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High-resolution monitoring of bedload transport rates: a benchmark of two approaches (accelerometers and image processing)

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Experimental and field studies have shown how intermittent bedload transport can be at low flow rates. The development and validation of bedload-transport equations require high-resolution records over long periods of time. Two technologies are considered in the present investigation: image processing and accelerometers mounted on impact plates. The former has been successfully applied to monitor bedload transport in many flume experiments, and the latter has shown encouraging results at different field sites. Calibration is a major issue in both cases, and it is often difficult to assess the precision of the data collected. In our talk, we show how to calibrate and compare the performances of accelerometer and image-processing based techniques in laboratory conditions. The accelerometer is fixed on a perforated steel plate, which is placed vertically at the lower end of the flume. The vibrations due to the particles impacting the plate are recorded with a sampling frequency of 10 kHz. The proxy for bedload transport rate is chosen as the number of peaks above a fixed threshold of the recorded signal. Note that impact plates are usually set in flush with the bed, and to our knowledge, the vertical configuration presented here has not yet been documented. The experimental setup for image processing involves a video-camera that takes top-view images of the particles moving over a white board mounted at the outlet of the flume. Data storage poses an issue, which can be got round by pre-processing the images in real time. The bedload transport rate is estimated based on the number of particles that are identified on the images. The two technologies have the advantages of being cost-effective and demanding limited effort for implementation. They provide high-resolution bedload transport rates over several hours. Estimates of bedload discharge were found to be robust and accurate for low sediment transport rates. At higher rates, the sensors may saturate due the arrival of particle clusters. This effect is described and, to a certain degree, taken into account in the calibration relations.