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Observed short-term precipitation patterns and uncertainty in hydrological models of small catchments

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The contribution presents the outcomes of a three-years' project named "Variability of Short-term Precipitation and Runoff in Small Catchments and its Influence on Water Resources Management". Six typical temporal patterns of subdaily precipitation, also known as design rainfalls, were derived and provided to the public via web services. Next, the impact of short-term precipitation variability on hydrological modelling and design of landscape water structures was analysed. Hydrological models HMS, SMODERP and MikeSHE were included in the sensitivity analysis in order to describe the variability of runoff characteristics induced by the model structure. Other sources of variability (soil properties and conditions, land cover etc.) were considered when generating computation scenarios.

Results showed that in general runoff depths from HMS model (the most widely used model by the Czech design planners) were within the range of values produced by the other two physically based models. However further assessment of HMS was hampered by the limitations of the SCS-CN method, which does not reflect the temporal distribution of input rainfall in terms of resulting runoff depths. In most aspects similar models SMODERP and MikeSHE differed in particular scenarios by as much as 100 % only due to the different infiltration routine - Philip's equation vs. G&A method. The deviations of these two models dissipate when initial soil conditions approach the saturated state or when the soils infiltrability is subnormal. The differences in model structure or methods proved to be more significant than the variability of rainfall temporal distribution.

Next, detailed sensitivity analysis was carried out in MikeSHE model, evaluating more than 32000 scenarios. The variability of modelled runoff proved to depend on the average soil infiltrability. At the same time the strength of the relationship differed for the two considered runoff characteristic. While in the conditions of subnormal soil infiltrability the rainfall temporal distribution did not play a significant role in terms of modelled runoff depths, it was a dominant factor affecting the runoff peak discharges. In contrast, in the conditions of average soil infiltrability the rainfall temporal distribution was equally important factor delimiting both runoff characteristics.

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