Baffin Island 2016

Field Report

SCIENCE IN THE WILD

Baffin Island 2016 - Intro

Dates: April 10 – May 5, 2016
Location: Penny Ice Cap and Qikiqtarjuaq, Baffin Island, Canadian Arctic
Trip level: For professionals
Team members: Dr. Ulyana N. Horodyskyj, Jorge Rufat-Latre, Dr. Jason Reimuller

Summary: Ice and snow are melting across the Arctic due to a combination of factors: rising air and ocean temperatures, diminishing sea ice thickness, and the deposition of black carbon/soot derived from industrial pollution and wildfires, as well as naturally occurring dust. We set off with the aim of collecting samples – both frozen and filtered – on Baffin Island to study the impacts these dark and absorbing particulates have on snowmelt. From flying a Cessna 210 from Boulder, Colorado to the Arctic, to navigating uncooperative sea ice, and to dealing with equipment malfunctions, our expedition was a testament to the challenges polar explorers of old (and of new!) experience while working in the wild.

U.N. Horodyskyj

Jorge Rufat-Latre checks on the Cessna 210 in Qikiqtarjuaq, a small town on Baffin Island, Nunavut, Canadian Arctic. The nose wrap the plane is wearing makes it possible to hold heat (produced by resistors around the cylinders and in the oil sump) inside the engine cowl before starting it.

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Baffin Island 2016 – The Approach

Team members Jorge (pilot) and Ulyana departed from Boulder, CO on April 10, 2016, taking a total of 5 days to fly across eastern Canada and the Hudson Strait, finally up to Nunavut (Baffin Island) for the start of the science expedition. Views from the cockpit revealed startling break-up of sea ice early in the season as well as magnificent views of the Penny Ice Cap and its large surrounding rocky "big walls," as seen on the following page.

U.N. Horodyskyj

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Above: Jorge and Ulyana at the Rocky Mountain Metro Airport, ready for takeoff.

Left: The condition of the sea ice in the Arctic, April 2016.

Arctic sea ice keeps the polar regions of the planet cool, as well as helps moderate climate globally. Given its white surface, sea ice is very bright, reflecting 80% of solar radiation back to space. As air and ocean temperatures continue to rise, more sea ice will melt exposing darker ocean water which will absorb rather than reflect the sunlight, leading to even more melt of the remaining sea ice.

For more information on the status of sea ice, please see: https://nsidc.org/arcticseaicenews/

