

A ¹⁰Be-based sediment budget of the Upper Rhône basin, Central Swiss Alps

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The Upper Rhône catchment located in southwestern Switzerland is one of the largest Alpine intramontane basins and, due to high topographic gradients and intense glacial conditioning, an important sediment factory in the Alps. Sediment is being produced in around 50 tributary basins, transported along the 150 km long course of the Rhône River, and deposited in the river delta and associated subaquatic canyons within Lake Geneva, its primary sedimentary sink. In order to quantify the modern sediment fluxes in this Alpine basin we infer catchment-wide denudation rates from concentrations of the cosmogenic nuclide ¹⁰Be in quartz extracted from modern fluvial sediment of the major tributary basins. Additionally, ¹⁰Be-based denudation rates are calculated for 14 locations along the main Rhône River to track downstream changes. Results from the tributary basins show a large scatter of ¹⁰Be concentrations and their respective inferred denudation rates, ranging from 9.72×10^4 atoms/g and 0.17 mm/a to 0.13×10^4 atoms/g and 2.64 mm/a. The Rhône basin does show a rather large spatial variability of parameters that are known to possibly influence denudation rates, for example recent rock uplift rates, lithology, precipitation and temperature, as well as geomorphological parameters such as relief, mean elevation and slope values. However, there is no significant correlation between those parameters and the calculated denudation rates. Instead, the denudation rates are found to be positively correlated with the recent glacial cover in the catchments. This suggests that in glaciated basins glaciogenic material with very low ¹⁰Be concentrations is the dominating source of sediment, and inferred denudation rates must be interpreted with great care, as they may overestimate the actual rates. Downstream the main Rhône River the ¹⁰Be-concentrations are rather stable and do not record significant inputs of the glaciogenic material supplied by the glaciated basins. Possible explanations we would like to discuss here include differences in sediment connectivity and temporary sediment storage.