Geophysical Research Abstracts
Vol. 14, EGU2012-10716, 2012
EGU General Assembly 2012

Numerical and analytical solution of diffusion wave approximation for surface water routing in a distributed hydrological model

T. Berezowski (1), O. Batelaan (2,3), and J. Chormanski (1)

(1) Dept. of Hydraulic Structures, Warsaw University of Life Sciences, Warsaw, Poland, E-mail: t.berezowski@levis.sggw.pl, (2) Dept. of Hydrology and Hydraulic Engineering, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium, (3) Dept. of Earth and Environmental Sciences, Katholieke Universiteit Leuven, Celestijnenlaan 200E, 3001 Heverlee, Belgium

The distributed rainfall-runoff model WetSpa was successfully used in the past 10 years for flood prediction and scenario analysis for impacts of landuse and climate change for a broad spectrum of catchment types. During the last decade more and more precise data sources became available for model parameterization. Use of them indicated some oversimplifications in the model structure. The major issue was the surface water routing component, which was based on an analytical solution of the diffusion wave approximation in the form of an Instantaneous Unit Hydrograph (IUH). The IUH is calculated in the preprocessing stage and defines for all flow paths the responses between each model cell and the catchment outlet. As a consequence, the model structure cannot account for changing conditions during a simulation as e.g. changes in hydraulic radius of the flow paths. Moreover, the flow paths does not reflect other hydrological processes (e.g. infiltration, evapotranspiration) occurring during the routing of the water to the catchment outlet. This model characteristic easily can cause overestimation of the surface runoff component in the total runoff simulated by the model. The here presented solution for this issue is a change from an analytical solution of the diffusion wave approximation (IUH) to a numerical solution. The numerical solution is calculated for each time step in the model computational cells while taking into account dynamics of surface water losses occurring in the catchment system. The two approaches of surface water routing are compared in a set of experimental catchments in order to evaluate the differences in results