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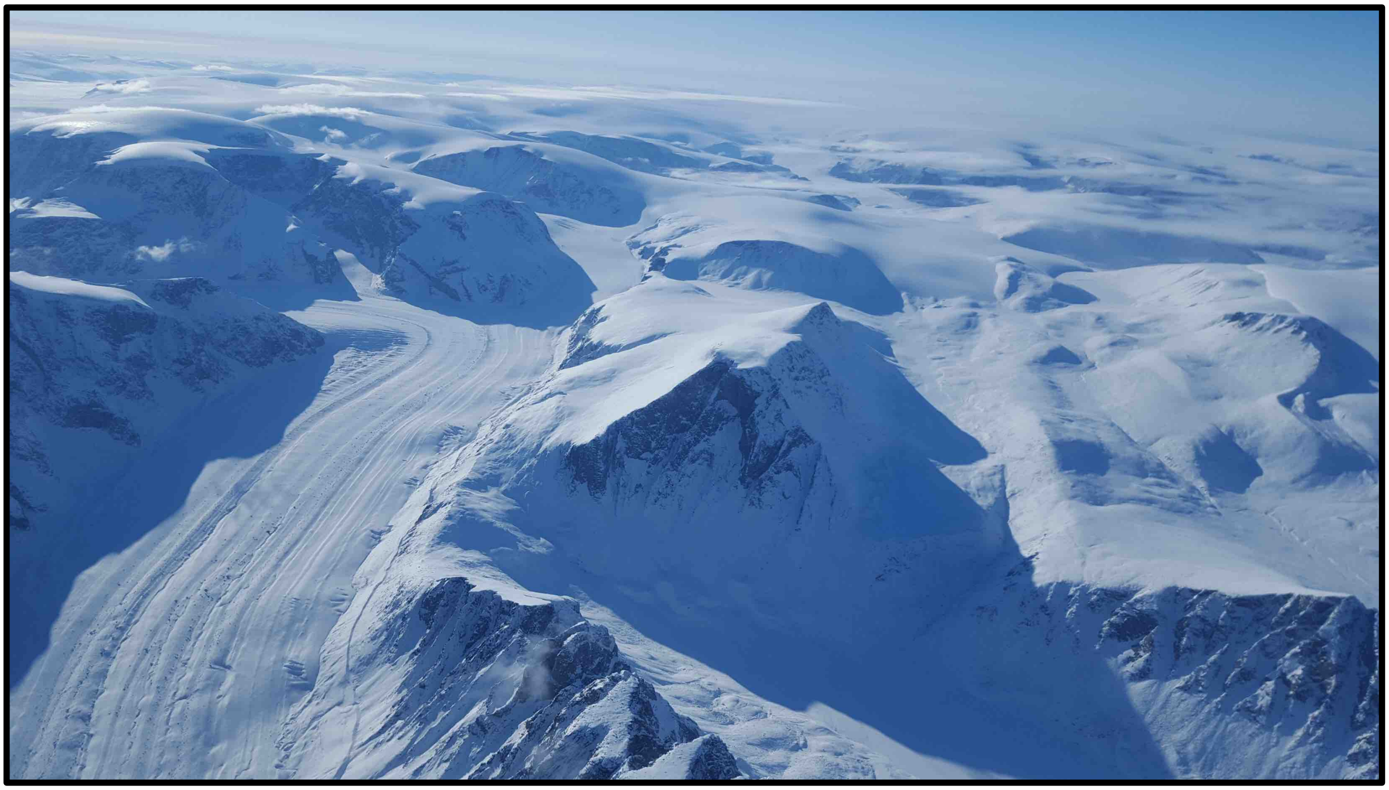
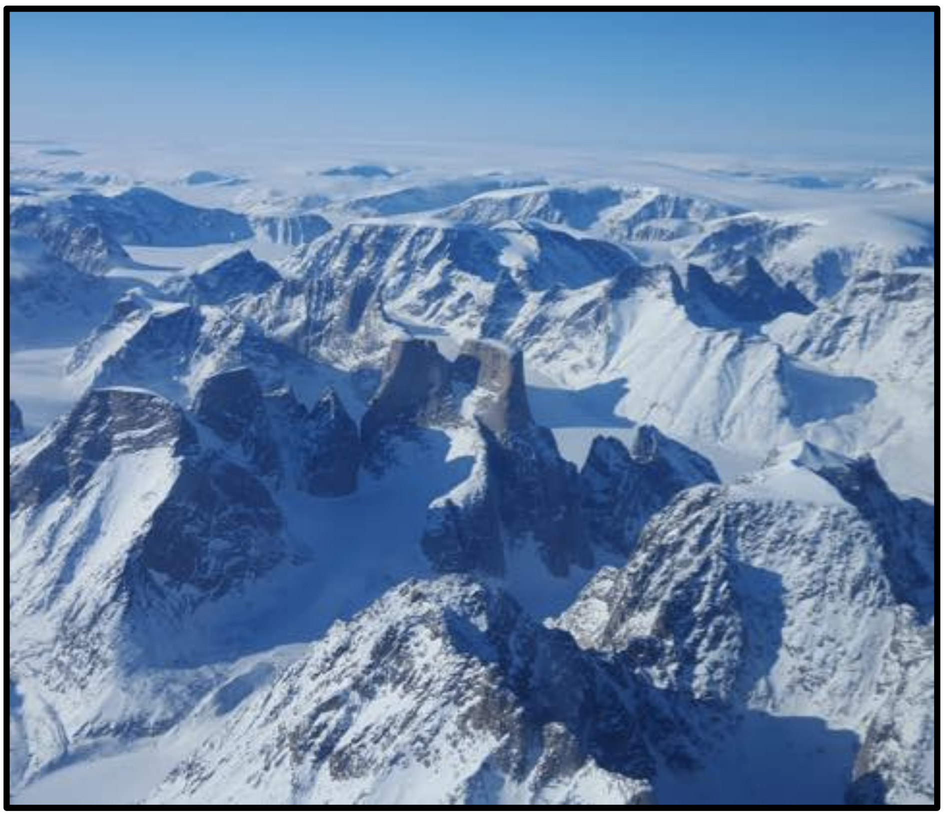
Baffin Island 2016 – The Approach



photos: U.N. Horodyskyj



Flying in a Cessna 210 over the Penny Ice Cap provided opportunities to scout routes and look at crevasse hazard on glaciers from above. Given no houses or roads, it is hard to imagine the scale of this landscape. The big walls easily tower hundreds of feet in the air.

