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| Title | Novel Parallel Computing Framework for Multi-Criterial calibration of WGHM | | |
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| Abstract |  |
| The WaterGAP Global Hydrological Model (WGHM) is a model to estimate the most important hydrological fluxes and water storage states of the continental water cycle for the entire globe, except Greenland and Antarctica. WGHM is used for analysing and understanding large-scale continental freshwater system dynamics and water resources, including their possible future changes with respect to environmental change and human water use. In order to improve the prediction performance of the model, the model parameters need to be calibrated against available observations, often of multiple variables, in hundreds of hydrologically heterogeneous river basins. However, two aspects make the multi-criterial calibration problem non-pragmatic to solve in view of the available computational resources: (i) due to the spatial heterogeneity of river basin properties, many different parameter sets become sensitive in different basins which results in considerable heterogeneity in the decision space, (ii) the number of available observables differs among the basins causing non-homogeneity in objective space. Traditional parallel schemes fail to appropriately address these features of the calibration/optimization problem. Here, we propose a new parallel framework of WGHM model calibration for more than thousand river basins worldwide with a recently developed Multi-Objective Evolutionary Algorithm (MOEA), Borg-MOEA. We show that by sharing model evaluations, i.e., the execution time, the proposed method can calibrate a large number of basins within practically feasible computation time while preserving all benefits of a Pareto based calibration approach. The time complexity of the proposed method is *O*(*n*), *n* being the number of model evaluations only, and is independent of the number of considered basins. | |