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Characterization of high mountain periglacial material by geophysical measurements within the Murtèl-Corvatsch Area, Swiss Alps

S. Schneider, C. Hauck, and M. Hoelzle
Fribourg, Geography, Switzerland (sina.schneider@unifr.ch)

Permafrost in high mountain areas occurs in a large variety of surface and subsurface material within short distances. To analyze the material specific characteristics an electrical resistivity tomography monitoring (ERTM), refraction seismic tomography (RST) and borehole temperature measurements were regularly performed during the last three years. The investigation area is situated within the Upper Engadine, Swiss Alps (Haeberli et.al (1988), Vonder Mühll et.al (2000) and Hanson & Hoelzle (2005)), covering different materials: bedrock, coarse blocky and fine-grained. Measuring electrical resistivity in permafrost regions implies, that changes in the resistivity are due to different subsurface materials and to phase change processes of water/ice. Whereas the resistivity contrast between ice, air and certain rock types is small, seismic refraction surveys provide a large contrast between very slow velocities in air and high velocities in ice (Hauck & Kneisel (2008)). A regularly, combined monitoring of the subsurface allows to detect seasonal as well as annual changes in resistivity, seismic P-wave velocity and temperature, and is therefore a useful method to analyze the characteristics and processes within periglacial material.

The results show material dependent seasonal and annual changes in resistivity, P-wave velocity and temperature. Analyzed by virtual boreholes which were cut into the resulting ERTM- and RST- inversion models, the ERTM and the RST data of the last three years show strong differences depending on the material. The coarse blocky material of a rock glacier shows a high variability of the specific resistivity during the year 2010/2011. A fine grained part of the same rock glacier seems to be strongly influenced by retained water. The bedrock and a further coarse blocky site without the presence of ground ice show much smaller variability of specific resistivity, and only little changes in the material and aggregate state can be assumed. The high mean resistivity values at the bedrock place, exclude the presence of water filled clefts.

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