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# A Diagnostic Assessment of Evolutionary Multiobjective Optimization for Water Resources Systems

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This study contributes a rigorous diagnostic assessment of state-of-the-art multiobjective evolutionary algorithms (MOEAs) and highlights key advances that the water resources field can exploit to better discover the critical tradeoffs constraining our systems. This study provides the most comprehensive diagnostic assessment of MOEAs for water resources to date, exploiting more than 100,000 MOEA runs and trillions of design evaluations. The diagnostic assessment measures the effectiveness, efficiency, reliability, and controllability of ten benchmark MOEAs for a representative suite of water resources applications addressing rainfall-runoff calibration, long-term groundwater monitoring (LTM), and risk-based water supply portfolio planning. The suite of problems encompasses a range of challenging problem properties including (1) many-objective formulations with 4 or more objectives, (2) multi-modality (or false optima), (3) nonlinearity, (4) discreteness, (5) severe constraints, (6) stochastic objectives, and (7) non-separability (also called epistasis). The applications are representative of the dominant problem classes that have shaped the history of MOEAs in water resources and that will be dominant foci in the future. Recommendations are provided for which modern MOEAs should serve as tools and benchmarks in the future water resources literature.