

Glacier forefields in mountain permafrost environments (Swiss Alps)

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Repeated sequences of glacial and interglacial have strongly orchestrated multi-phased geomorphic processes in glacier forefields in permafrost environments, and contributed to their present-day morphology and dynamical behaviour (Maisch et al., 2003). In the Alps, glaciers and frozen landforms have coexisted and episodically interacted throughout the entire Holocene. In the context of this study, the focus is attributed to the Little Ice Age (LIA), the last important glacial period, as it has a direct influence on today's morphodynamic processes in glacier forefields. Indeed, LIA glacier forefields located within the belt of discontinuous permafrost are complex systems sitting astride the glacial, paraglacial and periglacial research frontier. These recently deglaciated environments have been characterized as transient systems pursuing a state of equilibrium by adjusting to non-glacial conditions, and are therefore subject to intense geomorphological activity, especially under the current conditions of a warming climate (Lane et al., 2016; Bosson et al., 2015). Present-day landforms existing in these systems are legacies of the interrelations between glacial and permafrost-driven morphodynamics and are therefore precious proxies for the understanding of the spatio-temporal evolution of permafrost in glacier forefield systems since the LIA.

Specifically, this project aims at

- inventorying the occurrence of mass-wasting processes of glacitectonized (potentially) frozen sediments in LIA glacier forefields within the belt of mountain permafrost from the western to the eastern Swiss Alps;
- assessing the spatio-temporal dynamical evolution (decadal time frame) of selected glacier forefields in mountain permafrost environments, and specifically of the associated mass-wasting glacitectonized frozen sediments;
- providing in-situ data on the current state of permafrost/ground ice through geophysical prospection and to assess the evolution of permafrost/ground ice by repeating historical geophysical measurements (20-year interval);
- compiling, analysing and integrating existing datasets of more than 20-year of permafrost monitoring in glacier forefields (ground surface temperature, kinematics and geophysical data).

The combination of a complete inventory of permafrost-driven mass-wasting processes in glacier forefields in mountain permafrost environments, a thorough analysis of current and historical aerial images (and remotely sensed data, e.g. InSAR), and the repetition of existing geophysical surveys will allow a detailed assessment of the processes behind the spatio-temporal evolution of glacier forefields in mountain permafrost environments.

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