

Optical Sensor Validation in West Greenland

Caleb McDaniels, Class of 2025

I spent this summer field testing optical backscattering sensors in the fjords of western Greenland. The goals of this project were twofold. First, I aimed to field test an optical backscattering sensor prototype I designed during my final year at Bowdoin. While tests in the lab and nearby Harpswell Sound showed promising results, I needed to test the device in the harsh Arctic environment it was designed for. Second, I hoped to establish a validation dataset showing the efficacy of the device. To do this, I gathered data with my prototype and a commercially available sensor at the same time. I towed both sensors behind a packraft, a type of inflatable kayak, and paddled along fjords and bays with mixed sediment loads (Figure 1A).

The testing and identification of weak points in my sensor prototypes was quite successful. I deployed the sensors across a range of conditions, from clear coastal waters to highly turbid river deltas, and in temperatures from relatively warm July days to mid-September when sea ice was starting to form in the fjords. I pushed the sensors to failure repeatedly, learning which components worked and which should be changed in future iterations. I also became skilled at field repairs, having completed two full rebuilds along the way (Figure 1B). This process has provided me with substantial feedback on the construction of the electronics and housing of the sensor that I can use when designing the next version.

The success of my data collection is not yet certain. I gathered data from dozens of fjords, sampling in transects along fjords wherever possible to capture the gradient and mixing of different water masses (Figure 1C). However, the raw data must be processed before its validity can be assessed. Processing the data involves applying digital filters and coefficients calculated during the post-calibration of the sensors and must be done in the lab when I return to the U.S.

Figures:

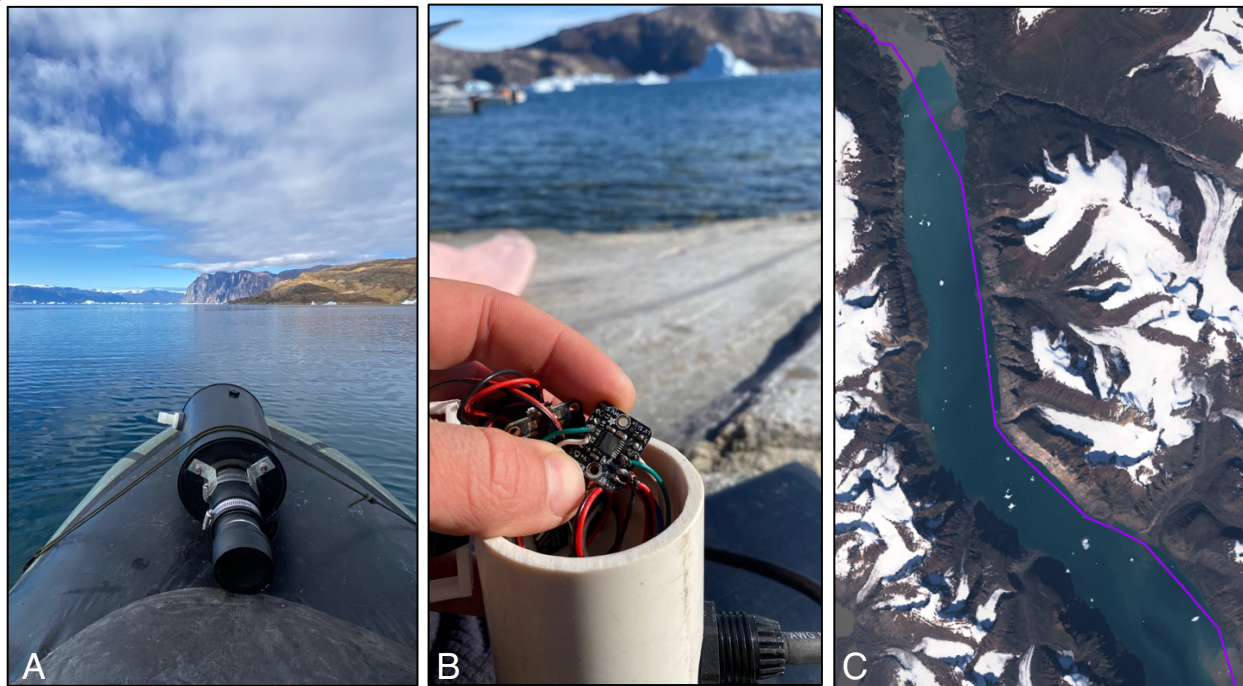


Figure 1. Sensor on packraft deck ready for use. When collecting data, the sensor is secured underneath the boat (A). Sensor disassembly and repair in the field (B).

Continuous transect taken along a fjord using optical sensors (C).

Faculty Mentor: Collin Roesler

Funded by the Christian A. Johnson Endeavor Fund