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Quantifying proglacial morphodynamics and sediment budgets: An overview of the PROSA joint project

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The recession of alpine glaciers since the end of the Little Ice Age (LIA), which has been accelerating in the past decades, has exposed stores of glacial sediment to the activity of paraglacial processes. Following deglaciation, an increase in sediment (re-)mobilisation within and export from proglacial areas (i.e. the area within the LIA terminal moraines) can be expected which may affect the downstream channel network, including potential threats to settlements and infrastructure. Slope aquatic and fluvial processes and mass movements (including debris flows, slides and falls) within the proglacial area have received comparatively little attention in previous studies of the (pro)glacial sediment budget that have been focused mainly on suspended and bedload sediment transport in proglacial streams. Hence, there is a need for research concerning the relative importance of non-glacial and glacial contribution to the sediment budget. Additionally, the connectivity of proglacial sediment cascades needs to be assessed in order to address the consequences of enhanced geomorphic activity on sediment export from the proglacial system.

The PROSA joint project (High-resolution measurements of morphodynamics in rapidly changing PROglacial Systems of the Alps) is determined to tackle these problems through a quantification of sediment fluxes effected by the aforementioned geomorphic processes within the forefield of the Gepatschferner glacier (Central Alps, Austria).

In this paper, we present an outline of ongoing and planned research activities of the interdisciplinary PROSA project group which encompasses the expertise of geomorphologists, geologists, glaciologists and geodesists. On the local scale, field measurements and high-resolution digital elevation models from multi-epoch ground-based LiDAR data (> 40 scan positions) are combined to map and quantify sediment (re)mobilisation, erosion and deposition.
Measurement plots are arranged in chronosequences in order to estimate the influence of time since deglaciation on morphodynamics. The catchment scale sediment budget will be established by multi-epoch high-resolution aerial LiDAR data (flight campains in July and October 2012) and by upscaling of local findings using geomorphological models including the appraisal of slope-channel coupling. Fluvial sediment transport is measured in the main proglacial rivers at 4 gauging stations. A combined dam and power plant directly downstream of the catchment outlet provides a good opportunity to close the sediment budget through measurements of delta aggradation when the reservoir level is artificially lowered.

see also PROSA-related EGU2013 abstracts:

Vehling et al. 2013 Landslides and rock fall processes in the proglacial area of the Gepatsch glacier, Tyrol, Austria - Quantitative assessment of controlling factors and process rates. Geophysical Research Abstracts Vol. 15, EGU2013-5323-2
Neugirg et al. 2013 Quantification of debris-flow erosion rates by using high-resolution multitemporal terrestrial and airborne LiDAR data in the Kaunertal/Eastern Alps, Austria. Geophysical Research Abstracts Vol. 15, EGU2013-7330
Hilger et al. 2013 Paraglacial adjustment of Little Ice Ace moraine slopes at the Gepatschferner glacier, Ötztal Alps, Austria. Geophysical Research Abstracts Vol. 15, EGU2013-7551

Rohn et al. 2013 Mass balance study of gravitational mass movements in proglacial systems. Geophysical Research Abstracts
Vol. 15, EGU2013-8557
Stocker-Waldhuber et al. 2013 Overview of glacial and subglacial mass exchange measurements on Gepatschferner (Ötztal Alps, Austria). Geophysical Research Abstracts Vol. 15, EGU2013-9444
Briese et al 2013 Integration of multi-temporal airborne and terrestrial laser scanning data for the analysis and modelling of proglacial geomorphodynamic processes. Geophysical Research Abstracts Vol. 15, EGU2013-9479
Morche et al. 2013 On the hydrology and fluvial sediment transport of the proglacial river Riffler Bach (Weißseeferner, Ötztal Alps, Tyrol). Geophysical Research Abstracts Vol. 15, EGU2013-9785
Baewert et al. 2013 Detecting surface changes of glaciofluvial deposits in an alpine proglacial area using terrestrial laser scanning. Geophysical Research Abstracts Vol. 15, EGU2013-9925