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Calibration of the Swiss plate geophone system at the Albula field site with direct bedload samples

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Indirect impact measuring systems have been increasingly used and developed over the last decade to estimate bedload transport in mountain streams. They have the advantage of providing continuous records of the transport activity both in time and over a cross-section. One of these techniques, the Swiss plate geophone (SPG) system, has been successfully deployed in several steep streams mainly in Switzerland and Austria. The amplitude of the seismic signal recorded by the SPG contains information about the grain-size distribution of the transported bedload. However, determination of bedload transport with the impact plate system ideally requires calibration with direct bedload sampling in the field.
In Spring 2018, a field calibration campaign was carried out at the Albula river, a field site in Eastern Switzerland equipped with the SPG system (Rickenmann et al., 2017). Bedload samples were collected with a large net attached to a steel-frame and operated from a crane. In total sixty-two bedload samples with masses M ranging from 5 kg to unexpected 500 kg were collected over time intervals lasting between 1 and 10 minutes. The samples were compared with the seismic signal recorded by the impact plate geophone system to convert the signal information into bedload transport rates.
Preliminary comparisons of the data with calibration measurements of earlier studies in other Swiss and Austrian streams suggested this bedload sampling method to be efficient. A similar calibration relation could be obtained between the unit bedload transport rate and the impulse rate as for other streams. Additionally, it could be shown that the power law function between the maximum amplitude registered by the geophone and the length of the B-axis of the largest particle found in the sample, previously determined for other streams, is also valid for the Albula field site.
The applied bedload sampling technique was found to be very useful in two respects. First, the relatively large capacity of the net allowed to collect bedload samples with a large range of masses. Secondly, having the sampling system fixed on a mobile crane allowed to collect samples at various locations and under different flow conditions within a short time interval. This allowed for example also to sample locations closer to the bank where the flow velocity was smaller than near the centerline of the stream.

Rickenmann, D., Antoniazza, G., Wyss, C.R., Fritschi, B., Boss, S. Bedload transport monitoring with acoustic sensors in the Swiss Albula mountain river. Proc. IAHS, 375, 5–10, 2017, doi:10.5194/piahs-375-5-2017