

Borehole temperature variability at Hoher Sonnblick, Austria

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The overarching aim of the project 'Atmosphere - permafrost relationship in the Austrian Alps – atmospheric extreme events and their relevance for the mean state of the active layer (ATMOperm)' is to improve the understanding of the impacts of atmospheric extreme events on the thermal state of the active layer using a combined measurement and modeling approach as the basis for a long-term monitoring strategy. For this purpose, the Sonnblick Observatory at the summit of Hoher Sonnblick (3106 m.a.s.l) is particularly well-suited due to its comprehensive long-term atmospheric and permafrost monitoring network (i.a. three 20 m deep boreholes since 2007).

In ATMOperm, a robust and accurate permanent monitoring of active layer thickness at Hoher Sonnblick will be set up using innovative monitoring approaches by automated electrical resistivity tomography (ERT). The ERT monitoring is further supplemented by additional geophysical measurements such as ground penetrating radar, refraction seismic, electromagnetic induction and transient electromagnetics in order to optimally complement the gained ERT information. On the other hand, atmospheric energy fluxes over permafrost ground and their impact on the thermal state of permafrost and active layer thickness with a particular focus on atmospheric extreme events will be investigated based on physically-based permafrost modeling. For model evaluation, the borehole temperature records will play a key role and, therefore, an in-depth quality control of the borehole temperatures is an important prerequisite. In this study we will show preliminary results regarding the borehole temperature variability at Hoher Sonnblick with focus on the active layer. The borehole temperatures will be related to specific atmospheric conditions using the rich data set of atmospheric measurements of the site in order to detect potential errors in the borehole temperature measurements. Furthermore, we will evaluate the potential of filling gaps in the time series by cross checking all available information of the three boreholes. Furthermore, the already available ERT profiles will serve as additional information source improving the quality of the measured borehole temperatures.