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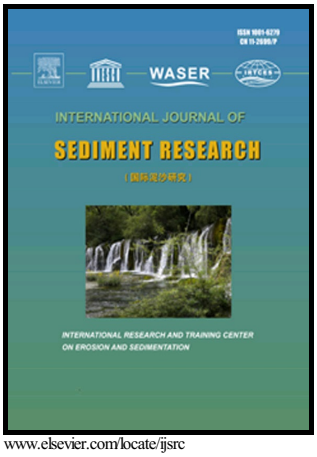

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Morphological reactions of schematic alluvial rivers: long simulations with a 0-D model

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Abstract

The paper presents a 0-D model of an alluvial watercourse schematized in two connected reaches, evolving at the long time-scale and under the hypothesis of Local Uniform Flow. Each reach is defined by its geometry (constant length and width, time-changing slope) and grain-size composition of the bed, while the sediment transport is computed using a sediment rating curve. The slope evolution is provided by a 0-D mass balance and the evolution of the bed composition is computed by a 0-D Hirano equation. A system of differential equations, solved with a predictor-corrector scheme, is derived and applied to the schematic watercourse to simulate the morphological response to changing initial conditions, and the evolution towards long-term equilibrium conditions. Differently from a single-reach 0-D schematization with uniform grain-size, besides the simplifications adopted, the model proposed here simulates the behaviour of alluvial rivers in a physically-based way, showing a grain-size fining in the downstream direction accompanied by milder slopes, and a tendency to develop concave longitudinal profiles.

Keywords

Alluvial rivers, Local Uniform Flow, Morphological equilibrium, Physically-based 0-D model, River morphology, Sediment transport