

## **Multi-criteria multi-stakeholder decision analysis using a fuzzy-stochastic approach for hydrosystem management**

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**Abstract** The conventional methods used to solve multi-criteria multi-stakeholder problems are less strongly formulated, as they normally incorporate only homogeneous information at a time and suggest aggregating objectives of different decision-makers avoiding water–society interactions. In this contribution, Multi-Criteria Group Decision Analysis (MCGDA) using a fuzzy-stochastic approach has been proposed to rank a set of alternatives in water management decisions incorporating heterogeneous information under uncertainty. The decision making framework takes hydrologically, environmentally, and socio-economically motivated conflicting objectives into consideration. The criteria related to the performance of the physical system are optimized using multi-criteria simulation-based optimization, and fuzzy linguistic quantifiers have been used to evaluate subjective criteria and to assess stakeholders' degree of optimism. The proposed methodology is applied to find effective and robust intervention strategies for the management of a coastal hydrosystem affected by saltwater intrusion due to excessive groundwater extraction for irrigated agriculture and municipal use. Preliminary results show that the MCGDA based on a fuzzy-stochastic approach gives useful support for robust decision-making and is sensitive to the decision makers' degree of optimism.

**Key words** multi-criteria decision analysis; fuzzy-stochastic approach; coastal hydrosystem management