Contribution of nitrate sources in the complex river catchment: An integrated nitrate dual isotopes and hydrological model approach

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We investigated the contribution of nitrate sources in the Geum-ho River (South Korea) as an example of the complex river catchment which is influenced from various nitrate sources such as agriculture, urban, waste water treatment plant (WWTP) and forest, using nitrate dual isotopic compositions ($\delta^{15}N_{NO3}$ and $\delta^{18}O_{NO3}$) and the modelling approach (IsotopeR). Nitrate concentrations ranged from 0.02 to 124 μM showed higher at WWTPs than those of other sources. $\delta^{15}N_{NO3}$ and $\delta^{18}O_{NO3}$ ranging from 3.90 to 15.51 ‰, and -9.86 to 12.09 ‰ respectively, indicating different isotopic values of each source, associated with discriminative nitrate origins in terms of the land-use types. These isotopic patterns showed well agreement with the nitrate dual isotopic variations which were previously classified into various nitrate end-members such as inorganic nitrogen fertilizer, soil nitrogen and sewage (Kendall et al., 2007). Based on dual isotopic data, the modelling result using IsotopeR indicated that nitrate sources loaded into the Geum-ho River derived from three land-use types (46 % to 65 % for agriculture and urban, 7 % for WWTP, and 40% to 55 % for forest). However, the isotope mixing model does not consider any isotope alteration which is possibly caused by biogeochemical processes, and may lead to miscalculation of each source contribution. Hence, in order to estimate more accurate contributions of each nitrogen sources, we cross-checked the results of isotope mixing model using hydrological model including various input factors (e.g. weather condition, soil type, basin slope and water flow).

[1] Kendall *et al*. (2007) *Book: Stable Isotopes in Ecology and Environmental Science*, chapter 12.