Project acronym: BELIGI

Project title: Broadband Electromagnetic Investigation of Glacier Ice using Spectral Induced Polarization, Time-Domain Electromagnetics, and Ground-Penetrating Radar

Project leader: Matthias Bücker, TU Braunschweig, Germany

Discipline: Earth Sciences & Environment: Other - Earth Sciences

Station(s): Sonnblick Observatory (Austria)

Geophysical investigations of glaciers are generally carried out as ground-penetrating radar (GPR) surveys, which offer the possibility to quickly map glacier ice thickness and eventually provide information on the internal structure of glaciers. We propose to evaluate the potential of broadband spectral induced polarization (SIP) and time-domain electromagnetic (TDEM) by extensive test measurements on the Goldbergkees glacier right below the Sonnblick Observatory in the Austrian Alps. High-frequency SIP measurements have already been shown to give reliable estimates of the frequency-variation of electrical resistivity with depth – provided that the subsurface has a high overall resistivity, as it is the case on ice and snow. This spectral information potentially allows to improve the interpretation of geophysical data from glaciers, e.g., by providing additional information, e.g., on the ice/water ratio within the glacier. Although promising, the realization of SIP measurements in the field is laborious and time consuming. In order to overcome this limitation, we propose to evaluate the use of (much quicker and less laborious) TDEM measurements, from which the frequency variation of electrical resistivity can theoretically also be reconstructed. Examples of TDEM soundings on glaciers are rare in geophysical literature, especially concerning the recovery of spectral parameters of electrical resistivity envisioned in this project. The generation of collocated high-frequency SIP and TDEM data sets in combination with a classical GPR survey will allow us to cross-evaluate both new methods and develop practical guidelines for their use by a broader user community in the area of glacier research.