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A combined geostatistical-optimization model for the optimal design of a groundwater quality monitoring network

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Monitoring networks provide essential information for water resources management especially in areas with significant groundwater exploitation due to extensive agricultural activities. In this work, a simulation-optimization framework is developed based on heuristic optimization methodologies and geostatistical modeling approaches to obtain an optimal design for a groundwater quality monitoring network. Groundwater quantity and quality data obtained from 43 existing observation locations at 3 different hydrological periods in Mires basin in Crete, Greece will be used in the proposed framework in terms of Regression Kriging to develop the spatial distribution of nitrates concentration in the aquifer of interest. Based on the existing groundwater quality mapping, the proposed optimization tool will determine a cost-effective observation wells network that contributes significant information to water managers and authorities. The elimination of observation wells that add little or no beneficial information to groundwater level and quality mapping of the area can be obtain using estimations uncertainty and statistical error metrics without effecting the assessment of the groundwater quality. Given the high maintenance cost of groundwater monitoring networks, the proposed tool could used by water regulators in the decision-making process to obtain a efficient network design that is essential.