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A turbidity current model for real world applications

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Traditional turbidity current models suffer from several drawbacks. Among them not preserving freshwater mass, a missing pressure term, or not including terms related to deposition, erosion and entrainment in the momentum equation. In Morales et al.(2009) a new turbidity current model was proposed trying to overcome all these drawbacks. This model takes into account the interaction between the turbidity current and the bottom, considering deposition and erosion effects as well as solid bedload transport of particles at the bed due to the current. Moreover, this model includes the effects of the deposition, erosion and water entrainment into the momentum equation,commonly neglected in this type of models and, finally, in the absence of water entrainment, freshwater mass in the turbidity current is preserved. Despite these improvements, the numerical results obtained by this model when applied to real river systems were not satisfactory due to the simple form of the friction term that was considered. In the present work we propose a different parameterization of this term, where bottom and interface fluid frictions are separately parameterized with more complex expressions. Moreover, the discretization of the deposition/erosion terms is now performed semi-implicitly which guarantees the positivity of the volumetric concentration of sediments in suspension and in the erodible sediment layer at the bed. The numerical simulations obtained with this new turbidity current model (component of HySEA numerical computing platform) greatly improve previous numerical results for simplified geometries as well as for real river systems.

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