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Undergraduate's innovation aids Alaska glacier research

The layers of rock that cover Alaska glaciers can act as insulation and scientists are seeking to quantify just how much this blanket of debris impacts the melt rate of the underlying ice. Sam Herreid, an undergraduate student at the University of Alaska Fairbanks, works with Geophysical Institute scientists on this issue and his innovation and proposal writing skills are a boon to the process.

Herreid and a handful of willing fieldworkers traverse the Alaska Range collecting thickness measurements of the debris cover atop glaciers. The measurements are then compared to large swaths of thermal satellite imagery in order to find correlations and develop a comprehensive picture of debris coverage and its impact. However, with a 90-meter resolution, the thermal satellite images are not detailed enough to estimate with a high level of confidence. Herreid thought a thermal camera made by FLIR would significantly enhance the debris cover story.

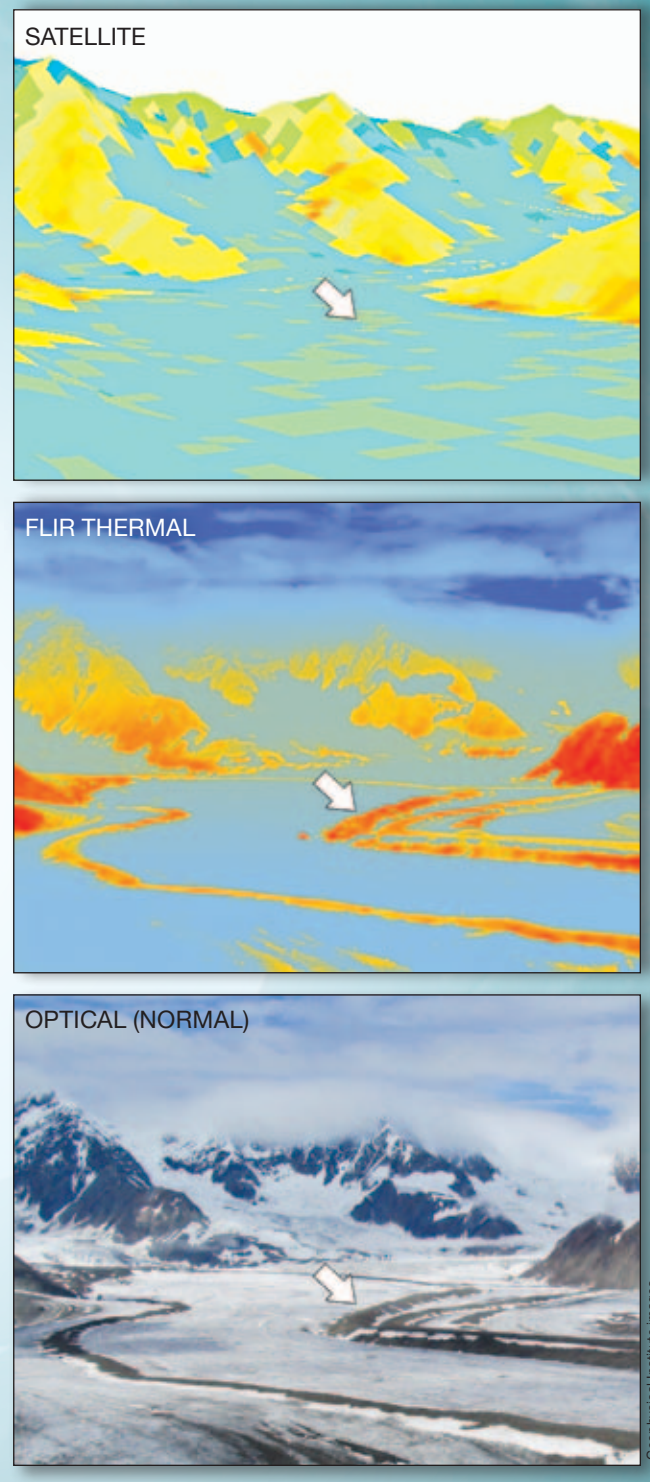
"The resolution was so coarse, so I thought it would be nice to have a thermal camera to stick in an airplane," Herreid said.

The FLIR camera will have an improved resolution of about one meter when attached to a small aircraft and flown over the multitude of Alaska Range glaciers, making comparisons of data much easier.

