Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11068, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11068
EGU General Assembly 2008

Ground truth observations of the interior of a rockglacier as validation for geophysical monitoring data sets

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Monitoring the permafrost evolution in mountain regions is currently one of the important tasks in cryospheric studies as little data on past and present changes of the ground thermal regime and its material properties are available. In addition to recently established borehole temperature monitoring networks, techniques to determine and monitor the ground ice content have to be developed. A reliable quantification of ground ice is especially important for modelling the thermal evolution of frozen ground and for assessing the hazard potential due to thawing permafrost induced slope instability. Near surface geophysical methods are increasingly applied to detect and monitor ground ice occurrences inpermafrost areas. Commonly, characteristic values of electrical resistivity and seismic velocity are used as indicators for the presence of frozen material. However, validation of the correct interpretation of the geophysical parameters can only be obtained through boreholes, and only regarding vertical temperature profiles. Ground truth of the internal structure and the ice content is usually not available. In this contribution we will present a unique data set from a recently excavated rockglacier near Zermatt/Valais in the Swiss Alps, where an approximately 5 m deep trench was cut across the rockglacier body for the construction of a ski track. Longitudinal electrical resistivity tomography (ERT) and refraction seismic tomography profiles were conducted prior to the excavation, yielding data sets for cross validation of commonly applied geophysical interpretation approaches in the context of ground ice detection. A recently developed 4-phase model was applied to calculate ice-, air- and

unfrozen water contents from the geophysical data sets, which were compared to the ground truth data from the excavated trench. The obtained data sets will be discussed in the context of currently established geophysical monitoring networks in permafrost areas. In addition to the unique validation opportunity for electric and seismic data sets on rockglaciers, photographs of several trenches through different rockglaciers along the construction site of the ski track provide images of the internal structure and material composition of the uppermost 5 to 8 m of the rockglaciers. By analysing these data it is hoped to gain new insights into geomorphic processes involved in the formation and kinematics of rockglaciers.