Insights from steep-bedrock, high-altitude mountain permafrost laboratory at the Matterhorn

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High-altitude mountain areas are very susceptible to the climate evolution at all scales. However little is known about this extreme end member characterized by steep topographies and remoteness. Therefore in-situ observations are scarce and often limited in their temporal and spatial coverage as well as their fidelity. Over the past two decades teams from Italy as well as Switzerland have concentrated multiple interdisciplinary research efforts at and on the slopes of the Matterhorn. This cross-border laboratory today covers a full altitude transect from the valley floor to the summit at 4478 m asl as well as from south to north with a dense network of permanent in-situ observation locations. In addition, several research campaigns have been historically undertaken and add to this unique footprint of observation data as well as insight. Primary data observed are ground-surface temperature as well as permafrost active layer depth, meteorological parameters, surface kinematics using crackmeters as well as GNSS, resistivity, optical imaging, seismic signals as well as personal observations through a regional observer network. In this presentation, we will summarize the activities over the past two decades and discuss insights, key findings as well as data availability.