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Permafrost Conditions in recently deglaciated Areas: An Example from the Dachstein Massif, Northern Calcareous Alps, Austria

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The Dachstein massif, as a part of the Northern Calcareous Alps, reaches a summit height of up to 2995 m (Hoher Dachstein, 47°28’32”N, 13°36’23”E). The mountain area is heavily glaciated, although the glaciers receded substantially since the end of the Little Ice Age at around 1850 AD. Distribution of permafrost in this area is widely unknown and current knowledge is mostly based on simulations. Within the framework of the project ROCKING ALPS – dealing with frost weathering and rockfall in alpine regions – knowledge of permafrost distribution in the headwalls surrounding the retreating glaciers is one key question in order to understand rock decay. Thus, several techniques have been applied to detect bedrock permafrost. In early winter 2012/13, 20 miniature temperature dataloggers (iButtons) were attached to rock walls (at a depth of 2 cm from the rock surface) with different orientations but similar elevation (2600-2700 m asl) to measure ground surface temperature. Most of these sites were later covered by an insulating winter snow cover (as indicated by the absence of temperature fluctuations), therefore allowing the calculation of the bottom temperature of snow cover (BTS). These data, combined with further measurements with a BTS-probe in March 2013, have been used as a first indicator of permafrost existence. In selected rock walls of the peaks surrounding the glaciers, additional 2D-geoelectric surveys (six ERT profiles with lengths between 32 and 98 m and 2 m electrode spacing) were measured in summer 2013. High resistivities (> 50.000 ohm.m) below the rock surface point to permafrost inside the bedrock at most sites. The thickness of the active layer is around 1-2 m. Interestingly, bedrock permafrost was also detected at locations which have been ice-free for a maximum of 2-3 decades. One explanation might be that the glacier there was too thin in having a sufficient insulating effect on the rock and hence was cold-based. Alternatively, permafrost aggradation occurred rapidly in the few last decades at these sites.