

Constructing a Sediment Budget for the Johnsbach, Styria – Adding up numbers and drawing arrows?

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Understanding the evolution and functions of a river system and interpreting the morphology and the dynamics of the channel is a key factor in fluvial geomorphology. For this purpose it is essential to analyse the processes of sediment input and output within and between river reaches and to detect the various forms of storage types on hillslopes and in the channel network. From these processes, catchment scale sediment fluxes are derived and result in sediment budgets showing the amount and motion of sediment through the system.

This study aims at developing a sediment budget for the so called “Zwischenmauerstrecke” in the Johnsbach Valley, a typical, non-glaciated alpine catchment in the eastern Austrian Alps. The valley covers an area of 65 km² with altitudes ranging from 584 m a.s.l. at the outlet to 2369 m a.s.l. (Hochtor). The valley is drained by the Johnsbach River which originates in a crystalline bedrock dominated part of the catchment. After approximately 10 km of the distance downstream the lithology changes to calcareous bedrock. In this part of the Johnsbach Valley (“Zwischenmauerstrecke”) most of the sediment contributing areas are located on both sides of the river along a 5 km river reach.

Initial activities included geomorphological mapping and a GIS based connectivity analysis. Building on this survey, test sites were selected for detailed investigations, and an activity classification of all side channels in the “Zwischenmauerstrecke” using different criteria was achieved from which the sediment budget will be extrapolated. Despite (or rather because of) the extensive dataset this is still a challenging task since geomorphic processes are highly variable in time and space.

Our applied methods in the field are associated to the geomorphic process chain from source to sink. Sediment input from rock falls was investigated using TLS measurements to determine the spatial distribution of rock fall rates. The quantification of erosion and debris flow processes on the hillslopes was achieved by means of TLS surveys two times a year from 2013-2015. The precedent mapping and the ALS overview surveys (DEMs from 2010 and 2015) ensure that the measured processes are representative for wider areas. The thickness and structure of important sediment storage bodies at the slopes and in the side valleys were investigated using geophysical methods (ERT, GPR, seismics). The fluvial sediment transport was analyzed using impact sensors, geophone installations and mobile basket samplers. The results of all steps of quantification will later be transferred to the entire study area (Johnsbach catchment) using the mapping results and GIS analyses.

The output will be a sediment budget model of the Johnsbachtal. The step towards application comprises the analysis of current management problems (amount of “missing” sediment for ecological purposes, and effects on hydropower plants) and the possible consequences of artificial barriers being altered or removed.