

Interactive comment on “Nitrogen attenuation, dilution and recycling at the groundwater – surface water interface of a subtropical estuary inferred from the stable isotope composition of nitrate and water” by Sébastien Lamontagne et al.

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We would like to thank the reviewer for his/her comments and we offer to address his/her concerns as outlined below.

1. Disclosure and data location: Not revealing the exact site location struck a nerve with both reviewers. We agree that this is not ideal but have to respect the wishes of the funder and landholder in this regard. The exact site location is frequently not revealed in scientific papers from contaminated sites (see Journal of Contaminant Hydrology,

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for example). We have discussed the matter with the HESS Editors and have come up with a compromise. We will provide additional details about the physical setting and add a statement in the Introduction about the requirement from the landholder not to have the exact location revealed. If there is a need to revisit the site by third parties for additional measurements, that could be arranged through a discussion with the landholder. This is one of our motivations to publish this work, to get a second opinion from our colleagues about the potential processes operating at this site. Likewise, we can also arrange to have some of the data referred to as 'unpublished' accessible if required.

2) DNRA: We do list DNRA as one of the other mechanisms that may be operating at the site (line 2.35) but indeed do not evaluate how this process could impact on isotopic signatures in any detail. Because both NH_4^+ and NO_3^- are consumed within the profiles, we put the emphasis on denitrification and anammox. However, it is not unreasonable to expect some level of DNRA at the site. We propose to address this by; 1) including DNRA more explicitly in Section 1.1 (review of key biogeochemical processes in intertidal environments), 2) referring to the literature on DNRA more extensively, and 3) discussing how the occurrence of DNRA would impact on isotope signatures.

Minor comments

3.25 What river?: As discussed above we cannot reveal the exact site location, including the river's name.

4.5: Rubber mats: During a preliminary trial, we had observed that the substrate was generally soft underfoot, possibly owing to the large upward hydraulic gradients. This was addressed by minimising movement to a minimum, deploying rubber mats, using harder substrate nearby whenever possible, and using a fairly coarse vertical spatial discretization (25 cm). There was still a noticeable disturbance of the sediments by the end of profiling but it was minimal at the drive point itself. A more detailed look at the scale of the hyporheic zone (cm) would require a different approach but we are

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reasonably confident that at the scale of our measurements (tens of cm) the level of disturbance was acceptable.

4.25. Filtration of nitrate samples: The author responsible for the preparation of nitrate samples is away at present but we will clarify this in the revision.

9.24. Isotopic signature for groundwater: It would indeed be preferable to know the isotopic composition of 'pristine' fresh groundwater at the site. The isotopic composition for groundwater further inland at the site has not been measured (yet). However, because N contamination is widespread at the site, determining the 'pristine' isotopic signature could be difficult anyway. The next preferable option would be local rainfall, but we unfortunately only realised that groundwater isotopic composition may not be conservative at the site late in the data interpretation stage. To develop a local meteoric water line for the site would also require a monitoring program of several years. The use of Sydney precipitation and groundwater is the third best option and the only practical one at this stage. The site is reasonably close to Sydney to use it as a proxy. We think we are providing reasonable evidence for groundwater not to be conservative at this site. We are planning to revisit this issue in more detail in the future.

Figures: We will adjust the figures according to the suggestions from both reviewers.

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