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Spatial patterns of hidden glacial erosion: Morphometric analysis of Swiss overdeepenings

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Alpine overdeepenings consist of widespread hidden geomorphic features shaped by glacial erosion, with up to hundreds of meters incision over the Quaternary. Their occurrence and geometry in the Swiss foreland have been investigated and mapped (Dürst-Stucki & Schlunegger 2013), however, their spatial distribution, morphometric characteristics and Quaternary evolution during successive glaciations remain poorly constrained (e.g. Preusser et al. 2010).
This study consists on the morphometric analysis of glacial overdeepenings (ODs) in the Swiss Alpine foreland to get quantitative constrains on both their shape characteristics and spatial occurrence. The aim is to understand how much the bedrock resistance, local settings (lithological contrasts, faults, foreland vs. mountain) or drainage network control the location and geometry of ODs.
A combined bedrock model derived from subsurface mapping of Mey et al. (2016) and Dürst-Stucki & Schlunegger (2013) was generated to better constrain the Quaternary sediment thickness both in the low-relief regions (Swiss Alpine foreland) and in the high-relief areas (Swiss Alps). For bedrock regions under modern glaciers, we also collected data from Haeberli et al. (2016) and used them for quantitative comparisons with ODs in ice-free areas.
For establishing the ODs shapes, an automated GIS-routine was designed with four different criteria for filtering: area, maximum depth, slope and basin connectivity. Differences in the spatial trends of the ODs (area, length, width, sediment thickness, elongation and orientation) and the potential influence of lithology, faults/folds and hydrological network were investigated for all Switzerland. A more detailed analysis was conducted for large overdeepened features (area > 4 km2), in which cross-section profiles, shape-factor computation, relationships with drainage confluences and valley asymmetry were further computed.
Preliminary results show that subglacial hydrology seems to play a decisive role on local erosion patterns, while bedrock resistance explains well maximum depths and width of ODs. On the other hand, no clear relationship between area and elongation or between width and length was found for our datasets.
Further steps using a more detailed drainage, as well as enhanced features-delimitation routines will be performed. The analysis will, ultimately, provide an overview of the main spatial trends and possible controls related to formation and development of overdeepenings, allowing a broader understanding of erosive processes by glaciers during Quaternary times.

REFERENCES

Dürst-Stucki, M. & Schlunegger, F. 2013: Identification of erosional mechanisms during past glaciations based on a bedrock surface model of the Central European Alps. Earth Planet. Sci. Lett, 384, 57.
Haeberli, W., Linsbauer, A., Cochachin, A., Salazar, C., Fischer, U. H. 2016: On the morphological characteristics of overdeepenings in high-mountain glacier beds. Earth Surface Processes and Landforms, 41(13), 1980–1990.
Mey, J., Scherler, D., Wickert, A.D., Egholm, D.L., Tesauro, M., Schildgen, T.F., Stecker, M.R. 2016: Glacial isostatic uplift of the European Alps. Nature Communications, 7, 10.
Preusser, F., Reitner, J.M., Schlüchter, C. 2010: Distribution, geometry, age and origin of overdeepened valleys and basins in the Alps and their foreland. Swiss J. Geoscience, 103, 407.