EGU21-2146
https://doi.org/10.5194/egusphere-egu21-2146
EGU General Assembly 2021

Frozen soils characterization by the use of ERT and EMI methods: cases in the Dolomites (Italy)

Mirko Pavoni and Jacopo Boaga
University of Padova, Department of Geoscience, Department of Geoscience, Padova, Italy (jacopo.boaga@unipd.it)

Nowadays, tourism and sport activities make the Alps high mountain environment widely populated. As example, the Dolomites (UNCESCO site, North-East Italy) host millions of tourists every year. Consequently, many infrastructures (e.g. roads, cable cars and hotels) have been built in these areas, and are subject to instabilities hazards as landslide, avalanches or frozen soils problems. Mountain permafrost is in fact one of the many aspects to be considered for the natural hazards and risk management in high mountains environment. Due to the atmospheric warming trend, mountain permafrost is thawing and its degradation is influencing the triggering and the evolvement of natural hazards processes such as rockfalls, landslides, debris flows and floods. We have nearly 5000 rock glaciers in the alps, as highlighted in the inventory of the PermaNET project (2011), therefore the study and monitoring of these periglacial forms has both a scientific and economic importance. Geophysical surveys have been historically applied in this kind of environment, in particular the Electrical Resistivity Tomography (ERT) for the characterization of the active layer thickness (ALT). The technique exploits the high electrical resistivity contrast between frozen and non-frozen debris, and, over the last years, has allowed the researchers to achieve very relevant results. However, performing these measurements is expensive both in terms of time and equipment, particularly considering that the rock glaciers are often very difficult to reach. Thus, usually we are not able to perform many investigation lines and, as the results are 2D resistivity sections, it is very difficult to obtain enough information to completely characterize a heterogeneous environment such as a rock glacier. For this reason, we tried to apply the EMI method (in the frequency domain) for the characterization of the ALT. EMI method, in fact, theoretically allows us to define the distribution of electrical resistivity in the first subsoil in a very quick way, simply by transporting the device over the interested area. Compared to ERT, it is potentially able to characterize much larger areas of a rock glacier, albeit with a lower resolution and penetration. On the other hand, because the high resistivities of the frozen ground, EMI do not guarantee an optimal working and rigorous acquisition protocol must be adopted. We tested ERT and EMI measurements along the same investigation lines, in two different sites of the Dolomites area (the Murfreit and Biz Boè rock glaciers). Finally, we discussed the advantages and disadvantages of both the techniques.