

A national strategy for a long-term monitoring of permafrost and periglacial processes and their relationship to natural hazard prevention in Austria

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About 2.5% ($\sim 2000 \text{ km}^2$) of the national territory of Austria is influenced by permafrost conditions. A slightly smaller area of Austria is additionally affected by deep seasonal frost which is, however, similarly exposed to intensive physical weathering and related geomorphic processes. Currently, 23 skiing resorts, 31 water reservoirs and 42 mountain huts are either directly or indirectly influenced by permafrost and associated processes in Austria as determined from regional permafrost models. Ground thermal changes most likely affect the ground stability and infrastructure in those areas. Therefore, changes in the distribution and characteristics of permafrost and seasonal frost are of high economic and ecological importance. A range of Austrian institutions are interested in systematic permafrost monitoring (several universities, geological surveys, the Austrian torrent and avalanche control agency or several different alpine clubs). However, to date no coordinated monitoring network has been established on a national scale and a strategy for long-term permafrost/periglacial observation did not exist so far. Such a national strategy has been developed in 2015 within the permAT project funded through the StartClim2014-program. During permAT an extensive literature review and data search as well as a workshop with 40 participants (scientists, stakeholder and policy maker) were accomplished. The workshop allowed the integration of national as well as international colleagues into the strategy development. Results of permAT clearly demonstrate that the number of present permafrost/periglacial monitoring sites is far too little in Austria. Only few alpine areas of Austria are well represented by the existing monitoring activities but large areas lack such instrumentations. Furthermore, permafrost boreholes exist at only three sites in central Austria (all contribution to the GTN-P network) and there is a lack of knowledge about thermal conditions and recent changes of permafrost temperatures in western Austria. A central recommendation of the permAT-strategy is to increase the number of monitoring sites based on our analyses of the current situation and exchanges with different stakeholders. This should include temperature measurements in deep and shallow boreholes close to the surface, geophysical surveys and ground movement measurements (rock glaciers, instable rock faces). In addition to the terrestrial measurements a spatially continuous observation of surface movements with remote sensing methods is required. Demand is highest for the entire federal province of Tyrol, the district of Zell am See (province of Salzburg) and the south-eastern part of the province of Vorarlberg. In order to achieve a similar spatial coverage and technical set-up as in Switzerland a minimum investment of 1.5 Mio € is required taking advantages in synergies with e.g. existing automatic weather stations (e.g. from the Central Institute for Meteorology and Geodynamics), alpine huts and skiing infrastructure into account. Financial support could – similarly to Switzerland – come from a combination of partners from public institutions, economy and research institutes.