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How flexibility in urban water resource decisions helps to manage uncertainty?

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Abstract Uncertainty in future climate change and demand presents a significant challenge to the planning and management of urban water supply systems. One of the approaches to deal with uncertainty is to break large investments into a series of smaller decisions. In fact, spreading investments over time lets decision makers respond to unfolding contingences. This study considers the issue of identifying Pareto-optimal solutions for urban water supply that are robust in the face of uncertain future demand. The approach is based on the simulation of three plausible future demand scenarios to allow expected economic performance to be traded off against the variability in performance. A case study demonstrates the feasibility of this approach for a complex urban water supply system. The primary objective is to minimize the expected present worth of costs associated with infrastructure decisions, operating rules and drought contingency plans. By introducing a second objective which minimizes the difference in present worth costs across future demand scenarios, the trade-off between efficiency and robustness is identified. The results show that a significant change in investment and operating strategy occurs when the decision maker expresses a stronger preference for robustness.

Key words multi-objective optimization; demand growth; urban water management; scheduling