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Swiss Geophone Plate system: Quantification of the variability of signal response and of the signal propagation across plates using field-based impact experiments

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Impact sensors are increasingly used to indirectly monitor bedload transport in streams. Among them, the Swiss geophone impact plate system has notably proved its efficiency to continuously record bed load transport rates. Nevertheless, this approach still requires a robust calibration of the sensors to transform the relative signal of the geophones into an absolute mass of sediment in transport. Typically, the calibration is performed through the sampling during natural bedload transport events of all the particles that impact the plates, in order to build up rating curves between the signal recorded by the geophone sensors and the characteristics of the sediment that impact them (e.g. mass, grain size). To better understand the system behavior it is important to quantify to what extent the signal response is similar (i) between sensors of a same geophone measuring station and (ii) between different geophone measuring stations. Also (iii), the amount of signal that propagates from impacted plates towards non-impacted plates (or 'neighbouring noise') needs to be quantified to improve the understanding of the system.

In this study, we investigate the above three elements by performing an impact experiment on the Swiss geophone plate system, and systematically record the signals produced at different plates by defined impacts of similar magnitude, and how the signal (maximum amplitude) propagates through neighbouring non-impacted plates. Each Swiss Geophone Plate of four measuring stations in the Swiss Alps – Vallon de Nant (VD), Albula (GR), Naviscence (VS) and Riedbach (VS) – were hit alternatively with impacts of increasing magnitude, and the signal they produced was systematically recorded over all the sensors of a given measuring station. Results of the study allow (i) to quantify the neighbouring noise that propagates from impacted plates towards non-impacted plates; (ii) to evaluate the attenuation rate of the signal for an impact of a given magnitude and (iii) to evaluate the variability in the propagation of neighbouring noise between sensors at a given measuring station and between different measuring stations.