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Scaling point-scale pedotransfer functions to seamless large-domain parameter estimates for high-resolution distributed hydrological modelling: An example for the Rhine river

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High-resolution grid-based hydrological models ask for novel parameter estimation approaches. In this study for the Rhine basin, we estimated the parameters of the wflow_sbm hydrological model with point-scale pedotransfer-functions in conjunction with scaling operators as applied in Multiscale Parameter Regionalization (MPR). Parameters were estimated on the original data resolution, followed by the upscaling of parameter fields to the model resolutions, requiring no further calibration. The approach was tested on a 6-hourly timestep and at four resolutions. Resulting parameter fields and simulated fluxes were assessed on consistency. In addition, results were assessed against discharge observations and LSA SAF actual evapotranspiration (ETact) estimates. We found consistent parameter fields, resulting in ETact and recharge preservation on coarser resolutions. However, no discharge flux preservation was found in smaller basins, which we attribute to model structure and the loss of lateral flow representations on coarser resolutions. Model validation gave KGE-values of >0.7, sometimes >0.85, at many discharge gauging locations, except for the Alpine region. Also ETact-estimates compared well, both spatially and temporally, with LSA SAF estimates (KGE$\sim$0.7).