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Inverse modeling on hydraulic conductivity in groundwater flow model using groundwater ages of ^{4}He and ^{14}C

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^{4}He and ^{14}C have been recognized as useful tracers to evaluate the groundwater age. Even though the methodologies for evaluating groundwater age have been established in past studies, applying groundwater age data to the calibration of numerical models has not been well investigated so far. The purpose of this study is to improve a model calibration by using not only hydraulic head but also groundwater ages evaluated from various natural tracers. Hydraulic conductivities in a groundwater flow model were estimated from ^{4}He and ^{14}C in addition to hydraulic head data.

The study area is the Tono area, where has been investigated by Japan Atomic Energy Agency. There are many data, which are hydraulic head and groundwater ages. Here, hydraulic conductivities in groundwater model are estimated by using these data. The numerical model was constructed using FEFLOW, which can simulate groundwater flow and mass transport. ^{4}He and ^{14}C were simulated by considering in situ production and radioactive decay, respectively. Inverse analyses were started at different initial values.

Hydraulic conductivities estimated by using hydraulic head, ^{4}He and ^{14}C were almost the same as those observed by in situ hydraulic conductivities tests. The estimation errors of hydraulic conductivities using head, ^{4}He and ^{14}C were smaller than that using only hydraulic head. Furthermore, the inverse analyses using hydraulic head, ^{4}He and ^{14}C gave almost the same estimation results regardless of the different initial values. Thus, it was thought that the addition of groundwater age can result in unique solutions of hydraulic conductivities. These results show that the addition of groundwater ages could contribute estimation for hydraulic conductivities.

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