Geophysical Research Abstracts
Vol. 19, EGU2017-16867-1, 2017
EGU General Assembly 2017

Dam-break over an erodible bed : an experimental approach to improve bed load transport predictions

Gauthier Rousseau, Tomás Trewhela, Daniel Vito Papa, and Christophe Ancey
EPFL, Lausanne, Switzerland (gauthier.rousseau@epfl.ch)

It is difficult to study bed load and water flow interact in waterways. A typical example is provided by dam-break waves that can erode and transport large quantities of sediment. In this abstract, we present dam-break experiments over an inclined (3.5 to 7 %) mobile bed in a narrow flume. The bed material is made of 4-mm crushed glass pebbles. In the experiments sudden dam-break waves are generated by removing a reservoir gate and releasing a finite volume of water. Downstream of the reservoir, the initial flow has reached steady state (i.e. a shallow flow takes place over the saturated pebble bed).

A high-speed camera is used to record flow and bed evolution for each experiment. Bed load movement is estimated using PTV (particle tracking velocimetry) methods. The total mass of sediment reaching the outlet is weighted. Comparison with numerical models and simple analytical solutions has been done in order to characterize sediment transport and flow. Experiments showed a delay between the moving sediments and the water wave front while classical models assume an instantaneous transport of the sediment when the shear stress reach a certain threshold. This observation suggest that inertia of the sediment should be considered for this transient phenomena.

The analytical prediction of bed load transport rates caused by a dam-break wave involves two steps. Firstly, the dam break flow is analysed as an ideal-fluid flow region behind a flow resistance-dominated tip zone. Secondly, the sediment transport estimation are evaluated by the means of semi-empirical bed load transport formulae. The resulting model provides predictions that are in good agreement with the experimental results (wave front velocity and bed load transport rate).

In addition, a simple approximate Riemann Solver for the Saint-Venant-Exner equations has been implemented. Different closure equations have been compared to compute flow resistance and sediment transport fluxes (entrainment and deposition). Attempts have been done to take in consideration the sediment inertia problem in this equations. Numerical tests are under way to determine whether strategy leads to a more accurate simulation of this intricate problem.