Earth and Space Science

Supporting Information for

Improving the Calibration of Impact Plate Bedload Monitoring Systems by Filtering Out Acoustic Signals from Extraneous Particle Impacts

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S1. Field Calibration

The field calibration measurements of the Swiss plate geophone (SPG) system at the Albula and Navisence sites were conducted based on the concept developed by Kreisler et al. (2017), using a crane-mounted net sampler adapted from the Bunte bedload trap (Bunte et al., 2010; Nicollier et al., 2019). The net sampler consists of a steel frame, a sampler bag and steel bar (Figure S1). The 3 m long sampler bag has a mesh size of 8 mm × 8 mm, corresponding to the size of the smallest particle size that can be sampled. The frame on which the net is fixed has an intake of 500 mm width and 300 mm height in order to cover the whole width of a steel plate. In addition, a thin tilted metal plate was welded at the bottom of the intake to ensure a good coupling with the concrete sill. The steel bar mounted centrally on the upper part of the intake frame is connected to a crane over a hydraulic rotator. This system enables to compensate for fluvial forces and helps to position the aperture of the frame parallel to the steel plate. Three additional elements were necessary to ensure a clean sampling. (i) First, a cable with markers indicating the correct position of the sensor plates was stretched from one bank to the other. (ii) Second, two static ropes attached on each side of the frame and

handled from the banks gave support to the hydraulic rotator to correct for fluvial forces at high discharges. (iii) Finally, a metallic tube was fixed horizontally at the top of the steel bar to facilitate the positioning of the frame parallel to the sensor plates in turbid water.

A calibration measurement starts as soon as the frame is placed on the concrete bed on the downstream side of an impact plate. The duration of each run had to be carefully matched with the current discharge in order to avoid overloading the sampling bag. After direct sampling downstream of an impact plate and synchronous recording of the raw geophone signal at a sampling rate of 10 kHz, each bedload sample was sieved and weighed per grain-size fraction following the ten sieve classes presented in Table 1. The large capacity of the net proved its value to collect bedload samples with masses ranging from 0.82 kg to 179.25 kg. Also, having the sampling system fixed on a mobile crane allowed to collect samples in various locations and under different flow conditions within a very brief time interval, considering that the flow velocity close to the bank is smaller than in the center of the stream.

Note that different direct sampling techniques were used to calibrate the Erlenbach and the Avançon de Nant streams. At the Erlenbach site, the bedload samples were collected using automatic basket samplers covering the length of two impact plates (e.g. Rickenmann et al., 2017). At the Avançon de Nant, the SPG system is embedded in a concrete weir. There the calibration measurements were conducted using a sediment basket mounted with rollers on a rail fixed on the downstream side of the concrete weir. Using a system of ropes and pulleys, the sediment basket could be moved along the rail and placed directly downstream of a given plate (Antoniazza et al., in review). Apart of the sampling technique, the calibration procedure was similar to the one followed at the Albula and Navisence sites.

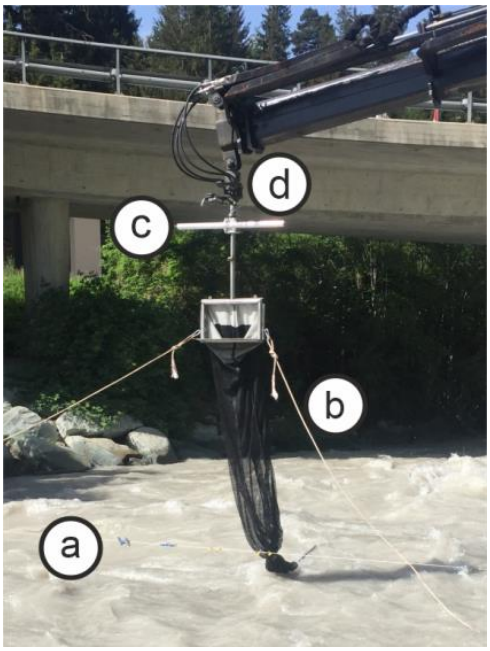

Figure S1. The crane-mounted net sampler at the start of a calibration measurement at the Albula field site with (a) the cable equipped markers indicating the position of the plates, (b)

the two static ropes, which gave support to the hydraulic rotator, (c) the aluminium tube used to visually monitor the positioning of the intake frame and (d) the rotator, which helped to compensate for fluvial forces.