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Comparing semi-distributed and distributed conceptual rainfall-run-off models - trade-off between uncertainty and model efficency?

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Land use change effects runoff at the meso-scale. Conceptual rainfall-runoff model have been used for a long time to study this effect. Different levels of spatial representation could be used to specify the process description in these models. A spatial explicit model should be able to consider the effects of the spatial pattern of land use change. This leads to the question if the improved model fit and the enhanced process description satisfies the increased uncertainty by the additional parameters. In other words, how much the benefits of the incorporation of the spatial pattern of land-use change are countervailed by the increased uncertainty. We investigated this trade-off by comparing a semi-distributed and a grid-based version of the rainfall-run-off model HBV (HBV-D and HBV-SME). Both model versions share the same conceptual process description. For the grid-based model the model parameters are allowed to vary depending on a linear combination of site conditions (slope, soil type, heat load index). A two step calibration procedure is used for the grid-based model: first, the model is calibrated assuming spatial homogeneity. In a second step weighting factor depending on site conditions are introduced while keeping the other factors constant. The weighting factors do represent the deviation of the site condition of a cell from the global mean of the site condition. A subset from the satisfying parameter sets is chosen to compare the effect of land use change patterns with the uncertainty that originates from the problem of equifinality. The study has been performed in a low-land meso-scale watershed, the Parthe (318 sqkm) near Leipzig in eastern Germany.