Geophysical Research Abstracts
Vol. 16, EGU2014-13344, 2014
EGU General Assembly 2014

Energy balanced numerical schemes for numerical modelling of river morphodynamics

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Environmental flows involving river morphodynamics can be defined mathematically as shallow type flows of hyperbolic nature. It is worth mentioning that realistic shallow type flows are hyperbolic but not strictly hyperbolic. Their characteristics require the development of novel numerical techniques. Among them, most advanced numerical predictive methods consider the well-balanced property. This property is a particular case of a more general one: the energy-balanced property. The energy-balanced property has proven significant advantages in the case of fixed bed. Being only first order accurate in time and space, leads to exact numerical solutions for steady solutions in channels with general geometries with independence of the mesh refinement. Energy-balanced schemes ensure convergence to the exact solution in Riemann problems involving nonprismatic channels, bed variations and the resonance regime. When modeling morphodynamics changes in a river bed, these variations are linked to the amount of available energy that can be extracted from the flow. Bed material mobilization is commonly expressed in terms of shear stress, responsible of the energy dissipation. Considering that energy arguments in river morphodynamics are of great importance, in this work a tentative description of energy balanced numerical schemes for numerical modelling of river morphodynamics and their performance are provided.