Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.8820

Development of data-driven models for estimating the probability of high-concentration occurrence of naturally occurring radioactive materials in groundwater

JINA JEONG[1], JIHO JEONG[1] AND SUNGWOOK CHOUNG[2]

[1]Kyungpook National University
[2]Korea Basic Science Institute
Presenting Author: jeong.j@knu.ac.kr

High-concentration occurrence probability estimation models was developed to estimate ^{238}U and ^{222}Rn in groundwater using in-situ monitoring data (i.e., geological rock types, well depth, T, pH, Eh, EC, DO, and HCO_3). The estimation models are based on a non-linear data-driven method to improve their effectiveness for applications in different estimation cases using various in-situ monitoring data. When developing the models, most sensitive in-situ monitoring data are selectively utilized to train the models, where various statistical and correlation analyses are applied to overcome challenges, including model overfitting during training, a highly nonlinear correlation between input and target variables, and poor training due to low-quality monitoring data. Based on statistical analysis results, all input variables, except for Eh and well depth, are used for developing the ^{238}U and ^{222}Rn estimation models, respectively. Actual data collected from groundwater quality monitoring networks of South Korea from 2007 to 2019 are used to validate the developed models. Although it is difficult to characterize ^{222}Rn occurrence using the geochemical conditions of groundwater because the gaseous phase behavior of ^{222}Rn highly depends on structural geology, the ^{222}Rn estimation model achieves reasonable performance with more than 70% accuracy. In addition, compared to the ^{222}Rn estimation model, the ^{238}U estimation model achieves higher classification accuracy with approximately 80%. Consequently, we can confirm that the developed estimation models can be effectively used to estimate the probability of high-concentration risk of ^{238}U and ^{222}Rn in groundwater. Conclusively, the practical applicability of the developed models is wide, as the models have been developed using direct observable and real-time data.