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Hydrology and Earth System Sciences
Discussions

Interactive comment on "High-frequency NO_3^- isotope (δ^{15}N, δ^{18}O) patterns in groundwater recharge reveal that short-term land use and climatic changes influence nitrate contamination trends" *by* Martin Suchy et al.

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Referee #1

Major comments:

Due to its clear structure and to the comprehensible English, the author's thoughts are easy to follow and the manuscript is good to read. The presentation of data in figures and tables could be improved (remarks below-mentioned). The authors explained clearly the gaps of knowledge and their objectives in the introduction section. The used

data including a five-year monitoring of nitrate concentrations (plus chloride as conservative tracer) and corresponding isotopic signatures for 19 monitoring wells presents an interesting dataset for a region which is partly impacted by high agricultural land use and poultry.

Possibly, it would be useful to generate a depth profile which represents the specific sampling depth for each monitoring well. Thereby, different nitrate sources which appear relatively close (Figure 4, 91-03 und 91-07) could perhaps better explained. RESPONSE: Table 4 shows the average water column height in meters as defined at the mid-screen depth below average static water, which is more relevant to the 3H-3He groundwater 'ages' than a depth profile would provide, due to large variations in unsaturated zone thickness across the aquifer. We elaborate our reference the water column height values in Table 4.

Does exist a direct connection between dominant landuse type (blueberry, raspberry, poultry etc.) in the surrounding of the monitoring well and major nitrate source or rather microbial process dynamics? Please try to explain in more detail dominate N-sources for wells with a small distance but different d15N source grouping. RESPONSE: Field specific nutrient management practices and land use are more dominant than microbial drivers in this highly aerobic aquifer (assuming the reviewer is hinting at potential anaerobic denitrification). Wells are mostly located adjacent to fields with different land use practices as depicted in Fig 4, so the groundwater flow direction is also relevant. We already strongly emphasize the close connection of nitrate concentration in recharge and its isotopic values to changeable near-field land use practices.

To get insights into residence time and the connection to surface water, it would have been nice to additionally measure deuterium and oxygen isotopes in water. Sad, that these additional variables are not part of this monitoring concept. RESPONSE: Previous publications (i.e. Wassenaar 1995) reported extensive d18O and d2H for groundwater across the aquifer at all depths that show characteristic fall and winter wet season dominated recharge and very little isotopic variance (∼+/-0.4 permil for 18O). The

stable isotopes reveal the relative importance of seasonality of recharge compared to precipitation, but do not provide any control on groundwater residence time like 3H-3He does. Of course, it would have been nice to include many more geochemical covariates, but our budget was limited and focused on primary aims.

The manuscript represents an interesting five-year dataset which interpret the major nitrate sources on a spatial and temporal scale for the ASA which is highly impacted by cultivation and poultry input. The interpretation of the results is precise and clear.

Some figures need further improvement. Despite the above-mentioned questions and comments, I'd suggest accepting the manuscript for publication in the Journal HESS if the authors are willing to address those questions and to apply major revisions.

Minor comments:

In chapter 3.1, the authors describe the dissolved oxygen content (DO – used abbreviation not explained) which is usually higher than 3 mg L-1. Unfortunately, I can't find further information in the Supplementary Table which is referred to. RESPONSE: Agree. We added dissolved oxygen concentrations for each sampling to the Supplemental Table.

Chapter 2.2: "The analytical uncertainty for _8O was $\pm$1.0‰$'' $ $--correct\_18ORESPONSE : Corrected.$

Chapter 3.2: first line "+7.9 $\pm$ .11‰$'' $--correct/completethelastnumber(0.11\ RESPONSE\ Corrected.$

Chapter 3.2: What is the "Bayesian VVV"? Please briefly explain. RESPONSE: Agree. Modified the text to clarify.

Figure 2A: It would be useful to see typical d15N signatures for dominate nitrate sources (endmember) on the left site of the diagram. Is it possible to add arrows with the typical range for manure, soil-N and synthetic fertilizer? RESPONSE: Figure modified.

Figure 3: Correct the axes labels (delta, shift and units in breaks) RESPONSE: Corrected.

Figure 4: ECCC sites are presented in the legend but I can't find one single red dot in the scheme. Consider the uniform use of capitalization. RESPONSE: Agreed. We removed the red dots in Figure 4.

Figures generally: What is the reason of the used nomenclature from the monitoring wells? Is it necessary to use these abbreviations? RESPONSE: Disagree. All previous published studies used these well identifiers. Re-labelling well names will cause confusion going forward by requiring an additional 'key' to reference previously published datasets.

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