

Geophysical exploration using the CMD Explorer (electromagnetic conductivity meter) in high mountain terrain

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Master thesis in Geography - Dynamics in Glaciology and Geomorphology

The phase of global warming that our planet is going through, due to anthropogenic activities, is inexorably affecting the equilibrium of the Alps. The progressive modification of these fragile balances has, and will have in the future, a direct influence on natural hazards in mountain regions which may therefore impact people, authorities and infrastructures. In this context, the analysis and monitoring of two characteristic phenomena of these environments, permafrost and landslides, are at the center of this research work.

To carry out this type of monitoring, geophysical methods have been widely applied to obtain information on the physical properties of materials and structures that compose the subsoil.

The objective of this thesis is to analyse the applicability of an Electromagnetic Induction (EMI) instrument (CMD Explorer) to study, in a permafrost context, the thickness of the active layer while, and in a landslide context, at what depth the layer saturated in water is located. The data obtained will then be compared and validated with Electrical Resistivity Tomography (ERT), Refracting Seismic Tomography (RST) and temperature sensors in boreholes.

Permafrost analyses were carried out at the sites of Gran Sometta, Cime Bianche and Schilthorn while Holzachseggen and Wasen were chosen for the landslides monitoring.

The results of the analysis of the different geophysical methods in periglacial environments, in most cases, allowed to identify with some clarity the exact thickness of the active layer. The results obtained for landslide monitoring, also thanks to the elaboration of apparent resistivity/conductivity maps, have permitted to successfully highlight the hydrogeological situation affecting the two sites and to identify at what depth the water circulates through the sediments.

The results of this combined approach between different geophysical methods allowed to obtain a complete vision of the phenomena affecting the subsurface of the analyzed sites.

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