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Groundwater quality modeling using geostatistical methods and artificial neural networks: a case study of the Western Middle Cheliff alluvial plain in Algeria

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ABSTRACT

The aim of the current research was to determine the most appropriate model for estimating potable groundwater in a geographical area based on the water quality index (WQI) using the Western Middle Cheliff alluvial plain in Algeria as a case study. The spatial distribution of the WQI in a graphical display was determined using geostatistical ordinary kriging (OK), and artificial neural networks (ANN) which were integrated with a geographical information system. Results indicated that the ANN model with its high correlation coefficient (*R*) and low error rate had a greater accuracy than OK in estimating the WQI. Based on the WQI classification index, 60% of water samples were found to be poor and 34% in the excellent and good categories. Among the kriging models, the Gaussian version was specified as the best for determining the WQI. The findings indicated that the ANN model with 11 hidden layers had the greatest accuracy. The root mean square error, the mean absolute error, and *R* values were 2.347, 0.71, and 0.9998, respectively compared to the kriging model. The geostatistical model, with its relatively lower precision, was limited by the number of samples. It was difficult to discover the relationship between the spatial location of sampling and the variable. Whereas intelligent models such as ANN, were more capable of obtaining this connection. The significance of this analysis shows that for semi-arid regions, modeling using ANN is an important tool for effective groundwater quality management.

Keywords: Middle Cheliff alluvial plain; Groundwater quality: Geostatistics; Artificial neural network; Prediction of water quality index; Kriging model

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