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Baffin Island 2016 – The Approach

photos: U.N. Horodyskyj

Travel by snowmobile was difficult due to slushy sea ice conditions. Along the way we saw evidence of polar bears (as pictured above) – tracks in the slush, signaling their journey from hibernation in the mountains during the winter and out to the sea ice in the spring, in search of food. Air temperatures were mild for this time of year, hovering to just above freezing, as measured by a mini Kestrel weather station.

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Coronation Glacier Terminus

Getting on the Penny Ice Cap to begin our snow sampling proved challenging given our having to navigate what's called the lateral (side) moraine of the glacier – riddled with rocks and crevasses hidden by heavy snowfall. We were each dragging 75-lb sleds which at some points we had to carry and shove in order to make it through the glacial maze.

The 40-meter tall calving (collapsing) ice front marks the terminus (end) of the Coronation outlet glacier, as pictured below. By the end of the field season, daily temperatures were above freezing, leading to the formation of meltwater pools. The water is darker than the surrounding snow, hence it can absorb more solar radiation and melt even faster. After about a week at our base camp, it was time to move as the sea ice in the fjord (the valley the glacier carved out and has now left with seawater in its wake), was starting to melt and crack. One morning, as we were just waking up, a loud "whomping" sound alerted Ulyana – who thought a polar bear was nearby. This wouldn't be totally unexpected, given nearby tracks. Instead, it was the cracking of the sea ice (pictured to the right), prompting us to immediately pack up and move our camp to higher ground.

photos: U.N. Horodyskyj

Blue ice walls mark the terminus (end) of Coronation glacier. Every summer, ice melts and collapses into the fjord, changing the face of the calving front. What is pictured here will never look the same.

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Baffin Island 2016 – Camp Life

photos: U.N. Horodyskyj

Our nights were spent in a Hilleberg tent, meant to withstand the harshest field conditions. The first task was making sure it didn't blow away! We would dig through the snow until we hit glacial ice, then use an ice screw to secure one end of the tent. Meanwhile, another team member would use his/her skis to stomp out a foundation for the tent. By the end of the trip, we were pretty efficient at getting the tent up and down. This proved crucial in the last days when a storm starting blowing off the ice cap, sending fierce winds down the valley.

The tent also served as a shelter for cooking our meals, powering our electronics, and filtering snow samples when it got too windy to work outside.

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Coronation Glacier Travel

Route-finding near the terminus of Coronation glacier initially involved leaving behind the sleds and skis at base camp and stomping a path through the deep snow, over crevasses, and around boulders. Temperatures hovered just above freezing but all the effort (think, less than 1 mph speed at times, but constantly post-holing (falling through) the snow led to a good workout. Sweating through all your layers out in the wild can kill, so it was important to regulate our efforts.

photos: U.N. Horodyskyj

Once on the clean ice of the glacier and onwards to the ice cap proper, we were able to gain progress on skis, while sliding our sleds behind us on relatively flat terrain. On the descent, one of the sleds became a "mini-fridge," to preserve the frozen samples for black carbon analysis once back in the States.

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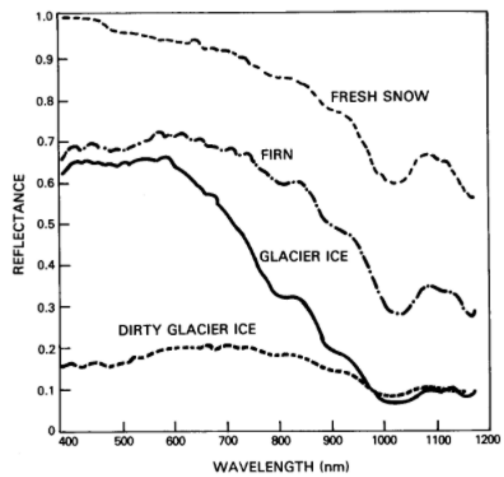
Reflectivity Measurements

photo: U.N. Horodyskyj

A spectroradiometer generously provided by ASD, Inc., a PANalytical company based in Boulder, Colorado, allowed us to make reflectivity measurements of the snow and ice in the visible and near-infrared part of the electromagnetic spectrum. The dirtier the material, the less reflective, and the more melting that can occur. Spectral slopes and shapes (absorptions) hold clues to whether a material is snow, ice, or dirty snow/ice – an important distinction sometimes difficult to make by orbiting satellites with large on-the-ground footprints, hence our attempt at ground-truth in the Arctic using smaller footprints..