Thermal infrared cameras are not commonly found in the toolbox of glaciologists, but are more often used by volcanologists. As a student and employee at the Geophysical Institute, Herreid knew to consult researchers in both fields prior to submitting his recent proposal. Assistant Research Professor Peter Webley of the GI's volcanology and remote sensing groups and Associate Professor Martin Truffer, leader of the snow, ice and permafrost group, helped edit Herreid's successful Technology Advisory Board proposal.

The UAF TAB proposals are purposed with funding projects benefiting students with monies collected from student fees. Faculty, staff and students are eligible to submit proposals to receive varying grant amounts. The board awarded Herreid's full request of $23,270 – the cost of the FLIR and some accompanying software.

No stranger to the proposal writing process, Herreid is a past recipient of a UAF Undergraduate Research and Scholarly Activity grant in 2011, a Center for Global Change research grant in 2010 and a NASA Space Grant Fellowship in 2009.



Geophysical Institute images

COMPARISON *– Gakona Glacier is a debris-covered surge-type glacier in the Alaska Range. The surface temperature of the debris can be used to determine cover thickness and its affect on glacier melt. However, calculations are limited by spatial resolution of the thermal data. At top: an ASTER thermal satellite image of Gakona Glacier from July 9, 2009; at 90-meter pixel resolution the medial moraines (arrow) are imperceptible. Comparatively, the same surface feature is fully resolved in a FLIR image (middle) collected on July 1, 2012. A digital photo (bottom) was also taken on July 1, 2012.*

UAF UNIVERSITY OF ALASKA FAIRBANKS

photo courtesy of Adrienne Kentner

Catastrophic eruption transforms Alaska landscape

On June 6, 1912, people in Fairbanks, Juneau and Dawson City heard an explosion. There was no way for them to know the boom came from hundreds of miles away, nor that it was the starting gun for the largest volcanic eruption of the 1900s. No one then could fathom that in the next three days a mountain would collapse upon itself, or that ash and hot gases would explode from the ground six miles from that mountain, creating a landscape of hot ash and 500-foot geysers of steam. The Novarupta-Katmai eruption of 1912 was hard to imagine then just as it is now, 100 years later.

In three days of the summer of 1912, about 40 square miles of the world's best bear habitat was transformed into instant badlands, burying the downwind valley, now known as the Valley of Ten Thousand Smokes, in more than 500 feet of ash and volcanic rock. Novarupta spewed 100 times more material than Mount St. Helens and sent skyward a plume that reached 20 miles high. Sometime during the eruption, Mount Katmai, six miles from Novarupta, disappeared into itself. In place of its summit today is a magnificent crater lake surrounded by 300-foot walls that echo the thunder of glaciers that now calve into the lake.

Though 100 years has passed since the eruption, the valley still resembles the barren landscape visited by American astronauts in 1966 who wanted to familiarize themselves with otherworldly volcanic formations. The GI's connection to Katmai goes back to those days when volcanologist Jürgen Kienle did his graduate work there assisted by his wife Linde. The Kienles were among those who built huts at Baked Mountain still used by researchers and hikers today.

photo by G.C. Martin, USGS

***NOVARUPTA SCULPTED LANDSCAPE**—At left, students traverse a fossil fumarole within the Valley of Ten Thousand Smokes in the Katmai National Park and Preserve in 2010, 98 years after the massive Novarupta eruption. Above is a view of an ash covered home in Katmai Village on August 13, 1912, nine weeks after the eruption.*

Valley of Ten Thousand Smokes is backdrop for annual field school

photo by Pavel Izbekov

FIELD SCHOOL—*What if this was your classroom? Students take in a lecture at the Baked Mountain huts with the Valley of Ten Thousand Smokes and Mount Griggs in the background.*

On the centennial of the cataclysmic Novarupta eruption, a group of 19 students and scientists embarked on the International Volcanological Field School's first 2012 hike to the volcano.

