



Linking permafrost distribution, glacial retreat and colluvial sediment dynamics in the Saldur River basin, Eastern Italian Alps

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In the last three decades generalized atmospheric temperature rise has produced rapid glacial retreat and permafrost degradation in high mountain environments of the European Alps. While it is widely recognized that these changes can impart general instability to mountain slopes (i.e. several projects have documented single case studies of high magnitude-low frequency, catastrophic slope failures), to our knowledge, there appears to be little empirical data available for investigating the spatial distribution of mass-wasting intensity through time in high mountain areas in relation to permafrost degradation and deglaciation patterns. This is a critical shortcoming. Understanding and quantifying the influence of similar transient conditions on mass-wasting processes holds critical long-term implications on the overall sediment flux reshaping mountain landscapes (e.g., post-LGM landscape evolution), as well as more practical short-term applications on water quality issues, damage control/prevention to infrastructure, and reservoir siltation, to mention some.

In this contribution we present an integrated approach that aims to: (i) document the spatial distribution of mass-wasting activity and sediment production in the Saldur River basin (97 km²); (ii) detect causal linkages between mass-wasting intensity, the potential spatial distribution of discontinuous permafrost, and patterns of glacier retreat; and (iii) identify source-to-sink colluvial sedimentary pathways as modulated by the spatial organization of glacial and periglacial landforms.

To these ends, we map rock glaciers, protalus ramparts and moraines, and compile a field- and air photo-based multi-temporal (1959-2012) inventory of colluvial sediment sources. We then combine these data with two historical datasets of debris flow and landslide events (both implemented and maintained by the Autonomous Province of Bolzano) and analyse mass-wasting spatial distribution and intensity in relation to proximity of glacier fronts, intact and relict periglacial landforms, and a permafrost index map (implemented through PermaNET; <http://www.permanet-alpinespace.eu/>).

This work is part of SedAlp (www.sedalp.eu), a project funded through the Alpine Space Programme.