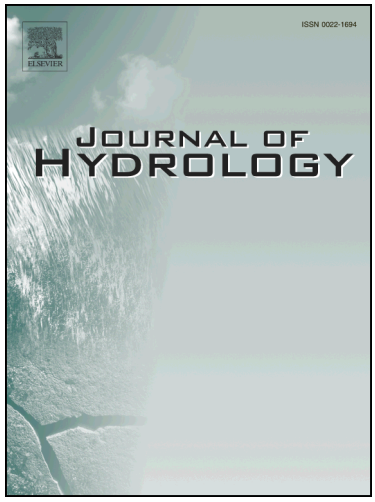

Research papers

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A risk-based multi-objective model for optimal placement of sensors in water distribution system

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Abstract

In this study, a new stochastic model based on Conditional Value at Risk (CVaR) and multi-objective optimization methods is developed for optimal placement of sensors in water distribution system (WDS). This model determines minimization of risk which is caused by simultaneous multi-point contamination injection in WDS using CVaR approach. The CVaR considers uncertainties of contamination injection in the form of probability distribution function and calculates low-probability extreme events. In this approach, extreme losses occur at tail of the losses distribution function. Four-objective optimization model based on NSGA-II algorithm is developed to minimize losses of contamination injection (by CVaR of affected population and detection time) and also minimize the two other main criteria of optimal placement of sensors including probability of undetected events and cost. Finally, to determine the best solution, Preference Ranking Organization METHod for Enrichment Evaluation (PROMETHEE), as a subgroup of Multi Criteria Decision Making (MCDM) approach, is utilized to rank the alternatives on the trade-off curve among objective functions. Alsom sensitivity analysis is done to investigate the importance of each criterion on PROMETHEE results considering three relative weighting scenarios. The effectiveness of