

Accumulation distribution on Abramov Glacier from GPR measurements

Silas Walther

[Master thesis in Geography]

In Central Asia, glaciers are especially important during dry continental summers providing melt water. Accordingly, knowledge about glacier mass balance sensitivity to changes in climate is crucial. Abramov Glacier is located between the headwaters of Syr Darya and Amu Darya rivers. It is the only glacier with long-term mass balance observations in Pamir and was monitored from 1967–1999 by Soviet scientists and again since 2011.

In modelling the mass balance, precipitation is a critical input parameter due to measuring uncertainties and extrapolation difficulties. It is common to apply a precipitation correction factor as well as an altitudinal precipitation gradient to distribute precipitation over the glacier area.

This master thesis provides spatially distributed precipitation multiplier (PM) rasters for Abramov Glacier. Thereto, comprehensive ground penetrating radar (GPR) surveys are performed in January 2018. Benefitting from simultaneous density measurements from two firn cores and three snow pits, direct conversion from two-way traveltimes to water equivalents is possible. Water equivalents are extrapolated to the entire glacier by multiple regressions based on the historical snow depth distribution, winter precipitation and two topographical parameters. After normalization, this PM raster replaces the altitudinal precipitation gradient in the mass balance model of *van Pelt et al. (2012)*. Using extensive Soviet measurements, additional monthly PM rasters are generated for assessing the intermonthly comparability.

The PM rasters reduce the number of tuning parameters in the mass balance model. Currently the mass balance model performs slightly worse using the GPR or Soviet PM raster, attaining an R^2 of 0.81 instead of 0.84. This shows that there remain other model parameters to calibrate. Further progress is to achieve performing GPR measurements encompassing the entire glacier and steep slopes and calibrating other model input parameters.

Machguth