



Towards a laboratory-based calibration of the Swiss plate geophone bedload monitoring system

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The Swiss plate geophone is an indirect bedload monitoring device that is used to continuously monitor bedload transport. The Swiss plate geophone consists of a geophone sensor that measures the elastic deformation of a steel plate induced by the collision of a bedload particle. Differences between bedload particle shape and sizes as well as in-situ hydraulic conditions control the particle transport mode, and these elements have so far required a field calibration of the Swiss plate geophone. In this study, we performed flume experiments with varying bedload transport parameters like particle size and mean flow velocity with natural bedload particles from the Erlenbach stream, Central Switzerland. The impulses, i.e. the number of times the signal recorded by the Swiss plate geophone exceeds a predefined threshold, and wave packets representing a single impact are used to compute laboratory-based calibration curves. These calibration curves are then used as a framework to estimate bedload mass from the impulses and packets registered in the field. Estimated and measured bedload mass are compared for more than 50 bedload samples taken by the automatic basket samplers at the Erlenbach. The results emphasize the sensitivity of the Swiss plate geophone to different hydraulic parameters, in particular mean flow velocity and bed roughness. We conclude that to calibrate the Swiss plate geophone in the laboratory, the hydraulic conditions like bed roughness and Froude numbers have to be replicated.

Keywords: Swiss plate geophone, calibration, flume experiments, bedload transport, indirect measurement.