recent past that has triggered it.

Truffer's colleagues on the glacier project include Roman Motyka and Jason Amundson of the Geophysical Institute, Mark Fahnestock of the University of New Hampshire, and Martin Lüthi and Jed Kallen-Brown

of the Swiss Federal Institute of Technology Zurich.

In May and August, the scientists ride in a helicopter from their base camp to locations on the glacier where they have GPS receivers that record for a full year. They also deploy eight temporary receivers, hoping to find out more about how calving at the terminus affects the glacier upstream and how much the glacier is thinning from top to bottom. The team also tracks mirrored prisms they placed on towers of glacier ice by leaning from a helicopter hovering above the ice. Recent measurements suggest that the fast-flowing ice is stretching, thinning the glacier up to 15 meters per year.

Geophysical Institute researchers will study Jakobshavn Isbrae glacier for one more field season in 2008. Amundson will use the research results to develop a model to predict how the rapid retreat of Jakobshavn Isbrae will affect the entire Greenland ice sheet.



photo by Jason Amundson

BASE CAMP—The seaside village of Ilulissat, Greenland, is home to 4,500 people. Geophysical Institute researchers studying Jakobshavn Isbrae glacier stage out of Ilulissat.



ANTARCTICA ((((Infrasound))))

Members of the Geophysical Institute Infrasound Group have been operating and maintaining an array of microphones since 2001 at Windless Bight on the Ross Ice Shelf, 30 kilometers from McMurdo Station, Antarctica.

Each year in the Antarctic summer (Alaska's winter), four Geophysical Institute researchers travel to Antarctica to perform maintenance on the array, including snow removal, calibration, and service of a large power supply.

The array is part of the verification regime of the Comprehensive Nuclear-Test-Ban Treaty Organization monitoring system and scientists use it to study atmospheric acoustics, propagation, and source mechanisms.

The team that traveled to Antarctica in 2007 included Senior Research Professional Dan Osborne, Assistant Professor of Physics Curt Szuberla, Research Professional Duncan Marriott, and Research Technician Ruth Freeburg.



- 1 Passengers on the flight to McMurdo Station wear extreme cold-weather gear in case of an emergency landing. Seen here after landing, excited visitors prepare to head out into the cold.
- 2 From left, Freeburg, Szuberla and Osborne attend a late-night orientation meeting upon arrival. Researchers must attend instructional meetings at McMurdo, as it is one of the most environmentally protected and hazardous field-work locations in the world.
- 3 Freeburg descends the stairs of a C-17 airplane upon arrival in Antarctica. After flying five hours from Christchurch, New Zealand, and landing after 10 p.m., passengers had a two-hour drive to McMurdo Station and an orientation meeting before getting some rest.
- 4 McMurdo is one of the largest scientific stations in Antarctica, with a population of over 1,200 in the summer. It serves as the base of operations for many distant field research teams.
- 5 Mount Erebus is an active volcano with a summit that stands more than 12,000 feet over the Ross Ice Shelf on Ross Island. Mt. Erebus frequently explodes hot volcanic gas, producing strong infrasound signals recorded by the eight-element array of infrasound microphones maintained by Geophysical Institute scientists and engineers.
- 6 The team calibrates each infrasound microphone annually. Here, Marriott uses a custom calibration system designed and built at the Geophysical Institute. Very few infrasound research groups have the capability to accurately calibrate their microphones.
- 7 The infrasound team uses mountaineering tents and two weather ports for shelter on the Ross Ice Shelf. Well secured against possible high winds and bad weather, the shelters serve as the team's home for two to three weeks on the ice.
- 8 Szuberla and Freeburg dig out an array microphone from four to five feet of annual snow accumulation. A primary reason for annual service visits is to raise the array up to the surface. If this task was not done, the equipment gradually would be buried deep into the Ross Ice Shelf ice pack.
- 9 Home of the Discovery Hut, built by 1901 Discovery Expedition members, Hut Point Peninsula has an excellent view. Numerous hiking trails start and end there, and penguins and seals occasionally congregate on the ice near the shore.

Mexico Volcano Study

Geophysical Institute researchers are teaming with Mexican volcanologists to map the deep crust of earth beneath Colima Volcano. Colima is located near Mexico's west coast, about 85 miles south of Guadalajara, and is on the western end of the trans-Mexican volcanic belt.

Matt Gardine, a Geophysical Institute graduate student working with Research Assistant Professor Mike West, is mapping the deep crust under Colima Volcano. Colima currently is in an eruptive cycle, with one to three explosions per day. The researchers are interested in the Mexico volcano because of its unique combination of current activity, accessibility by road, and the opportunity to collaborate with American and foreign colleagues.

Working with University of Colima Volcanologist Tonatiuh Dominguez Reyes, Gardine and West visited the volcano in January 2006 and 2007 to install 20 seismometers within a larger seismometer network installed by researchers at the University of Texas at Austin. Gardine's results should lead to a model of deep crust dynamics in Earth's subduction zones.

***ERUPTION**—Colima volcano erupts in a small, vulcanian-style explosion. Matt Gardine took the photo from Montes Azules, which is 15 kilometers southwest of the volcano.*



IN THE FIELD—From left: Greg Chavez, New Mexico Tech; Silvio DeAngelis, Montserrat Volcano Observatory; Matt Gardine; Tonatiuh Dominguez Reyes; student Jose Guadalupe Landin Orozco, University of Colima; and Mike West. Photo courtesy of Mike West.

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