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DEEP NEURAL NETWORK PREDICTION AND GEOSPATIAL MAPPING OF GROUNDWATER CORROSION/SCALING POTENTIAL

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Abstract

Groundwater is an essential natural resource that is vulnerable to various factors that affect its quality and usability. One of these factors is the corrosion and scaling potential (CSP), which represents the tendency of groundwater to corrode or scale metal pipes and structures. Although groundwater quality is widely studied, research specifically focused on the CSP of groundwater remains scarce. Moreover, the application of artificial intelligence for predicting CSP indices is largely limited. Hence, in this study, deep learning neural network (DNN) models were employed to predict the CSP of groundwater in the Serbian Banat plain. A total of ninety-six groundwater samples were collected and analyzed for twenty-one physico-chemical parameters. Five different CSP indices were utilized: the Langelier Saturation Index (*LSI*), Puckorius Scaling Index (*PSI*), Larson-Skold Index (*LS*), Ryznar Stability Index (*RSI*), and Aggressive Index (*AI*). Each index was modeled using a backpropagation-based multilayer perceptron DNN. The DNN's predictive performance was high, with R^2 values of 0.959, 0.972, 0.970, 0.902, and 0.966 for *LSI*, *RSI*, *PSI*, *LS*, and *AI*, respectively. Additionally, the DNN model demonstrated low mean absolute error ($MAE \leq 0.08$) and root mean square error ($RMSE \leq 0.138$) values for all five indices. Using Geographic Information System (GIS) techniques, the five CSP indices predicted by the DNN were mapped across the study area, indicating a large spatial variation in groundwater characteristics. In general, a DNN model coupled with GIS mapping can be employed as a useful tool for the assessment and management of groundwater CSP in an area.

Key words: artificial neural network, corrosivity, GIS, scale forming, water aggressiveness

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