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Improvement of sediment transport models using the shallow water framework

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Sediment can be transported in several ways by the action of a river. During low transport stages, particles move by sliding and rolling over the surface of the bed. This type of transport is usually called bedload transport. With the increase of the velocity, the sediment is entrained into suspension and travels significant distances before being deposed again. One can observe a continuous exchange between sediment at the riverbed and sediment in suspension.
One possible approach to model these phenomena is to use a shallow water model coupled with transport equations for sediment in suspension and a morphodynamical component for the bedload transport, which depends on an empirical flux. Nevertheless, this approach presents some drawbacks, for instance, the vertical distribution of the sediment in suspension is lost, gravitational effects for bedload transport is neglected and the models are usually too simplified for practical situations.
We present here some recent advances in sediment transport modeling that aim to overcome the difficulties present in classic models. In particular, for suspended transport, a multilayer approach results as a promising tool. This allows to keep track of the vertical distribution of sediment and the computational cost is less expensive than a fully 3D approach. In what concerns bedload transport, a new general formulation will be introduced that recovers classic formulae as a particular case, but incorporates more information on the physics of the problem. This makes the model more suitable for practical applications.

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