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Global-scale regionalization of hydrological model parameters using streamflow data from many small catchments

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Motivated by the lack of large-scale model parameter regionalization studies, a large set of 3328 small catchments ($< 10\,000$ km^2) around the globe was used to set up and evaluate five model parameterization schemes at global scale. The HBV-light model was chosen because of its parsimony and flexibility to test the schemes. The catchments were calibrated against observed streamflow (Q) using an objective function incorporating both behavioral and goodness-of-fit measures, after which the catchment set was split into subsets of 1215 donor and 2113 evaluation catchments based on the calibration performance. The donor catchments were subsequently used to derive parameter sets that were transferred to similar grid cells based on a similarity measure incorporating climatic and physiographic characteristics, thereby producing parameter maps with global coverage. Overall, there was a lack of suitable donor catchments for mountainous and tropical environments. The schemes with spatially-uniform parameter sets (EXP2 and EXP3) achieved the worst Q estimation performance in the evaluation catchments, emphasizing the importance of parameter regionalization. The direct transfer of calibrated parameter sets from donor catchments to similar grid cells (scheme EXP1) performed best, although there was still a large performance gap between EXP1 and HBV-light calibrated against observed Q. The schemes with parameter sets obtained by simultaneously calibrating clusters of similar donor catchments (NC10 and NC58) performed worse than EXP1. The relatively poor Q estimation performance achieved by two (uncalibrated) macro-scale hydrological models suggests there is considerable merit in regionalizing the parameters of such models. The global HBV-light parameter maps and ancillary data are freely available via http://water.jrc.ec.europa.eu.