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# Catchment classification by means of hydrological models

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An important hydrological objective is catchment classification that will serve as a basis for the regionalisation of discharge parameters or model parameters. The main task of this study is the development and assessment of two classification approaches with respect to their efficiency in catchment classification. The study area in western Germany comprises about 80 catchments that range in size from 8 km2 up to 1500 km2, covering a wide range of geological substrata, soils, landscapes and mean annual precipitation.

In a first approach Self Organising Maps (SOMs) use discharge characteristics or catchment characteristics to classify the catchments of the study area. Next, a reference hydrological model calibrates the catchments of the study area and tests the possibilities of parameter transfer. Compared to the transfer of parameters outside a class, for most catchments the model performance improves when parameters within a class are transferred. Thus, it should be possible to distinguish catchment classes by means of a hydrological model. The classification results of the SOM are compared to the classification results of the reference hydrological model in order to determine the latter validity.

The second approach builds on the first approach in such a way that it uses the Superflex Modelling Framework instead of only one reference model. Within this framework multiple conceptual model structures can be calibrated and adapted. Input data for each calibration of a catchment are hourly time series of runoff, precipitation and evaporation for at least eight years. The calibration of multiple models for each catchment and their comparison allows for the assessment of the influence of different model structures on model performance. Learning loops analyse model performance and adapt model structures accordingly with a view to performance improvement.

The result of the modelling exercise is a best performing model structure for each catchment that serves as a basis for catchment description and clustering. Hence, the classes do not only represent a distinctive hydrological regime, but also provide information on specific quantitative aspects that are directly linked to a certain model structure. The clustering that is based on model structures or model parameters are validated by the classifications based on SOM and are thus related to physiographic and climatic catchment properties and runoff behaviour, which provides insight into catchment functioning. Clustering based on model structures can be a fast and simple way of catchment classification.

A database consistently relates input data and output data; model structures and model performance and allows formulating distinctive processes that are attached to a class. Thus, the final result of the study is a powerful classification tool that helps to formulate generalizations based on observations and testable hypotheses (i.e. model structures).