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Does the complexity in precipitation disaggregation matter for hydrological applications at the catchment scale?

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Flood peaks and volumes are essential design variables. In case of missing or short observation records required for statistical analysis of floods, these variables can be estimated by precipitation-runoff (p-r) modelling. For such estimates in mesoscale catchments high-resolution precipitation time series (sub-daily) are required which can be generated by various temporal disaggregation models of different complexity. Here, we compare a simple model (M1, one parameter), focusing on the effective precipitation duration for flood simulations, with a more complex multiplicative cascade model (M2, 32/36 parameters). While M2 aims at generating realistic characteristics of precipitation time series, M1 aims only at accurately reproducing flood variables by p-r modelling.

Both disaggregation models were tested in nine Swiss mesoscale catchments. Generated high-resolution (hourly) precipitation time series served as input for p-r modelling using a lumped HBV model to evaluate both disaggregation models regarding their predictive capabilities of reproducing flood peaks and volumes. Our results indicated that differences between two models identified in precipitation characteristics of disaggregated precipitation time series vanished when precipitation series were introduced into the lumped hydrological model. In addition, we found that flood peaks were more sensitive to the disaggregation model choice than flood volumes. These findings suggest that the complexity in precipitation disaggregation, important for reproducing precipitation characteristics, becomes less relevant for hydrological applications at a catchment scale.