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Global-scale regionalization of hydrologic model parameters

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Current state-of-the-art models typically applied at continental to global scales (hereafter called macro-scale) tend to use *a priori* parameters, resulting in suboptimal streamflow (Q) simulation. For the first time, a scheme for regionalization of model parameters at the global scale was developed. We used data from a diverse set of 1787 small-to-medium sized catchments (10–10 000 km^2) and the simple conceptual HBV model to set up and test the scheme. Each catchment was calibrated against observed daily Q, after which 674 catchments with high calibration and validation scores, and thus presumably good-quality observed Q and forcing data, were selected to serve as donor catchments. The calibrated parameter sets for the donors were subsequently transferred to 0.5° grid cells with similar climatic and physiographic characteristics, resulting in parameter maps for HBV with global coverage. For each grid cell, we used the ten most similar donor catchments, rather than the single most similar donor, and averaged the resulting simulated Q, which enhanced model performance. The 1113 catchments not used as donors were used to independently evaluate the scheme. The regionalized parameters outperformed spatially-uniform (i.e., averaged calibrated) parameters for 79 % of the evaluation catchments. Substantial improvements were evident for all major Köppen-Geiger climate types and even for evaluation catchments $>$ 5000 km distance from the donors. The median improvement was about half of the performance increase achieved through calibration. HBV using regionalized parameters outperformed nine state-of-the-art macro-scale models, suggesting these might also benefit from the new regionalization scheme. The produced HBV parameter maps including ancillary data are available via http://water.jrc.ec.europa.eu/HBV/.