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Quantifying fluvial sediment transport in a mountain catchment (Schöttlbach, Styria) using sediment impact sensors

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Sediment transport in river systems, being the output of geomorphic processes in the catchment, is a recurrent problem for geomorphological sediment budget studies, natural hazard assessment and river engineering. Sediment budgets of alpine catchments are likely to be modified by changing total precipitation and the probability of heavy precipitation events in the context of climate change, even if projections of precipitation change for Austria and the entire Alpine region are still very uncertain. Effective sediment management requires profound knowledge on the sediment cascade in the head-waters. However, bedload measurements at alpine rivers or torrents are rare; in Styria, they are altogether missing. Due to a three hour heavy rainfall event on 07-Jul 2011, which caused cata-strophic flooding with massive damage in the city of Oberwölz and its surrounding, we chose the catchment area of the Schöttlbach in the upper Mur river valley in Styria (Austria) as our study area.
In the framework of the ClimCatch project, we intend to develop a conceptual model of coupled and decoupled sediment routing to quantify the most prominent sediment fluxes and sediment sinks, combining up-to-date geomorphological and river engineering techniques. Repeated Airborne Laser Scans will provide an overview of ongoing processes, diachronous TLS surveys (cut-and-fill analysis), ground-penetrating radar and 2D-geoelectric surveys should quantity the most important mass fluxes on the slopes and in the channels and derive a quantitative sediment budget, including the volume of temporary sediment stores.

Besides quantifying slope processes, sediment sinks and total sediment output, the sediment trans-port in the torrents is of particular interest. We use sediment impact sensors (SIS) which were in-stalled in several river sections in the main stretch of the Schöttlbach and in its tributaries. The SIS mainly consists of two parts connected by a coated cable, the steel shell with the sensor mounted in the riverbed and the logger-case nearby the river. The number of clast impacts is recorded through an acceleration sensor installed underneath a steel plate. This type of sensor was developed by Richardson et al. and later applied e.g. by Raven et al. and Rickenmann & Fritschi. However, this device does not supply volumetric information of sediment flux. For data on sediment volumes we are monitoring the sediment retention dam at the outlet of the Schöttlbach using repeated TLS sur-veys.
Our measurements focus on the representative sub-catchments and will deliver values on the in- and output of river sections. Tests and calibration are carried out in an artificial channel at the Water Engineering laboratory of the TU Graz; the sensors are sensitive enough to record impacts of parti-cles > 5 mm. Further calibrations are carried out in the field using mobile basket samplers.
The SIS were installed in winter 2012/13. First results allow us to derive the start of sediment transport in dependence of precipitation or water level, respectively.
ClimCatch should find out where the sediments of the Schöttlbach catchment actually derive from, which geomorphic processes are the most important in our study area and which catchment areas are significant for the overall sediment output.