JUNEAU ICEFIELD RESEARCH PROGRAM 2018

JIRP Research Project: Mass Balance

Overview: Glacier mass balance is a measurement of glacier health. When gains (snowfall) outpace losses (melt), a glacier has positive mass balance and grows. The opposite is true when losses outpace gains. Snowfall and melt in turn are determined by the climate specific to a given location. Thus, mass balance is the crucial link between the climate system and glaciers.

JIRP Mass Balance: JIRP monitors annual mass balance of Taku and Lemon Creek Glaciers. These two records, starting in 1946 and 1953 respectively, are two of the longest on the planet and are an important component of the larger scientific community's understanding of glacier change. The season-long effort of JIRP mass balance continues these important data sets. As part of this, JIRP is responsible for a first-order analysis of the 2018 annual mass balance of the Juneau Icefield.

Specific Research for 2018: Melt water percolation in snow and firn is an important input process within glacier hydrology and mass balance; particularly with respect to the lag between melting, percolation, and residence time of meltwater within the glacier hydrologic system. Moreover, the availability of meltwater is a limiting factor to the presence of snow algae which have a significant effect of ablation rates. Measurement of seasonal water fluxes in snow and firn has historically been difficult and often not attempted due to limitations in measurement technology. Recent advances in the geophysical technology of self-potential (SP) measurements have shown promise for the measurement of unsaturated water flux in geological media and melting snow. Measurements of melt water flux may improve our understanding of glacier mass balance processes and allow modeling of meltwater percolation processes. We will undertake exploratory measurements of meltwater fluxes using SP, in combination with meteorological measurements of surface energy balance (i.e., energy inputs for melting), to explore the dynamics of surface melting.

Logistics: Mass balance research begins at Camp 17 at the end of the second week of JIRP where field methods are introduced on Lemon Creek Glacier. Field efforts continue throughout the season as we move to Camps 10, 18 and 26 while working on the Taku, Gilkey and Llewellyn glacier systems. Meltwater percolation studies will be conducted at two sites on Taku Glacier near Camp-10 and Camp-18 respectively.

Faculty: Listed by dates of involvement

- Chris McNeil (U.S. Geological Survey) (C17-C10)
- Wilson Clayton (Colorado School of Mines) (C10-C18)

Recommended pre-JIRP reading:

Strel, A. 2016. Tackling the Taku: Measuring Mass Balance on the Juneau Icefield, Lindsey Nicholson Blog. [*infographic*] http://lindseynicholson.org/2016/10/glacier-mass-balanceinfographic/

Pelto, M., Kavanaugh, J., and McNeil, C. 2013. Juneau Icefield Mass Balance Program 1946– 2011: *Earth System Science Data*, v. 5, no. 2, p. 319–330.

Ganey, G. Q., Loso, M. G., Burgess, A. B., & Dial, R. J. 2017. The role of microbes in snowmelt and radiative forcing on an Alaskan icefield. *Nature Geoscience*, *10*(10), 754.

Clayton, W. S.: In situ measurement of meltwater percolation flux in seasonal alpine snowpack using self potential and capillary pressure sensors, The Cryosphere Discuss., https://doi.org/10.5194/tc-2017-187, in review, 2017.