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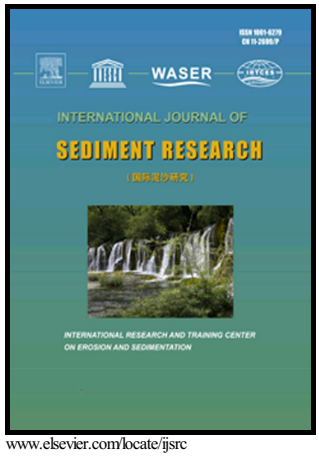

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Development and validation of a morphological model for multiple sediment classes

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Abstract

The complexity of sediment dynamics in aquatic systems can be better understood by applying numerical models. The development of a comprehensive morphological model is presented in this paper. The model aims to predict the sediment transport and bed evolution in natural systems composed of different sediment types. The morphological model was implemented in MOHID, a modelling system that solves the three-dimensional hydrodynamics and advection-diffusion transport of suspended sediments. Multiple sediment classes were taken into account (non-cohesive and cohesive) considering the effects of sediment mixtures and bed consolidation on resistance to erosion. To represent bottom stratigraphy, the bottom column can be divided into several layers. The key points of the simulated processes are discussed in this paper. Model results are assessed in six test cases through comparison with analytic solutions or experimental data. The outcomes demonstrate the model's capacity to simulate the transport dynamics of non-cohesive and cohesive sediments. The speed up of morphological changes by an acceleration factor permitted modelling bed evolution for long time periods. Moreover, a test case for the Tagus Estuary demonstrated the model's capacity for generating realistic sediment distribution based on the local hydrodynamic conditions. Limitations in the availability of bed composition data can be overcome by considering a warm-up run to provide realistic initial conditions for further predictions of morphological developments.