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Comparison of a Simple and a Spatially Distributed Hydrological Model for the Runoff Simulation of a Lowland Catchment in Northern Germany

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For modelling of discharge in catchments there are basically two alternatives: the usage of simple models with low demand of input data or complex, spatially distributed models, where input data sets have to be interpolated or derived with transfer functions.

As an example we have used the lowland catchment of Kielstau (Northern Germany). The catchment is 50km^2 large extending from sea level to nearly 30m above sea level. It is dominated by agricultural land use. The typical soils are sandy to loamy cambisols, the lower wetlands are covered by mires.

As an example for a simpel model we took SIMPEL (www.hydrology.uni-kiel.de/simpel), a one-dimensional spreadsheet model with a Unit-Hydrograph component for discharge calculation. The spatially distributed simulation was carried out with the "simplified hydrological runoff model" of Karssenberg et al. (1997) with the PC-RASTER system (http://pcraster.geog.uu.nl/). As far as possible, both models are based on same algorithms for simulations. The presentation first describes the parameterisation and calibration of the original and the modified models. Based on the runoff curves we discuss the assets and drawbacks of the two model types and finally we show the improved results of the SIMPEL and PC-Raster model. The first simulations showed a systematic underestimation of runoff in spring and an overestimation in autumn and winter, caused by fluxes from and to the groundwater. Because there was no information available about the state and the fluxes of groundwater in this region, we solved the problem by adding a simple accounting procedure to the model.