Principal investigators names & institutions
Martin Truffer, University of Alaska Fairbanks
Chris Larsen, University of Alaska Fairbanks
Roman Motyka, University of Alaska Fairbanks
Alessio Gusmeroli, University of Alaska Fairbanks
Jason Amundson, University of Alaska Southeast
Jeffrey Kavanaugh, Juneau Icefield Research Program and University of Alberta

Experiment name & nickname
Name: Taku Glacier seismic reflection survey, 2015-2016
Nickname: Taku Seismic

Purpose of experiment
The purpose of this experiment was to image sediment deposits beneath the Taku Glacier terminus, to determine their thickness and geometry, and to perform Amplitude Variation with Offset (AVO) analysis of seismic reflection returns from the glacier bed to learn the nature of the sediments (dilatant and soft vs. dewatered and solid). This seismic reflection survey was part of a larger glacier monitoring project aiming to characterize the relationship between subglacial sediments and the unusual dynamics of the advancing Taku Glacier terminus.

Layout of instruments
We performed our survey 1 km above the Taku Glacier terminus on ice that is ~200 m deep. We performed out survey between July 28th and August 5th. The glacier surface where we worked was bare ice at that time.

We had two geophone configurations, consisting of one line of 24 40-Hz geophones that we moved halfway through the survey. We fired Betsy Gun blasts colinearly with the geophones, spaced every 10 m (ocassionally with 5 m spacing). See Figure 1.
The line ran SW to NE and we used line coordinates during the survey, starting with 0 m at the SW end of the line and ending with 555 m at the NE end. Refer to Table 1 for the starting and ending coordinates of shots and geophones for Configuration 1 and Configuration 2.

Configuration	Shots start coordinate	Shots end coordinate	Phones start coordinate	Phones end coordinate	Number of shots
1	170 m	660 m	440 m	555 m	71
2	0 m	420 m	210 m	325 m	43

Table 1. Line coordinates of the starts and ends of shot lines and geophone lines for the 2015 Taku Glacier seismic survey.

