



Tracking sources of nitrate in groundwater in the Jeju volcanic island, Korea, through monitoring spatio-temporal variations of hydrogeochemistry and isotope signatures

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Groundwater is the sole source of water supply for about 660 thousand residents in Jeju volcanic island, Korea. Since the early 1990s, nitrate contamination in groundwater has become serious in the western part, probably due to agricultural and livestock activities. To develop proper management measures, this study was initiated to track sources and to comprehend the fate of nitrate in groundwater through the monitoring spatio-temporal variations of hydrogeochemistry and isotopic signatures.

Groundwater samples were collected quarterly from Sep. 2016 to Oct. 2018, and the study area became gradually expanded to upstream area while tracking the sources. In July 2017, five multi-depth monitoring wells were implemented to confirm the direct input of surface contaminant vertically through the known low-K layer. Water samples were analysed for anions (Cl, NO₃, SO₄, HCO₃), cations (Na, K, Ca, Mg, Fe, Mn) and stable isotopes ($\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{15}\text{N-NO}_3$, $\delta^{18}\text{O-NO}_3$).

Based on the monitoring results, 45% of deep groundwater samples (about 100m in depth) have NO₃-N concentrations of >10mg/L, mainly from fertilizers. Contaminated groundwaters have different hydrochemical compositions from unpolluted groundwaters, implying that preferential flow paths could be developed. The time-series of water-level fluctuations show that the possibility of surface contaminants migrating through the low-K layer is low. And thus, nitrate from the surface sources could get into the deep groundwater through the poorly grouted wells and by the inflow of contaminated groundwater from the upgradient areas. Presently, we are studying the relationship between seasonal precipitation and nitrate fluctuations in groundwater, and are tracking the recharge areas using isotope signatures of precipitation at different seasons and altitudes. Final results will be presented at the Conference.