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Scale-Based Statistical Analysis of Sediment Fluxes

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A b s t r a c t

The flux of sediments over a line perpendicular to the main flow direction was measured during experiments of weak one-dimensional bed load. The standard definition of solid discharge through a boundary is a straightforward issue, yet the dependence of resulting values on the spatial and temporal scales used as a support for measurement is not. In this work, first- and second-order statistics of sediment transport rates were analyzed as scale-dependent quantities. The spatial scales used were significantly larger than the particle size, while the temporal scales covered a two-orders-of-magnitude range enabling the physical time scales of the single particles to be appreciated. In addition, the relationship between sediment fluxes, process intermittency and particle inter-arrival times was investigated. Proper knowledge of the scale-dependence of statistical properties of sediment transport fluxes may allow for adequate design of measuring campaigns (both in the laboratory and field) and for sound interpretation of data from multiple sources.

Key words: sediment transport, solid discharge, inter-arrival time, probability density function, correlation, support scale.