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The effect of hydrologic process parameterisations on runoff from single soil column model simulations of a Land Surface Model

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Spatially distributed hydrologic models coupled with atmospheric models have the potential to improve the prediction of the impacts of atmospheric extremes on the terrestrial water cycle. However, systematic deficiencies have been reported for coupled atmospheric-hydrologic simulations, which are, to a large extent, attributed to the parameterisation of hydrologic processes. Thus, the identification or development of efficient hydrologic process parameterisations is a necessary step towards skilful coupled hydrometeorologic applications. This study aims to investigate the sensitivity of modelled runoff to the infiltration and drainage process parameterisations of the unified Noah Land Surface Model (LSM). The Noah LSM-modelled runoff is one of the inputs into the WRF-Hydro distributed hydrologic model. Single soil column model simulations are performed using a subset of functions and routines of the Noah LSM code. The adjusted code is used in simulations with varying precipitation inputs, antecedent soil moisture conditions, soil types and model time steps. The infiltration parameter REFKDT and the parameter SLOPE controlling the drainage at the bottom of the soil column are tested using different combinations of their values and the amount of generated runoff is examined. The results of such type of model sensitivity can provide us with useful insight into how precipitation is partitioned to runoff and infiltration into the soil column, and how the model time step and different parameter values must be selected in the case of spatially distributed coupled atmospheric-hydrologic model simulations.