



Permafrost aggradation in recently deglaciated alpine environments

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Permafrost degradation is of major interest in the present discussion about alpine climate change and natural hazard prevention. Glacial retreat since the Little Ice Age (LIA) is followed by stabilisation of the surrounding mountains due to melting permafrost in bedrock and sediments. Glacial retreat also exposes huge areas of lateral and ground moraines. Areas of formerly temperate glaciers experience colder temperatures only since their ice cover has melted and basal meltwater no longer heats the ground. With a huge pore volume in the sediment body, water supply during the melt season and large daily temperature variations in high mountains, distinct freeze and thaw processes start and generate periglacial forms like patterned ground in the direct glacier forefield. Those geomorphic features are precursors for possible permafrost aggradation in proglacial areas.

The work presented is part of the joint project PROSA (High-resolution measurements of morphodynamics in rapidly changing PROglacial Systems of the Alps) that aims in the quantification of a sediment budget for the upper Kaunertal valley, Austrian Central Alps. In this sense and to find out about erosion causing prerequisites and processes, permafrost and ground ice occurrence, as well as sediment thickness is measured by i.a. application of geophysical measurements, multitemporal airborne and terrestrial LiDAR, as well as aerial photographs.

In this case study we examine the spatial and temporal settings for permafrost aggradation in a recently deglaciated cirque, belonging to the catchment area of the Gepatschferner glacier using electric resistivity tomography (ERT) and basal temperature of the winterly snowcover (BTS) measurements to detect the state of the permafrost, multitemporal aerial photographs dating back to 1953 to reproduce recent deglaciation of the cirque and multitemporal airborne LiDAR data to gain information about surface elevation changes. The northeast facing cirque is situated in between the pre-peak of the Weißseespitze (3420 m a.s.l.) and the Nörderberg mountains (3052 m a.s.l.). Large, elongated scree slopes fed by rockfall from bedrock walls imbedding the above located Gepatschferner glacier plateau and a large ground moraine dominate the cirques morphology. Stone polygons and frost clefts form in the loose sediments and support results from an ERT survey, where ground ice was found in September 2014.