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# The effect of the spatial variation of soil hydraulic properties on runoff generation at the small catchment scale

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Spatially distributed soil hydraulic properties are required for distributed hydrological modelling. These soil hydraulic properties are known to vary significantly in space, and considering the non-linearity of runoff generation, the question arises how the spatial variation of soil hydraulic parameters affects the continuous runoff modelling for a micro-scale catchment. This was analysed by applying a three-dimensional hydrological model to the 28.6 ha Berrensiefen catchment for a simulation period of one year. The model was based on a geostatistically derived distribution of soil hydraulic properties, which were assumed to be layered in vertical and to vary continuously in horizontal direction, and validated for total runoff. Numerical experiments with five spatial distributions of soil hydraulic parameters derived from the observed spatial distribution, which was supposed to be the 'true' underlying spatial variation, were carried out. These five spatial concepts were: choropleth map, spatially homogeneous case, random distribution, stochastic simulation and conditional stochastic simulation. The comparative modelling revealed a significant sensitivity of runoff generation towards the spatial variation of soil hydraulic properties. The comparison of the hydrograph of surface and macropore runoff to the initial model runs exhibited the highest root mean square error with 1.3 mm $h^{-1}$ for the homogeneous case. Further, the frequency distribution of soil hydraulic properties played an important role for the reproduction of runoff amounts. But also the spatial topology (deterministic spatial variation) was relevant for an adequate description of runoff generation. Conditional stochastic simulation is seen as a promising approach, because it preserved both, the

frequency distribution and the deterministic variation.