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Nonlinear autoregressive neural networks to predict fracturing fluid flow into shallow groundwater

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Hydraulic fracturing fluid migration from the deep subsurface along abandoned wells may pose contamination threats to shallow groundwater systems. This study investigates the application of a nonlinear autoregressive (NAR) neural network to predict leakage rates of fracturing fluid to a shallow aquifer in the presence of an abandoned well. The NAR network was trained using the Levenberg-Marquardt (LM) and Bayesian Regularization (BR) algorithms. The dataset employed in this study includes fracturing fluid leakage rates to the aquifer overlying the Posidonia shale formation in the North German Basin (Taherdangkoo et al. 2019). We evaluated the performance of developed models based on the mean squared errors (MSE) and coefficient of determination (R^2). The results indicate the robustness and compatibility of NAR-LM and NAR-BR models in predicting fracturing fluid leakage to the aquifer. This study shows that NAR neural networks are useful and hold a considerable potential for assessing the potential groundwater impacts of unconventional gas development.

References

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