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Multilinear flood routing model for flood forecasting on alluvial rivers

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In many circumstances detailed field investigations, which would supply sufficient and up-to-date data describing the morphologic and hydraulic channel characteristics, are prohibited by time schedules and project costs. The lack of appropriate channel geometry and roughness data hinders the application of hydraulic models for flood routing in flood forecasting. Moreover the application of complete distributed hydraulic flow routing models is neither justifiable nor advantageous in alluvial rivers with a changing river bed. Therefore, in the HRON conceptual rainfall- runoff model, which is implemented in several catchments in the Flood forecasting system of Slovakia, the application of a hydrologic flood routing method was chosen as a rational alternative. In the contribution this nonlinear hydrologic routing model is described and tested on two alluvial rivers with strongly discharge dependent flood wave speed. The model is based on a state-space formulation of the cascade of linear reservoirs and an empirical wave speed discharge relationship, which accounts for nonlinearity of the flood routing process. The resulting model belongs to the family of multilinear models. The time distribution scheme of model inputs was employed in the setup of the multilinear model and the travel-time parameter of the model was allowed to vary with discharge according to the wave speed-discharge relationship. The shape and the parameters of that were fitted by constrained optimisation of the multilinear model performance with the help of a genetic algorithm. The optimised piecewise linear relationship fitted well the empirical data on travel-times of flood peaks and was also consistent with the findings in the literature. The modelling results showed that the proposed inclusion of empirical information on the variability of the travel-time parameter of the model

enabled satisfactory accuracy of the prediction of flood propagation.