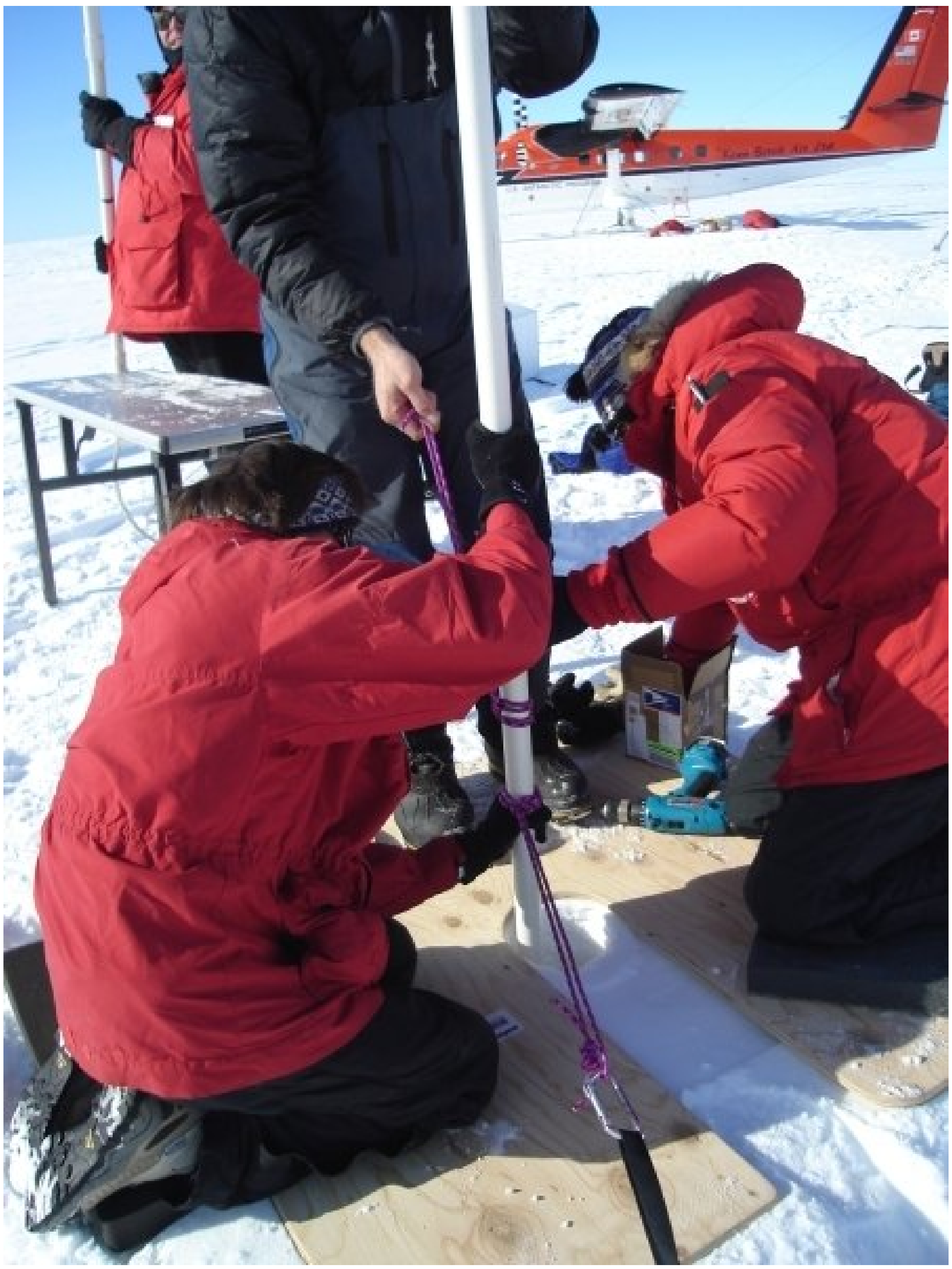
Glaciologist's commute to the world's coldest job

August 26 2015, by Kathryn Mersmann



Brunt working her project for NASA in Antarctica. Credit: K. Brunt

For glaciologist Kelly Brunt, the commute to work can range from driving a few minutes to develop models on a computer to taking long-distance flights to gather data in some of the planet's coldest places.

Most days, Brunt drives in to the Cryospheric Sciences Laboratory at NASA's Goddard Space Flight Center in Greenbelt, Maryland, where she works as an assistant research scientist. In the lab, she builds models of ice shelves that focus on how the ocean and atmosphere change the flow of these shelves.

