

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-30

Anonymous Referee #2

Referee comment on "Tracing the source of nitrate in a forested stream showing elevated concentrations during storm events" by Weitian Ding et al., Biogeosciences Discuss.,
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Review of the manuscript entitled "Tracing the source of nitrate enriched in a forested stream during storm events" (MS No: bg-2022-30) by Ding et al.

The study provides a rather comprehensive analysis of nitrate dynamics over a temperate forest-stream system, with emphasis on sources of stream nitrate during storms. The results are potentially publishable. However, the way the results are presented stops me from recommendation at the present form. Furthermore, it is unclear to me to what extent the results of the concluded nitrate saturation/release in temperate forests can impact our knowledge of nitrate dynamics. Major comments follow.

- Abstract: it is not clear to me how the "stable" "unprocessed" atmospheric nitrate can be used to evaluate nitrogen saturation in forested catchments. I'm also not able to follow why the conclusion of "the storm events have little impacts on the concentration of unprocessed atmospheric nitrate in the stream" is important and how the conclusion is arrived. Overall, I'm not able to follow why "unprocessed atmospheric nitrate fraction" in river water is so important that the authors have to repeat and emphasize many times in the manuscript. My understanding is that with finite fraction of atmospheric nitrate, one can utilize the unique triple oxygen isotope composition in atmospheric nitrate for riverine nitrogen dynamics study, which is what the group did in the past years. The fraction of "unprocessed atmospheric nitrate" represents a balance of release of soil nitrate and atmospheric deposition.
- Line 25-30: no flux estimation is provided, and so it is not clear how the statement of "the annual export flux of unprocessed atmospheric nitrate relative to the annual

deposition flux" is obtained.

- Overall, from my understanding, the value of NO₃_atm is quite stable. The values of the 3 storms are 1.6+/-0.4, 1.8+/-0.4, and 2.1+/-0.4 uM, while that during non-storm time is 2.2+/-0.6 uM. Isn't it more valuable to discuss storm and non-storm samples in the same context of nitrogen saturation and dynamics?

Specific comments

- The term "enriched" may cause confusion. In isotope community, often the term is used for indicating an increase in isotope values, i.e., increase in the abundance of heavier isotopic compounds.
- Line 121: M_atm, D_atm are not defined till much later in section 4.3. Even in section 4.3, the two variables are not clearly defined and explained. Instead, the authors referred to their earlier paper (Nakagawa et al., 2018). The authors are fine to have the details in their previous paper but the authors have to at least explain the meaning of the two.
- M_atm (or NO₃_atm) is obtained by assuming a certain number of D₁₇O_atm, which is not measured in this work. And so, D_atm is not known. Please elaborate and explain why M_atm/D_atm is little affected by storms and how this conclusion is arrived.
- Line 163: Please discuss whether 1-2 weeks of storage would affect the sample nitrate concentration and isotope compositions.
- Line 428, enhancement of D₁₇O on 2019/1/31: I did a simple estimate by assuming that the snow nitrate has the same D₁₇O value as the atmospheric at 26 per mil and took 2018/12/28 as an initial state before snow melting. From 2018/12/28 to 2019/1/31, the D₁₇O value increases by 7 per mil, implying ~30% (=7 per mil/26 per mil) of stream nitrate is from snow melting. This increase however is not reflected in the water flow rate (from 110.0 to 117.3 L/min only). Please elaborate and provide a more quantitative explanation.
- To be more complete, for routine sampling analysis and discussion, please include precipitation and do the same analysis as the storm events.
- Fig 4: it seems there are two groups (one having smaller slope and one steeper) of D₁₇O vs. 1/[NO₃-] in the storm event II. Any reason for that?