The Use of Landscape Variability in the mesoscale Hydrologic Model

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Dealing with catchment heterogeneity remains an important issue in hydrological modelling. One way to deal with catchment heterogeneity is by subdividing the catchment into smaller representative watersheds, like Reggiani et al (1998). In line with this, Savenije (2010) proposed a modelling set-up where different landscape units get different model structures. Every unit describes in this way the dominant processes in the landscape. However, transferring the model to other catchments without recalibration is still hard.

The mesoscale Hydrologic Model (mHM; Samaniego(2010)) is a distributed model which was proven to be transferable to other regions, due to the used regionalization technique. Nevertheless, the mHM model uses a single model structure (the configuration of states and fluxes in the model), which may not describe the hydrological processes correctly.

The mHM model has been equipped with a more complex model structure based on topography in order to obtain a transferable and realistic model. Three landscape classes have been defined based on the Height Above Nearest Drainage (HAND) and terrain slope. These three landscape classes each have a different model structure.

The new model, mHMtopo, has been compared with the original mHM after calibration of both models with a Monte Carlo approach. A number of hydrological characteristics (signatures) were used to determine which model showed the best representation of reality. Afterwards, the transferability was tested by a simultaneous calibration of four different catchments and a validation in four other catchments.