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Sediment budgets for glacier forefields (Pasterze & Obersulzbachkees, Upper Tauern, Austria) - quantification and temporal variability

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In the context of Global Climate Change, magnitudes and frequencies of geomorphic processes are subject to climatic controlled variations leading to significant modifications in land surface topography. A sediment budget approach identifies and quantifies sediment transfer processes and sediment storages and clarifies to what extent these system components are coupled to each other. The relationship between sediment storage volumes and present-day sediment transfer rates can contribute to both, an understanding of previous (postglacial) landscape development and the prediction of future topographic evolution. As retreating Alpine glaciers expose landscapes with partly unconsolidated, loose and potentially unstable landforms (e.g. moraine slopes), which are not in equilibrium with changing environmental conditions, glacier forefields react very sensible to climate change and therefore are susceptible to rapid topographic modification. Due to this accelerated, paraglacial geomorphodynamic, sediment budget studies on relative short time scales within glacier forefield landsystems are of specific scientific interest.

Within the collaborative research project SedyMONT (Timescales of Sediment Dynamics, Climate and Topographic Change in Mountain Environments, ESF Top Europe programme), these issues are concerned by an individual project of the University of Salzburg. This paper points out the conceptual approach, aims and objectives of this ongoing research project and presents first results within the glacier forefield of the Pasterze. The methodical approach includes orthophoto-interpretation, geomorphological mapping, GIS analyses and a combination of field geophysics (ERT, GPR, RST) in order to identify sediment storages, sediment transfer processes as well as thickness, volumes and internal structures of sediment bodies. Present sediment fluxes will be monitored by a number of different measurements, including hydrological methods (valley bottom) and repeated terrestrial laser scanning (valley bottom and slope processes). The outcomes of the project are i) a high temporarily resoluted data in a proglacial area with rapidly changing sediment budget conditions, ii) the integration of present day fluxes and temporarily stored sediments, and iii) the validation of existing models of landscape development (paraglacial sedimentation).

The study site Pasterze is a former lake that has been completely filled up by continuous glacifluvial sedimentation. The glacial melt water stream is the dominant path of sediment transfer through the sandur system. The mean sediment thickness is approx. 6.15 m leading to a calculated volume and mass of 785.700 m^3 respectively 1.571.400 t stored in the forefield. More than 50.000 t of suspended load produced by glacial erosion were passed the system in 2006.Compared to channel processes, slope processes play a minor role and sediment input through avalanches, rock falls and debris flows seems to be negligible. Furthermore it is remarkable, that no significant clastic output (bed load) has occurred in 2006 at the outlet of the sandur. The system therefore appears to be partially closed.