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Sensitivity of rainfall-runoff processes in the Hydrological Open Air Laboratory

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The objective of the present study was to simulate the rainfall response and analyse the sensitivity of rainfall-runoff processes of the Hydrological Open Air Laboratory (HOAL) in Petzenkirchen, a small experimental watershed (66 ha) located in the western part of Lower Austria and dominated by agricultural land use. Due to the extensive monitoring network in the HOAL, the spatial and temporal heterogeneity of hydro-meteorological elements are exceptionally well represented on the catchment scale. The study aimed to exploit the facilities of the available database collected by innovative sensing techniques to advance the understanding of various rainfall-runoff processes.

The TUWmodel, a lumped, conceptual hydrological model, following the structure of the HBV model was implemented on the catchment. In addition to the surface runoff at the catchment outlet, several different runoff generation mechanisms (tile drainage flow, saturation excess runoff from wetlands and groundwater discharge from springs) were also simulated, which gave an opportunity to describe the spatial distribution of model parameters in the study area. This helped to proceed from the original lumped model concept towards a spatially distributed one.

The other focus of this work was to distinguish the dominant model parameters from the less sensitive ones for each tributary with different runoff type by applying two different sensitivity analysis methods, the simple local perturbation and the global Latin-Hypercube-One-Factor-At-a-Time (LH-OAT) tools. Moreover, the impacts of modifying the initial parameters of the LH-OAT method and the applied objective functions were also taken into consideration.

The results and findings of the model and sensitivity analyses were summarized and future development perspectives were outlined.

Key words: spatial heterogeneity of rainfall-runoff mechanisms, sensitivity analysis, lumped conceptual hydrological model