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Applicative limitations of sediment transport on predictive modeling in geomorphology

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Sources of uncertainty or error that arise in attempting to scale up the results of laboratory-scale sediment transport studies for predictive modeling of geomorphic systems include: (i) model imperfection, (ii) omission of important processes, (iii) lack of knowledge of initial conditions, (iv) sensitivity to initial conditions, (v) unresolved heterogeneity, (vi) occurrence of external forcing, and (vii) inapplicability of the factor of safety concept. Sources of uncertainty that are unimportant or that can be controlled at small scales and over short time scales become important in large-scale applications and over long time scales. Control and repeatability, hallmarks of laboratory-scale experiments, are usually lacking at the large scales characteristic of geomorphology. Heterogeneity is an important concomitant of size, and tends to make large systems unique. Uniqueness implies that prediction cannot be based upon first-principles quantitative modeling alone, but must be a function of system history as well. Periodic data collection, feedback, and model updating are essential where site-specific prediction is required.

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