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Biogeosciences Discussions

Interactive comment on "Stable isotopes of nitrate reveal different nitrogen processing mechanisms in streams across a land use gradient during wet and dry periods" *by* Wei Wen Wong et al.

Anonymous Referee #2

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Wong and co-authors present a study of stable isotopes of nitrate from five streams within the same catchment area in Southeast Australia sampled during wet and dry periods. The five streams show different degrees of land use intensities. The aim is to reveal different sources and transformation processes of nitrate compared between rainfall patterns through the isotopic composition (d15N-NO3- and d18O-NO3-). Results show that differences between wet and dry periods can be explained by the dominance of different sources on the isotopic composition. During wet periods artificial fertilizer was probably the main source, whereas nitrified organic matter in sediment and nitrified manure dominated the sources during dry periods. The manuscript is well written and presents the results in a logical order. The figures illustrate the findings

very well. This novel dataset is suitable for publication in Biogeosciences, however, there are some points that should be addressed by the authors.

Main points:

1) To study the impact of rainfall on isotopic composition in a more rigorous way, it would have been interesting to use samplings with different amounts of rainfall in the previous days (instead of only differentiating between wet and dry periods) in order to see whether rainfall and isotopic composition could be correlated. At least the authors should explain why such a study was not carried out.

2) Could the data not have been explored more thoroughly, e.g. other statistical methods than linear regression in order to identify multiple sources? What about isotope mixing and emission modeling for source identification?

3) Significant correlations with very low r2 for isotopic composition and % agriculture (Fig. 4) are used as argument for "dominance of anthropogenic nitrogen inputs within the catchment". The discussion should include a more detailed comparison to studies which found a similar but much stronger correlation between d15N of nitrate and land use.

4) Is there any information to take away from individual samplings within the same stream? There is no information on river flow rates, for example. Could patterns of isotope data within the streams be explained by mixing of sources or in-stream processing?

Minor points:

Page 2 line 11 : Kendall 2007 ; "et al." is missing

Page 2 line 21-24: please explain in more detail in which way rainfall patterns are different in the southern hemisphere compared to the northern hemisphere.

Page 2 line 28: please delete space in "samplin g".

Page 3 line 21-23: what are the criteria to give the amount of rainfall for 5 days (5-10 days) before sampling of wet periods (dry periods)? Following up, what is the residence time of water in the aquifer and in the river?

Page 4 line 10: a figure with some additional water quality parameters would be nice to include as a supplementary material.

Page 4 line 16-18: how many samples of fertilizer and cow manure were analysed? Please specify.

Page 6 line 14/15: what about atmospheric deposition? It is only mentioned on page 7 line 1. Couldn't mixing lead to a depletion of the d18O, with NO3- from atmospheric deposition still contributing partly to the signal?

Page 6 line 27: delete the d of "comprised".

Page 7 line 8-10: there is no statistic evidence given by the authors to show that there is an actual trend, so this should be rephrased.

Page 7 line 10-12: for the dry periods there are at least 6 data points with NO3- conc. > 50 μM, so "consistently lower" (than 36 μM) is not correct.

Page 7 line 13: replace "entered" by "entering".

Page 7 line 21/22: please state clearly, that although significant, correlation coefficients r2 are 0.2 and 0.39, respectively, so quite low. From there on it is obvious that the relationship between d15N and % agriculture is not evident at all from this study. This has to be expressed more clearly.

Page 7 line 24-26: the comparison to the other studies has to be made more in detail. For example, Voss et al (2006) observed a significant correlation for 11 streams and weighted monthly means of d15N and % agriculture. If comparable to this data, it should be Figure 7 from this study (if it is correct that it represents average values per stream). And for this representation, there is no significant correlation.

Page 8 line 18-20 (and following sentences): Give first all the evidence that allows you to conclude that in-stream processing was not the dominant process for regulating the isotopic composition. These arguments could be supported by a more detailed discussion of the relevant literature.

Page 8 line 20-22: Put figures of d18O vs [NO3-] and d18O vs d15N for individual streams in supplementary material to support your argument.

Page 9 line 23: add "be" in between "subsequently" and "nitrified".

Page 10 line 19-21: as stated above, according to figure 4 there is no significant correlation for [NO3-] and percentage agriculture and r2 for the corr. between d15N and percentage agriculture are low, so please rephrase this conclusion. Similarly please rephrase the related sentence in the abstract (page 1 line 17/18).

Figures

Fig. 1: indicate percentage agriculture for each sampling site.

Fig. 2: For the Watsons river the "distance from WPB" does not correspond to the values from Fig. 3 (max= 30 km).

Fig. 4: use A and B for the two panels. In the lower panel indicate which trend curve corresponds to which dataset.

Fig. 7: Are these average values per site? If so, please indicate the SD. For Bass river (dry period) the value is somewhat high compared to Fig. 6. Please explain.

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