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From Impact to Volume? - A Sediment Impact Sensor progress report

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Sediment routing approaches investigating the entire alpine sediment cascade from source to sink, including transport in rivers and considering the anthropogenic component, are rare. In the ongoing ClimCatch project we investigate into the sediment budget of the Schöttlbach catchment in Styria. The initial motivation of the project was a catastrophic flood event in 2011 which filled a sediment retention basin completely and caused severe damage in the downstream village of Oberwölz. We have put considerable efforts in the development of a sediment transport measuring network which consists of two meteorological stations and two additional rainfall gauges for the precipitation input, while the fluvial sediment transport within the catchment is being quantified by means of repeated series of cross profiles and by using sediment impact sensors (SIS). Currently, there is still not much available data on sediment transport in alpine torrents outside of a handful of well-investigated catchments, in which the sediment yield is measured almost exclusively at the catchment outlet. In order to enable the setup of a spatially dense measuring network, we developed a cheap and easy-to-build sediment impact sensor.

In the first year of measurement we obtained interesting and promising data with the first generation of sensors. Data obtained during heavy precipitation events highlighted the different event magnitudes within different sub-catchments quite well (even if no event took place in 2013 that was comparable to the catastrophic event of 2011). However, deficiencies of this first approach are evident. The main constraint is that only the number of impacts is recorded while information on the intensity of the impacts is missing. To overcome this limitation, we developed the sensor further and created a novel SIS type with completely new components which enables to measure the force of each impact.

In laboratory flume experiments, we performed numerous different calibration runs with the new sensors and compared them with the first generation of SIS. The results are satisfying and the newly acquired data is of higher significance, particularly concerning transported grain sizes. Nonetheless, for this kind of indirect sediment transport measurement system, individual field calibration in addition to the flume experiments is still strictly necessary. The sensors were integrated in relatively thin metal plates which are comparatively easy to be installed on sills or large boulders (we use concrete blocks in the field). The developed measurement assembly is surely less accurate than technically extensive bedload stations using concrete sills equipped with lines of geophone plates. However, the material costs of each sensor are below 100 Euro and thus, the low-budget approach renders it possible to equip several tributaries within a catchment and/or several profiles along the main torrent. The better spatial resolution meets the requirements of geomorphological sediment budget studies.