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# Catchments characterization by means of lumped conceptual models – a case study.

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Lumped conceptual models are important tools for understanding, predicting and characterizing the hydrologic behavior of meso-scale catchments. An important prerequisite for this is a clear relationship between catchment characteristics and the model structure. The large number of possible model structures complicates the selection of appropriate model structures. We prove the behaviour and suitability of 12 different predefined model structures for 99, often neighbored or nested catchments in western Germany for catchment characterization. The 12 model structures are formulated within the modelling framework SUPERFLEX. They differ in their architecture and complexity. We calibrate all 12 model structures for all 99 catchments. For all models with an acceptable performance, we compare the flow duration curves of observed and simulated runoff by means of signature indices derived from the flow duration curves.
The comparison results in three types of catchments:
a) For 15 catchments, none of the 12 model structures led to an acceptable model. Either there is no suitable model structure within the 12 tested structures or these catchments are not suitable for modelling.
For the other catchments up to eight acceptable models per catchment are recognized. No model structure leads to an acceptable model for every catchment.
b) For 35 catchments, all acceptable models show different performance and flow duration curves with a clear best performing model. A relationship between the best performing model structure and catchment characteristics may be possible. Model structure selection is an important issue.
c) For 49 catchments, all, or the majority of acceptable models, show similar signature indices indicating similar flow duration curves of simulated runoff. Similar simulation results with different model structures for a catchment refer to model equifinality. A clear relationship between catchment characteristics and model structure, a direct cause- and effect relationship, does not exist for these catchments.
All types of catchments occur among neighbored or even nested catchments and show no clear correlation to mean catchment properties.
Types a) to c) define catchment characteristics other than usually used properties like catchment area, climate or landscape description. Results show, that these characteristics are crucial for all modelling exercises, model structure selection, understanding, predicting and characterizing the hydrologic behavior of meso-scale catchments.