



Integrating geomorphological and geotechnical mapping for sediment budgeting in the upper Kaunertal valley, Austrian Alps

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The PROSA project (High-resolution measurements of morphodynamics in rapidly changing PROglacial Systems of the Alps) aims at quantifying the sediment budget of the upper Kaunertal valley, specifically focusing on the proglacial zone of the Gepatschferner and Weißseeferner glaciers. This sediment budget must account not only for the fluvial sediment output at the catchment outlet, but for erosion, deposition and remobilisation by a wide range of geomorphic processes occurring within the catchment. With most of these processes, measuring the sediment flux is feasible on the local scale only, hence geomorphological mapping of the areal extent of process activity along with characteristic landforms is an important basis for calculating the sediment budget. Geomorphological mapping should always be guided by the purpose and usability of the final product; the latter is more than a map for presentation purposes but serves as input for further analyses. For the goals of the PROSA project - above all the regionalisation of local-scale measurements -, these considerations were used as a guideline for the preparation of a digital geomorphological map:

- The methodological framework of the project includes the detection and quantification of surface changes through the analysis of high-resolution digital elevation models generated from multi-epoch terrestrial and airborne LiDAR surveys. The interpretation of the observed changes is facilitated in a GIS framework by taking into account the classification of the respective surroundings on the geomorphological map. Conversely, the geomorphological-geotechnical map is complemented and updated using morphological data from the digital elevation models (derivatives of which greatly help in the mapping process).
- Deglaciation promotes the occurrence of shallow and deep-seated mass movements in both rockwalls and moraine deposits. Hence, geotechnical information, i.e. rockmass structure and strength, and sediment properties, is added to the geomorphological map in order to make it useful for the regionalisation of process occurrence and measured flux rates.
- The geomorphological map constitutes an important input to numerical models used in the PROSA framework to regionalise measured sediment fluxes. Together with information on the coupling relationship of neighbouring spatial units, sediment cascades can be extracted from the geomorphological map using a network approach. These uses of the map require areal spatial units rather than the mixture of areal, line and point features usually contained in a geomorphological map.

In this study, we present a section of the geomorphological-geotechnical map from the proglacial zone of the Gepatschferner glacier. We explain the structure of the digital database containing the objects and properties of the map, and demonstrate its usability for further analysis.