Geophysical Research Abstracts
Vol. 19, EGU2017-16644, 2017
EGU General Assembly 2017

Three-dimensional internal structure of an entire alpine rockglacier, detected by Electrical Resistivity Imaging

Adrian Emmert and Christof Kneisel
Institute of Geography and Geology, University of Wuerzburg, Germany (adrian.emmert@uni-wuerzburg.de)

Uertsch rockglacier (46.61° N, 9.84°E, ca. 2500m asl.) is a tongue-shaped 300m x 100m landform at the head of a small high mountain valley in the Eastern Swiss Alps. Located at the lower end of possible permafrost existence, the rockglacier shows indications of permafrost decay although borehole temperature measurements exhibit an at least partly occurrence of permanently frozen subsurface conditions.

To delimit the extent of the frozen area and to characterize subsurface structures, we performed three adjacent 3-D Electrical Resistivity Imaging (ERI) surveys consisting of data from altogether 138 merged 2-D profiles, covering nearly the entire rockglacier by an investigation area of more than 2.5 ha. More than 47000 data points of Wenner-Schlumberger and Dipol-Dipol electrode arrays grant sufficient data coverage. Ground-truthing was achieved through borehole temperature measurements and multiple comparative ground-penetrating radar (GPR) and seismic refraction tomography (SRT) surveys.

Results show that the rockglacier today lacks a consistent permafrost table and only shows a patchy permafrost distribution. Several structures differing in geometry and electric resistivity show a complex pattern of ice-rich, ice-poor and ice-free areas. We could identify glacial influence in the root zone of the rockglacier, where a 3200m2 perennial surface ice field is visible. In a downslope direction, a shallow layer of high resistivity values, which is limited to the shallow subsurface, follows the ice field and indicates a genesis by refreezing meltwater. The central part of the rockglacier also shows traces of glacial interaction by the occurrence of a several meters thick buried ice patch in the shallow subsurface at a marginal position. Next to this position, in an area where longitudinal surface ridges are exposed, modelled resistivity values indicate frozen conditions with relatively low ice content, limited to the shallow subsurface. We assume that these structures are likely connected to permafrost creep processes. The frontal part of the rockglacier is affected by a strong ridge-and-furrow topography with arcuate ridge structures. Frozen conditions within these structures indicate an increase of ice content by thickening through compressive flow.

Our study reflects the complexity of landform evolution for Uertsch rockglacier, where glacial and periglacial processes occur in close proximity. This emphasize the value of comprehensive 3-D investigations to assess the geometry and characteristics of larger subsurface structures.