

*Title:* Determination of the spatial organisation of river basins by GIS-based tools

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*Abstract:*

The consideration of spatial heterogeneity of watersheds is the basic principle for semi-distributed rainfall-runoff modelling. Such models consider this heterogeneity in two ways: by a subdivision into several sub-catchments and clustering of the remaining variability of catchment characteristics e. g. into hydrological response units. The increase of model complexity by such a subdivisions is a common approach to enhance the performance of an existing model-structure. However the number of parameters will be increased as well as the problem of equifinality. Here we consider that many catchment characteristics, such as soil types (field capacity, hydraulic conductivities), landuse or topographic factors are interrelated and can be used in combination for the delineation of sub-catchments, explaining the majority of heterogeneities within river basins. Using a raster-based GIS, a method for the identification of the succession of characteristics along the stream flow length is provided. The increase of watershed heterogeneity in upstream direction, starting at the basin outlet is analysed. Nodes of the model are derived at points of ramification of the river network if the added watershed characteristics differ significantly from the cumulative sample of characteristics which were estimated before. The proposed order-analysis provides a routine for catchment delineation. At distances along the stream flow length, where the deviation of watersheds characteristics increases significantly, an extended spatial analysis is carried out, to identify the clusters which are causing this deviation. It has to be decided if the model should have a node at this point or if the heterogeneity should be considered by hydrological response units. Gauges are nodes of the model by definition. Their sub-basins are analysed in the same way. To demonstrate the benefit of preserving the hydrological order of river networks within a hydrological model, a watershed in eastern Germany is subdivided with the provided method in a comparative analysis.