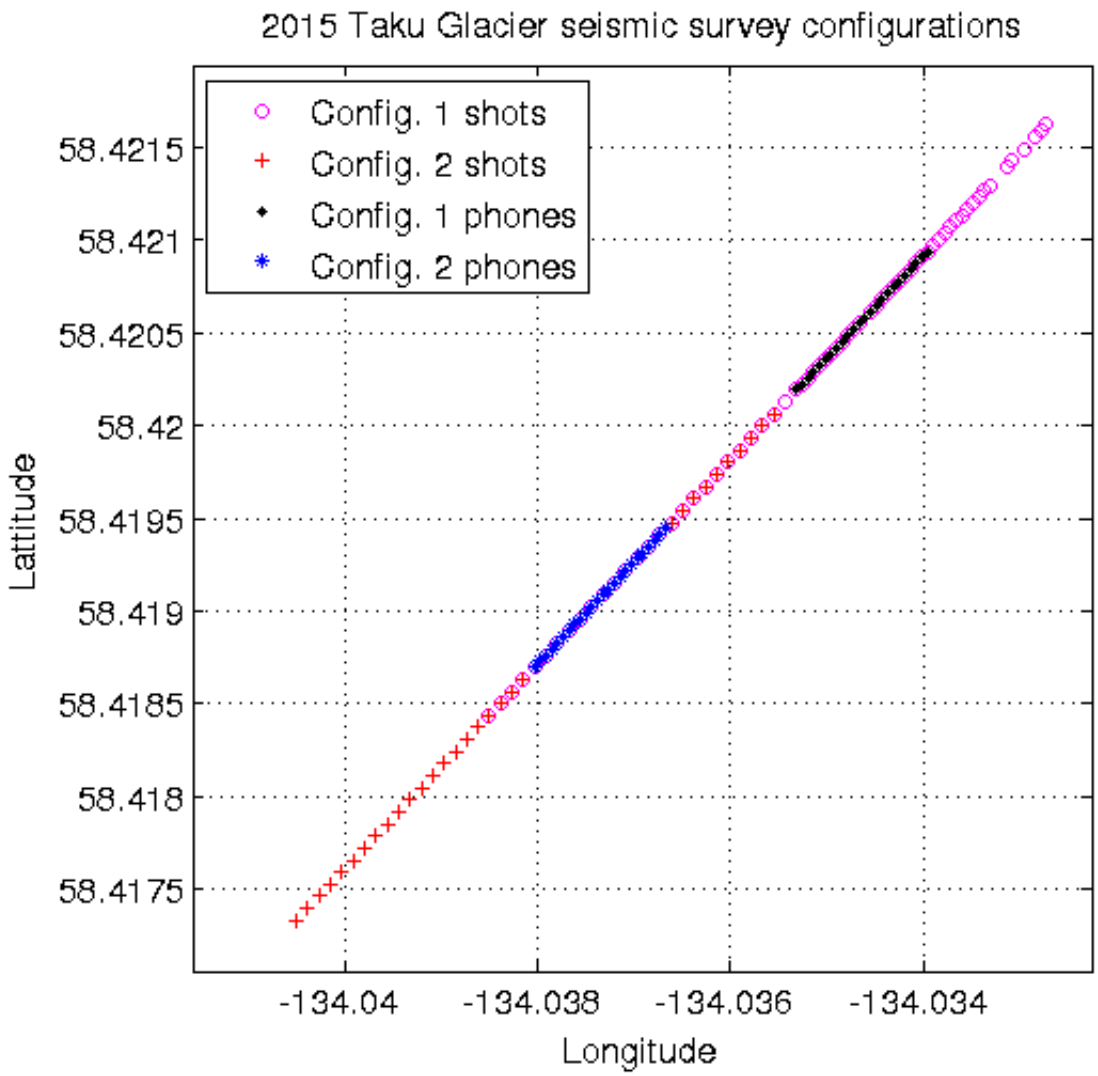

Figure 1. Layout for the 2015 Taku Glacier seismic line.

We used a Betsy Seisgun with 26 g black powder charges (400-grain industrial blanks) as our seismic energy source. We augured 50 cm holes into the ice surface and fired vertically into them, holding the Betsy Gun down with a cord and an ice screw. We struck the Betsy Gun with a mallet to trigger it. We taped a trigger switch to the mallet so the geode would commence recording when we struck the Betsy Gun.

To install the geophones in the ice surface, we drilled small holes into the glacier ice with a hand drill. The holes were just big enough to fit a geophone spike snugly. The glacier melted a few centimeters every day, so we reset geophones every day. Nevertheless, geophones tended to loosen in their holes and tilt as the day progressed. Geophone tilt ranged from vertical (as installed) to ~30 degrees from vertical (after a day of melt).

Data recording

The data from Configuration 1 and Configuration 2 are each contained in a SEGY file, Taku_2015_configuration_1.SGY and Taku_2015_configuration_2.SGY. These include x, y, and z traceheader coordinates in the form of UTMs (WGS 84, Zone 8V) and elevation above sea level. The Geode recorded data at 8000 samples per second for 2 seconds. In Configuration 1 there are 2 common shot gathers where recording began before the shot went off, resulting in signal delays that are not precisely known. There are also 2 common shot records which missed the signal entirely. Configuration 2 has a slight time delay in the first common shot gather displayed.
Some parts of the seismic records show local high-amplitude short-duration signals, which are rain drops striking geophones.

We display the traces in the SEGY files by order of shot-geophone offset in order to group seismic records to look like common shot gathers, for easier viewing. Each of these pseudo-gathers consists of multiple common shot gathers which may have been recorded days apart. They also image non-consecutive parts of the bed. Traceheaders still reflect real geophone and shot locations, though.

The two spreadsheet files Taku2015_config1_archive and Taku2015_config2_archive contain additional geophone and shot metadata for each trace, in the order they appear in the SEGY files.