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Stochastic bedload transport in gravel bed streams : new insight from field data

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Bedload fux in gravel bed rivers is a paradigm for stochastic transport on the Earth's surface, primarily due to the complex interactions between fluid flow, channel topography, and distribution of grains on the bed. Predicting bedload and its impact on our environment over a range of timescales, relies on our ability to quantify the randomness induced by these interactions. As a first step, using a dense dataset acquired on a high mountain gravel bed stream in China, we show that it is possible to extract a simple functional relationship between average bedload transport and shear stress that is in agreement with theoretical transport relationships and takes the form of a simple 3/2 power law. We then analyze the dispersion of (around?) individual bedload measurements for different classes of shear stress values. This dispersion is the stochastic component that dominates the signal in the vast majority of cases. Again, a power law emerges when we plot this variance with respect to the shear stress. Using these power laws, it is then possible to generate random and artificial datasets for bulk bedload transport that comply with both theoretical predictions and field observations. This analysis opens new perspective for the description of stochastic bedload transport in gravel bed rivers. As an example we discuss here the infuence of the morphology of simple channel on bedload transport and mass balance.