Geophysical Research Abstracts
Vol. 16, EGU2014-6211-1, 2014
EGU General Assembly 2014

A fuzzy stochastic framework for managing hydro-environmental and socio-economic interactions under uncertainty

Yohannes Hagos Subagadis, Niels Schütze, and Jens Grundmann
Germany (yohannes.subagadis@mailbox.tu-dresden.de)

An amplified interconnectedness between a hydro-environmental and socio-economic system brings about profound challenges of water management decision making. In this contribution, we present a fuzzy stochastic approach to solve a set of decision making problems, which involve hydrologically, environmentally, and socio-economically motivated criteria subjected to uncertainty and ambiguity. The proposed methodological framework combines objective and subjective criteria in a decision making procedure for obtaining an acceptable ranking in water resources management alternatives under different type of uncertainty (subjective/objective) and heterogeneous information (quantitative/qualitative) simultaneously. The first step of the proposed approach involves evaluating the performance of alternatives with respect to different types of criteria. The ratings of alternatives with respect to objective and subjective criteria are evaluated by simulation-based optimization and fuzzy linguistic quantifiers, respectively. Subjective and objective uncertainties related to the input information are handled through linking fuzziness and randomness together. Fuzzy decision making helps entail the linguistic uncertainty and a Monte Carlo simulation process is used to map stochastic uncertainty. With this framework, the overall performance of each alternative is calculated using an Order Weighted Averaging (OWA) aggregation operator accounting for decision makers' experience and opinions. Finally, ranking is achieved by conducting pair-wise comparison of management alternatives. This has been done on the basis of the risk defined by the probability of obtaining an acceptable ranking and mean difference in total performance for the pair of management alternatives. The proposed methodology is tested in a real-world hydrosystem, to find effective and robust intervention strategies for the management of a coastal aquifer system affected by saltwater intrusion due to excessive groundwater extraction for irrigated agriculture and municipal use. The results show that the approach gives useful support for robust decision-making and is sensitive to the decision makers' degree of optimism.