River bathymetry model based on the analytical curves.

Luděk Bureš (1), Petra Sychová (1), Štěpán Marval (2), Filip Urban (3), and Radek Roub (1)

(1) Czech University of Life Sciences Prague, Water Resources and Environmental Modeling, Prague, Czech Republic (buresl@fzp.czu.cz)., (2) Research Institute for Soil and water Conservation, Žabovřeská 250, Prague 5, Czech Republic., (3) Water Management Development and Construction joint stock Company, Nábřežní 4, Prague 5, Czech Republic.

Abstract

Accurate hydrodynamic modeling requires accurate topographic data as one of the inputs. Topographic data usually are entered into hydrodynamic modeling in the form of digital elevation model (DEM). For these DEMs high bathymetric accuracy is required. The river bathymetry is usually created by the spatial interpolation of discrete points or cross sections data. The bathymetric quality of DEM depends on the quality of the measurement, the used technology and the size of the input data set. Extensive surveying of large areas are time-consuming and expensive. The mathematical modeling can be the alternative way to create the river bathymetry.

We present the mechanism for creating of the river bathymetry model based on the analytical curves. In this model, analytical curves are transformed into cross sections. Themain mechanism consists of four steps: (1) Creating of the analytical curves. (2) Conversion of the curves to real state (current width, current flow area). (3) Creating of the 3D bathymetric network from the analytical curves. (4) Creating the bathymetry model. In our paper we evaluate the final quality of the bathymetric model, and the ability of the analytical curves to represent the shape of the cross section. The hydrodynamic comparison was also assessed. The DEM with the bathymetric model, DEM with the measured bathymetry, and DEM without bathymetry were used as topographic inputs for the established hydrodynamic model.

The novel approach was applied on the part of the Vltava river in the Czech Republic. The bathymetry of the river and inundation areas were described on the base of the point fields. The bathymetric point field was measured by Meridata ty MD500 echo sounder. DMR 5G data set (product of aerial laser scanning) was used for describing the inundation area.

References:
Casas, A., Benito, G., Thorndycraft, V. R., and Rico, M. The topographic data source of digital terrain models as a key element in the accuracy of hydraulic flood modelling. Earth Surface Processes and Landforms, 31(4), 444–456, 2006.
Caviedes-Voullième, D., Morales-Hernández, M., López-Marijuan, I., and García-Navarro, P. of 2D river beds by appropriate interpolation of 1D cross-sectional information for flood simulation. Environmental modelling & software, 61, 206-228, 2014.
Legleiter, C. J., and P. C. Kyriakidis. Spatial prediction of river channel topography by kriging. Earth Surface Processes and Landforms, 33.6 , 841-867, 2008.
Merwade, V. Effect of spatial trends on interpolation of river bathymetry. Journal of Hydrology, 371.1, 169-181, 2009.