Geophysical Research Abstracts
Vol. 14, EGU2012-1191, 2012
EGU General Assembly 2012

Characterization of bedload transport in steep-slope streams

F. Mettra, J. Heyman, and C. Ancey
EPFL, LHE, ENAC, LAUSANNE, Switzerland (francois.mettra@epfl.ch)

Large fluctuations in the sediment transport rate are observed in rivers, particularly in mountain streams at intermediate flow rates. These fluctuations seem to be, to some degree, correlated to the formation and migration of bedforms. Today the central question is still how to understand and account for the strong bedload variability. Recent experimental studies shed new light on the processes. The objective of this presentation is to show some of our results.

To understand the behavior and the origins of sediment transport rate fluctuations in the case of steep-slope streams, we conducted laboratory experiments in a 3-m long, 8-cm wide, transparent flume. The experimental parameters are the flume inclination, flow rate and sediment input rate. Well-sorted natural gravel (8.5 mm mean diameter) were used. We focused on two-dimensional flows and incipient bedforms (i.e. for flow rates just above the threshold of incipient motion).

A technique based on accelerometers was developed to record every particle passing through the flume outlet (more specifically, we measured the vibrations of a metallic slab, which was impacted by the falling particles). Analysis of bedload transport rates was then possible on all time scales. Moreover, the bed and flow were monitored using 2 cameras. We computed bed elevation, water depth and erosion/deposition at high temporal and spatial rates from camera shots (one image per second during several hours or days).

In our laboratory experiments, the fluctuations of the sediment rate were large even for steady flow conditions involving well-sorted particles. Time series exhibited fluctuations at all scales and displayed long range correlations with a Hurst exponent close to 0.8. The results were compared for different input solid discharges. The main bedforms observed in our flume were anti-dunes migrating upstream. Bedform formation and propagation showed intermittency with pulses (high activity) followed by long sequences of low activity. We tried to interpret our results (bedform behavior, bed scouring) in terms of sediment outflow rate.