Hall et al., 1985

photo: J. Rufat-Latre

The portable FieldSpec4 and batteries weigh in at around 30 lbs and the set-up is worn like a backpack while working in the field. The instrument is capable of the full visible and near-infrared spectrum: from 350 to 2500 nanometers (nm).

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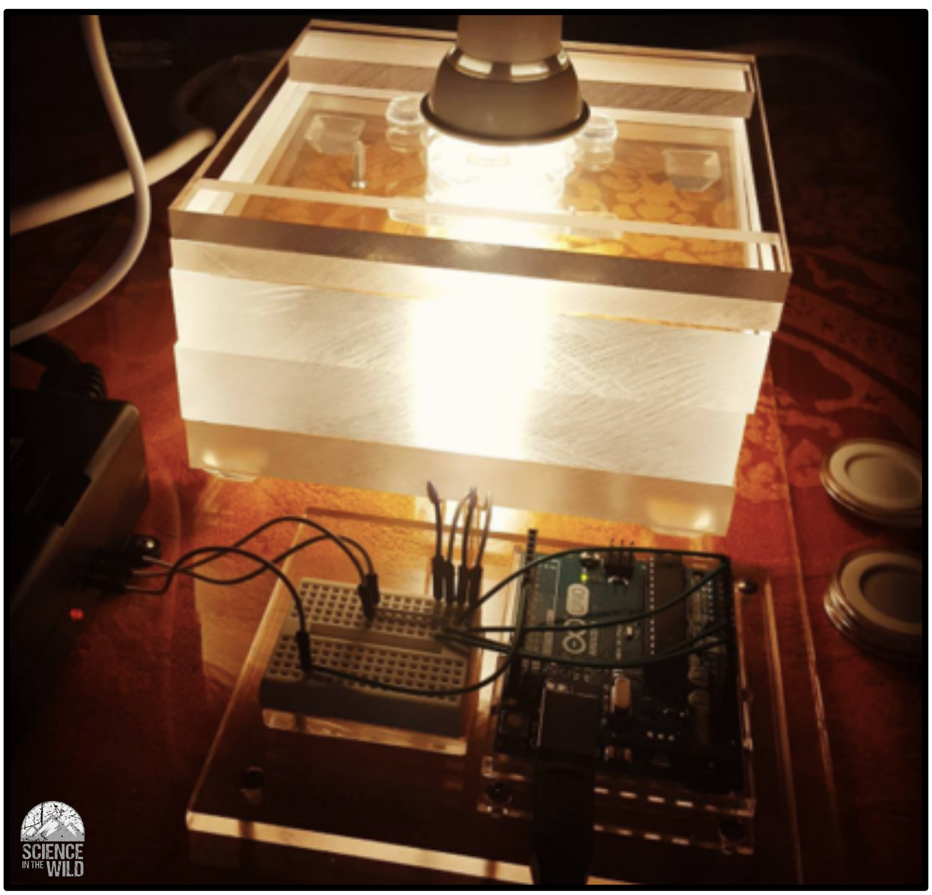
Snow Sampling

Snow was sampled from the surface and at the snow/glacial ice interface from the Penny Ice Cap to Qikiqtarjuaq, covering a distance of over 100 miles. A sampling shovel and ice axe, as well as bare hands (if temperatures allowed for it) would be cleansed in the nearby snowpack before sampling. Small vials of collected snow remained in a frozen state for analysis in a laboratory setting once back home, while gallons of snow would be collected in bags, melted, and then filtered as another technique for determining black carbon and dust concentrations.

photos: U.N. Horodyskyj



An instrument developed by Dr. Carl Schmitt, National Center for Atmospheric Research in Boulder, CO, is used to measure concentrations of effective black carbon on filters. It works through a light absorption heating method – depending on the "load" of pollutants on the filter, it will heat up either faster or slower, as well as at larger or smaller increments that correlate with a known concentration of pollutants. This method does not distinguish dust from black carbon, hence the need also for collecting frozen samples which are measured in a soot photometer specifically for black carbon.

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Contact info@scienceinthewild.com or check out www.scienceinthewild.com to learn more about upcoming expeditions and how you can get involved.

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