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# Analysis of the thermal regime of active layers with different subsurface textures by using borehole temperature data, geophysical measurements and numerical modelling

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Compared to polar regions permafrost in high mountain regions occurs in a great variation of surface and subsurface material and texture. Therefore, the thermal regime of the active layer strongly depends on internal factors like the grain size, the pore volume and type of material beside external factors such as air temperature, incoming radiation, precipitation and runoff. Geophysical measurements are useful methods to get information about the subsurface texture without disturbing it. In addition to the data from direct borehole temperature measurements they yield information about the influencing factors of the thermal regime within the active layer and its seasonal and annual change.

The main goal of this work is the understanding of the behaviour of the thermal regime as well as an analysis of the applicability of different geophysical methods for characterising the relevant subsurface properties on varying subsurface textures. Furthermore the geophysical data will serve as input data for a numerical model. Parameters such as the water and ice content and the porosity which are obtained by these measurements are essential to simulate future permafrost development.

The study site is a high mountain region below Piz Corvatsch (Upper Engadin, Switzerland) with a high variation of surface textures and ice contents of the surface and subsurface. Nine 6m deep boreholes are available, that are equipped with 18 thermistors for measuring the temperature at various depths. The boreholes differ in material and texture including a bedrock site, a talus slope, and a rock glacier, as well as in the amount of ground ice. In addition five electrical resistivity tomography and three refraction seismic profiles were measured across (respectively close to the boreholes to avoid the influence of the hole) the boreholes. To observe the annual change of the thermal regime the installation of a geoelectrical monitoring network has been started at these sites.

Because the real subsurface characteristics are unknown it is very important to know the reliability and accuracy of the geophysical data and to verify their results. This was being done by comparing the results from the different geophysical methods and by comparing the geophysical data with the direct temperature data of the boreholes.