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Non-linear Shallow Water Models for coastal run-up simulations

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Abstract

Shallow water models are frequently used to simulate ocean or coastal circulation or tsunami wave propagation. But these models are seldom used to explicitely reproduce for example tsunami wave run-up into coast. In Vázquez-Cendón (1999) a finite volume numerical scheme with upwinding of the source terms. This numerical model has good properties as well-balance, but do not treat correctly wet/dry fronts, as it produces negatives values of the thickness of the fluid layer and stationary solutions corresponding to water at rest including wet/dry fronts are not exactly solved. In Brufau et al. (2002) and Castro et al. (2005) several variants of this numerical scheme have been proposed that partially solve these difficulties. Finally, in Castro et al. (2006) a new variant is proposed, where a Nonlinear Riemann Problem is considered at each intercell instead of a Linear one. In this work we use the implementation of dry/wet for shallow water models proposed in this latter paper which allows us to reproduce coastal inundation and water retrainment once the impact wave passes over. The run-up model has been tested for simple test cases and geometries as in complex, real cases, as the Lituya Bay 1958 megatsunami.

Keywords: Wet/dry fronts, run-up simulation, shallow water equations, finite volume methods.

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