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Hydrological flow routing methods used for flow forecasting on the Morava River in Slovakia

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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 as a rational alternative to hydraulic routing, beside numerical hydraulic models, conceptual hydrological models and also models belonging to the class of non-storage routing methods are still in operational use in Slovakia. In this contribution several new hydrologic routing models used on the Lower Morava River are presented and compared. First two alternatives to standard non-storage routing on the Morava River are discussed. These are using multiple linear regression and artificial neural networks to estimate the relationships between travel times of flood-wave peaks and the peak discharge and between inflow and outflow discharges. Next a nonlinear hydrologic routing model based on the state-space formulation of the cascade of linear reservoirs and an empirical travel time vs. discharge relationship, which accounts for nonlinearity of the flood routing process, is presented. This 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. The shape of the model travel-time parameter vs. discharge relationship was assessed by optimisation of the multilinear model performance with the help of a genetic algorithm. The performance of the new models was compared against existing approaches used in practice. The results showed that the inclusion of empirical information on the variability of the travel-time with discharge into all models enabled the prediction of the flood propagation with satisfactory accuracy.