Geophysical Research Abstracts
Vol. 15, EGU2013-14151-1, 2013
EGU General Assembly 2013

Numerical modeling of bed armoring

Gergely Torok (1), Sandor Baranya (1), and Nils Ruther (2)

(1) Hydraulic and Water Resources Engineering, Budapest University of Technology and Economics, H-1111, Budapest Műegyetem rkp. 3, HUNGARY (baranya@vit.bme.hu), (2) Department of Hydraulic and Environmental Engineering, Norwegian University of Science and Technology, S.P. Andersensvei 5, N-7491 Trondheim, Norway (nils.ruther(@)ntnu.no)

A three-dimensional numerical model is introduced which is capable of reproducing the bed armoring process in rivers resulted by nonuniform bed material. The numerical flow model solves the 3D Reynolds Averaged Navier-Stokes equations with a k-ε turbulence model. The bed shear stress field is calculated over the study domain which serves as input data for the sediment transport model. The sediment transport model of Wilcock and Crowe (2003) has been implemented to solve the sorting of mixed-size sediments. In this model the effect of the sand content of the bed material on gravel transport rate is taken into account which contributes to a more appropriate description of sediment transport than in previous transport models.

First, we carry out a model testing against the laboratory data of Yen and Lee (1995). The effects of different flood waves are investigated in a 180° channel bend with mixed-size sediments. We show a good agreement between measured and calculated bed changes, moreover, the horizontal distribution of median sediment sizes are also acceptably reproduced.

Second, a simple numerical test channel is set up with a rectangular cross section and one single groyne. A bed material of two fractions (sand and gravel) is defined. The typical phases of the bed armoring phenomenon is studied modeling the bed material sorting mechanism during long-term bed forming steady-state conditions as well as the sudden reaction of the river bed to a flood event. We show that the calculated bed changes and the temporal changes of bed material composition indicate both the development and the break-up of the bed armor.

The results suggest that the introduced numerical model is capable of simulating river morphodynamics of complex hydrological and sediment conditions and can be a suitable tool for river engineering studies where bed armoring plays an important role.