The two-week field class in Katmai National Park and Preserve in southwest Alaska is an annual course in which select students learn about volcanology in a hands-on, extreme context. Students explore key sites in the Valley of Ten Thousand Smokes, the locale of two of the largest volcanic eruptions of the last century. The experience is unique and takes a tremendous amount of planning and preparation, according to Pavel Izbekov, a research associate with the Alaska Volcano Observatory at the University of Alaska Fairbanks' Geophysical Institute. Izbekov is leading the field school with John Eichelberger, U.S. Geological Survey volcano hazards program coordinator.

"The hardest task is to explain what students are in store for," Izbekov said amid three ActionPacker storage containers, four large packs and various other supplies stacked in his office a few days before his departure. "It's cold and it's quite rugged. I tell them when I write 'strenuous' (in an email), I mean it."

Students participate in lectures and expeditions. They work in groups most of the time, whether cooking group dinners or traversing the massive park, but they must also be self-sufficient. Students hike as much as 20 miles per day, while carrying packs that can weigh 60 pounds.

Izbekov, a graduate from UAF, has coordinated the annual field school since 2003. He says he enjoys the annual treks, along with the transformation he sees students, both graduate and undergraduate, undergo as part of the program.

"It's very important for geologists to travel, to see things with our own eyes," he said. "The field school provides strong motivation for students to continue their careers in geosciences and that's our primary goal."

The 2012 International Volcanological Field School has two sessions—the first in Katmai and the second a few weeks later in Kamchatka, Russia. The program is hosted by the UAF Department of Geology and Geophysics in cooperation with the Institute of Volcanology and Seismology and the Kamchatka State University in Petropavlovsk-Kamchatsky, Russia.

More than 350 students have participated in the program since its inception.

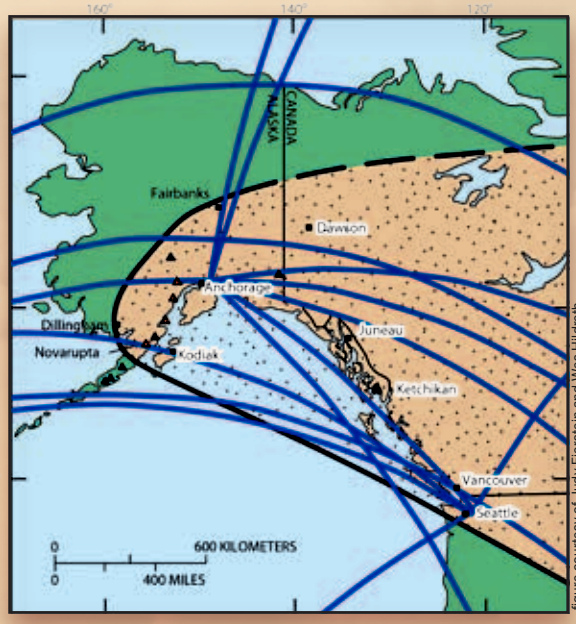


figure courtesy of Judy Fierstein and Wes Hildreth

BROAD IMPACT—*The figure above shows major air traffic routes (blue lines) near Novarupta Volcano and its 1912 ash plume area (tan section). At right are pyroclastic deposits of the 1912 eruption located eight miles away.*

photo by Pavel Izbekov

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ASF launches education program

What started as a casual request for a classroom demonstration on rocketry has morphed into a formalized outreach program operated by staff at the Alaska Satellite Facility.

Personnel from the ASF User Support Office teamed up to deliver hands-on workshops to elementary students at Barnette Magnet School in Fairbanks, Alaska. Students were introduced to satellite basics from launching, orbiting to data collection and learned of the many functions of remote sensing used by ASF, located within the Geophysical Institute.

ASF Senior Science Consultant Jessica Garron, Junior Science Consultant Bill Hauer, Science Consultant Rebecca Sanches and Senior Engineer David Matz covered the full gamut of rocketry and remote sensing processes over the span of four weeks to students in the spring of 2012.

Garron, also a member of the GI's Education Research group, said activities weren't purely entertainment. Before demonstrations, students were prompted to draw their own hypotheses on what would happen and staff guided students through the process of scientific inquiry.

The ASF team continues to refine their program and has branched out to more schools in the Fairbanks North Star Borough School District.

photo by Stevie Seibert

Bill Hauer demonstrates ASF's hand-made rocket launching system, PVC piping connected to an empty two-liter soda bottle. By stomping on the bottle, students were able to launch paper rockets connected to the tubing up to 60 feet high.