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Variation of bedload transport threshold in two Alpine mountain streams inferred from geophone measurements

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Geophone measurements are a surrogate technique to monitor bedload transport in mountain streams. The two mountain streams Fischbach and the Ruetz in Western Austria are fed by glacial meltwater and feature regular bedload transport during the summer months. In spring 2008 the so-called Swiss plate geophone system was installed in the two streams. The sites are operated by the Tyrolean water power company (TIWAG), and discharge data are available as well. The geophone sensors record the motion of bedload particles transported over a steel plate mounted flush with the channel bed. Calibration measurements of the geophone system were performed by TIWAG, and they show an approximately linear relation between number of impulses and bedload mass transported over the sensors.

For the period 2008 to 2013, the variation in bedload transport with shear stress was analyzed using an exponential form of the Meyer-Peter & Müller equation proposed by Chen (2002). If the dimensionless threshold shear stress at initiation of motion, i.e. the Shields number, is back-calculated from the measured bedload transport rates, the temporal variability in bedload transport efficiency can be reasonably well described by postulating a corresponding temporal variability in the Shields number. The geophone measurements were also used to qualitatively assess the grain size distribution of the transported particles. It is hypothesized that an increase in the Shields number is associated with a coarsening of the surface grain size distribution of the bed material upstream of the measuring site.