Geophysical Research Abstracts
Vol. 21, EGU2019-7839, 2019
EGU General Assembly 2019

Estimation of flood wave travel times by using multilinear Muskingum method with variable parameters

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The Muskingum method is a popular two parameter lumped hydrologic flow routing method (McCarty, 1938). Method is based on an assumed linear relationship between a channel's storage and inflow and outflow discharge. There are a variety of techniques for estimating the two parameters associated with the Muskingum method. The general applicability of using travel-time discharge relationships to model the variability of the K parameter in a Muskingum routing model was tested in this study. Two such parametrisation methods were compared here with the classical approach on a river reach with anthropogenically altered floods regime. The new parameter estimation methods are based on relationships between the travel time parameter K and the input discharge for the reach of the Danube River between Devín-Bratislava and Medveďov, which includes an inland delta and the Gabčíkovo hydropower scheme. The parameter X was taken as the average of its values from a small set of flood waves used (and used as a constant value) and K was estimated as a function of the travel time parameter (K) and discharge, which was optimized for one large flood wave. The results were validated using the Nash-Sutcliffe coefficient on 10 floods. The results obtained by the new methods presented in this work were satisfactory and, based on these, one could reduce the amount of data required for calibration in practical applications. The tested methods can be recommended for use for situations when the flood data availability is limited.