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Assessing multi-objective optimization algorithms for large-scale reservoir operating rules based on sensitivity analysis

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With more reservoirs built in China, the application of large-scale reservoir system has gained more attention. But non-commensurable objectives and high dimensionality exist in the optimization of large-scale reservoir system. To solve these problems, three steps exist in the derivation of large-scale reservoir operating rules: (1) simplification of large-scale reservoir operating rules by aggregation-decomposition model, (2) identification of sensitive parameters by sensitivity analysis for dimensional reduction, and (3) three multi-objective optimization algorithms have been compared for deriving the large-scale reservoir operating rules. Non-dominated sorting genetic algorithm II (NSGAII) is the benchmark of three algorithms. Weighted crowding distance replaced the traditional crowding distance in weighted non-dominated sorting genetic algorithm II (WNSGAII). And the Weighted Multi-Objective Adaptive Surrogate Model Optimization (WMO-ASMO), embedded with WNSGAII, could reduce the computational cost and speed the searching process. The large-scale reservoir system of Xijiang River Basin in China are selected as a case study. Results indicate that: (1) WNSGAII performs better than the well-known NSGAII because of the weighted crowding distance, and (2) WMO-ASMO outperforms NSGAII and WNSGAII in effectiveness and efficiency with same original model runs. Therefore, WMO-ASMO is proved to be more efficient and could provide better Pareto frontier.