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Testing the distributed hydrological wflow_sbm concept across different geographical domains

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Improving our understanding of hydrological processes beyond single catchments is important. Here we test wflow_sbm (simple bucket model) for modelling hydrology across different geographical areas (i.e. Europe, Africa). Wflow_sbm is a conceptual bucket-style hydrological model based on simplified physical relationships. It uses kinematic wave surface and subsurface routing for lateral transport. The model setup and parameter estimation are fully automated based on global and regional data sources (like MERIT DEM, SoilsGrids, monthly MODIS LAI, global/regional land use) and includes anthropogenic influences like lakes and reservoirs and its management from HydroLAKES and GRanD databases. It makes use of scaling operators as applied in Multiscale Parameter Regionalization (MPR) to go from high resolution data sources to a ~1km² or coarser resolution model.

The model is tested at 1 km² spatial and daily temporal resolution for different basins: Umealven (Sweden), Glomma (Norway), Mono river (Togo), the white Nile, Save River (Mozambique) and Incomati river using EOBS or CHIRPS rainfall and ERA5 derived temperature and potential evaporation forcing. From these applications, it becomes apparent that the model can explain the measured discharge most of times reasonably well (KGE~0.4 and higher). The main factors controlling the performance are (quality of the) forcing, lateral hydraulic conductivity, rooting depth and reservoir/lake management.