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Assessment of aptness of purely data driven and data-plus-knowledge driven techniques to derive transfer function for precipitation loss

Sachin Patil and András Bárdossy

Department of Hydrology and Geohydrology, Institute of Hydraulic Engineering, Universitaet Stuttgart, Germany

In order to estimate effective precipitation for a storm event in ungauged basin it is desirable to associate the precipitation loss with catchment variables as well as event variables. The functional form of the association between the parameter and the variables is commonly known as transfer function which transfers the knowledge gained from the known entities to an unknown entity.

The existing techniques to derive the transfer function could mainly be classified into two categories; purely data driven techniques and data-plus-knowledge driven techniques. The purely data driven techniques, e.g. Artificial Neural Network (ANN) and multiple regression, obtain the transfer function simply by selecting a functional form that gives the best curve fitting with dependent variable for the given dataset of independent variables. These techniques use black box approach and do not consider a priori knowledge. On the other hand the data-plus-knowledge driven techniques, e.g. logistic regression, combine a priori knowledge about the system derived from the experience or experiments along with the curve fitting. In this case hydrological knowledge is considered by assuming monotonic behavior of transfer function with respect to the selected variables leading to the conditioned partial derivatives of the fitted function.

Several catchment and event variables, e.g. slope, soil classes, soil moisture, were estimated for as many as 244 storm events from 41 mesoscale catchments located in the Southern Germany. The variables were then associated with precipitation loss by using non-linear form of transfer function. To derive the transfer function ANN, multiple regression and logistic regression techniques were employed separately. Thus

obtained three different transfer functions and there performance were investigated to assess the aptness the techniques.

The study has provided a useful insight into handling the black box approaches and the advantages of the incorporation of priori knowledge for deriving such transfer functions.