Geophysical Research Abstracts
Vol. 13, EGU2011-1937, 2011
EGU General Assembly 2011

Changing permafrost distribution in the Glatzbach catchment, Austrian Alps – A response to 20 years of climate change?

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Within the Austrian Alps, very few locations exist, where permafrost has been investigated over more than five to ten years. At the Glatzbach catchment test site in the central Hohe Tauern range permafrost conditions and periglacial processes have been under investigation since more than 20 years. An intensive monitoring program conducted by the Universities of Bayreuth and Bamberg, Germany, delivered valuable data on permafrost distribution and solifluction dynamics. Since 2008, permafrost conditions and ground movements are monitored by the University of Salzburg, Austria using geophysical techniques, BTS measurements and terrestrial laser scanning. The Glatzbach catchment with maximal elevation of around 2900 m and a main orientation towards the east represents a critical location at the lower boundary of permafrost in this part of the Alps. We expect that even small changes in mean annual air temperature can lead to significant loss of permafrost area in this type of localities. Thus, the Glatzbach catchment test site can be used to study localized, small scale influences on permafrost distribution and their reaction to snow cover and air temperature changes.

We present the current permafrost conditions in the Glatzbach catchment and analyse local influences of surface cover and local morphometry on ground surface temperatures. The present permafrost distribution is compared to data collected 20 years ago and changes are discussed involving local climate data from the catchment.

The study shows a significant decrease in permafrost area. Permafrost distribution within the catchment is very patchy, localised on eastern and northern locations. Permafrost occurrence seems to be strongly influenced by grain size and local shading effects of the surrounding cliffs. The permafrost distribution can be used to verify existing regional models of permafrost. The patchy occurrence pattern shows apparent differences between regional permafrost modelling and local conditions and reveals difficulties in regional modelling to represent local conditions.