



## **Using a transformation matrix based algorithm to achieve a novel catchment classification scheme**

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This work proposes a new scheme for the classification of catchments in a watershed. The procedure is based on similarity interpreted as distances between catchments. The similarity or distance is defined under three basic premises: 1. similar catchments behave similarly; 2. similarity can be described with catchments' characteristics; and 3. hydrological models are able to capture catchments' similarity.

When many sets of model parameters lead to similar model performance for two catchments, they are considered as similar catchments. Similarity or distance measure is defined based on the Nash-Sutcliff (NS) efficiency. A transformed distance is obtained based on only catchment descriptors multiplied by a transformation matrix. The transformation matrix is determined by means of a local variance reduction method to resemble the catchment similarities. The obtained transformed distance between a pair of catchments is not necessarily the same as the distance based on the NS, however the rank order of all distances within a group of catchments can be preserved to the largest extent. Catchments can be then classified based on the catchment descriptors with the help of the transformation matrix. The latter potentially allows similar catchments to be classified and hence generate similar model performances, which can act as a precursor for predictions in ungauged basins.

The proposed scheme is tested with research versions of the HBV-IWS and Xinanjiang models on a number of catchments within the Rhine Basin. An outstanding research question includes whether the obtained transformation matrix can preserve similarity information when different time periods, different catchment groups or different

hydrological models are applied.