But studying the cryosphere, the parts of the world where water is frozen into snow or ice, sometimes requires Brunt to get out of the lab and onto icy terrain.

What are you working on right now?

I'm part of the pre-launch team for the Ice, Cloud and land Elevation Satellite-2 (ICESat-2), which launches in 2017 and will measure the height and thickness of sea and land ice, as well as estimate global vegetation mass. The scientists need to collect data in the field to understand how some of the satellite's tools will measure water and ice in different forms, so they can develop software for the satellite.

What kind of fieldwork have you done in the past?

Last summer, I travelled to Fairbanks, Alaska, to help with the flight of MABEL – the Multiple Altimeter Beam Experimental Lidar – to gather data for the ICESat-2 mission. MABEL measures the time it takes individual light photons to bounce off the Earth and return to MABEL's sensor to determine the height of melting sea ice. MABEL was very important to us, for developing the software for ICESat-2, and making sure that we can get different types of surfaces – ice, vegetation, sea ice – out of clouds of photon data.

How will your fieldwork be different this summer?

We're asking just slightly different science questions that require a different instrument than what MABEL had the capabilities of doing, so this summer I am working with an airborne instrument called SIMPL - the Slope Imaging Multi-polarization Photon-counting Lidar, in Thule, Greenland, at the U.S. Air Force's northernmost base. SIMPL will measure land and sea ice in the Arctic, with a special emphasis on how the instrument's different lasers react to meltwater on top of the ice. Ideally, SIMPL can show us exactly what kind of signal two different wavelengths of light – green and near-infrared – produce when both types of lasers hit the same area of ice at the exact same time.

Why does SIMPL include both green and near-infrared wavelengths of light?

ICESat-2 will use both, and we know the two wavelengths react differently to features like water sitting on the ice, or places where the top of the ice sheet isn't entirely solid. MABEL also had both green and near-infrared light, but the two beams didn't line up exactly on the instrument, meaning they measured the ice at slightly different times. That was an issue when it came to comparing the results; you can't accurately compare readings that aren't taken at the exact same time. By placing the beams exactly together on SIMPL, the scientists will be able to better compare how the two wavelengths interpret data and track ice elevation. All of this information will help with the software design of

ICESat-2, ensuring that we can more accurately analyze the data it returns.

Once ICESat-2 is launched, how will the data it gathers help your work in the lab?

After the satellite is in orbit, I'll use the data it collects to continue studying the flow of ice shelves, particularly the Ross Ice Shelf in Antarctica. Ice shelves are the floating parts of our ice sheets; they form where an ice sheet flows down to a coast and begins to float on the ocean surface. Ice shelves are the only part of an ice sheet that are in contact with both the atmosphere and the ocean, so they're part of this insanely integrated atmosphere, ocean and ice system.

What can you learn by studying ice shelf flow?

Ice shelves are very sensitive and they're basically barometers for what the rest of the ice sheet might experience in contact with both a warming ocean and a warming atmosphere. The models I create can help contribute to better understanding of the effect of tides and the atmosphere on ice sheets in Antarctica.

What are you looking at specifically with these models?

Right now, I'm especially interested in looking at the grounding zone of glaciers. Grounding zones are generally in protected bays, where flowing ice sheets stop resting on solid ground. Just out from the grounding zone, an ice shelf becomes fully buoyant and reacts to motion in the water. It's a very interesting, highly dynamic zone of the ice shelf, where tides can sometimes change up to four meters throughout the course of a day. And in grounding zones, these tides can change the height of the ice shelves significantly.

What happens when the tides change the height of an ice shelf?

What the tides do to the ice shelf over the course of a day is just shocking to me, that the ice shelves are able to respond this way. So getting a good handle on that sort of process of how these things are responding, is what the modeling is all about. Scientists are studying how ice sheets, including ice shelves are thinning, but to get accurate measurements, we have to understand how much the height of the ice shelves change due to the tides. From there, we can work out the rate at which the ice sheets are thinning.

What are you looking forward to learning?

I think that measuring the height of ice shelves is going to be easier in the near future, with the launch of ICESat-2. The satellite will precisely measure elevation and additionally, it'll measure different times of the tidal state, so you can actually start to see the full elevation change in response to the tides. I can't wait for ICESat-2 to get up.

Provided by NASA

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