Geophysical Research Abstracts
Vol. 14, EGU2012-14161, 2012
EGU General Assembly 2012

Hydro-morphological analysis of a sand-bed river in Hungary

S. Baranya, S. Rajmund, and J. Józsa

Department of Hydraulic and Water Resources Engineering, Budapest University of Technology and Economics, Budapest, Hungary (baranya@vit.bme.hu)

The main goal of this paper is to introduce a suitable procedure for the assessment of reach-scale hydro-morphological conditions of rivers. For this purpose a 4 km long reach of River Tisza in Hungary was chosen and investigated by means of comprehensive field measurements and three-dimensional numerical modelling. The river can be characterized with an average depth of 6 m and an average width of 150 m, whereas the mean annual discharge is around 800 m3/s. The bed material is sand with a d50 of 0.2 mm. In the shallow zones of the river bed forms are migrating with a typical length of 20 m and amplitude of 0.3 m. The study reach has recently been surveyed in 2008 and 2010. The river bed evolution occurred during the two years is assessed by difference maps of the river bathymetry. Furthermore, moving and fixed ADCP measurements were carried out in order to reveal the spatial flow structure. Suspended sediment and bed material samples were also collected yielding the sediment discharge and characteristic grain size distributions. Moreover, the bed movement was also quantified in some locations of the reach based on the deviation between bottom track and GPS positions collected during fixed ADCP measurements.

Parameterizing with the detailed field data a three-dimensional flow and sediment transport model was applied to carry out morphological simulations. The numerical model solves the Reynolds averaged Navier-Stokes equations (RANS) using a k-epsilon turbulence closure. The empirical formulas of van Rijn were used to estimate sediment concentration close to the bed. Moreover, the flow resistance due to bed forms was also considered using an empirical approach. A comparative analysis of the measured and simulated velocity field, sediment concentration and river bed migration was accomplished to introduce model capabilities. Furthermore, three-dimensional flow structure accounting for the development of local, unique morphological features is analysed. The coupled field and numerical investigations can greatly contribute to the establishment of the sediment budget for the study reach, however, further research is needed, e.g. analysis of high water regimes or the study of long term changes in the sediment transport and river morphology.