



A subordinated Brownian motion for sediment transport

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Recent experimental studies have documented the time-scale (sampling time) dependence and the non-Gaussian nature of the probability density functions (PDFs) of bed elevation fluctuations and sediment transport rates. However, this time-scale dependence is not accounted for by any of the existing stochastic models for sediment transport. Here, we propose an extension to the Brownian motion model for sediment transport, called the Laplace motion. Laplace motion arises by randomizing the clock time of Brownian motion and acknowledges the fact that the time over which the gravel particles are operated upon is itself a random variable. We show that this model reproduces the multi-scale statistics of sediment transport as quantified by a large-scale laboratory experiment.