

Comments on “Nitrate isotope investigations reveal future impacts of climate change on nitrogen inputs and cycling in Arctic fjords”

By presenting hydrographic data, macro nutrients, and isotopic compositions of nitrate, Santos-Garcia et al. examined the influence of tidewater glaciers on nitrogen inputs and cycling in two fjords in Svalbard during the summertime. Overall, this study is a good demonstration of the application of nitrogen isotopes and nutrients in Arctic fjords to reveal the sources, cycling, and possible response of these nutrients to future changes in two well-characterized fjords. The work could be valuable to improve our understanding of the influence of climate change on polar region nutrient cycles. However, the structure of this manuscript needs to be further condensed and reorganized. The comments are as follows:

Major concerns:

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The **Introduction section** generally gives a good background to the study, but is structurally too long and does not flow smoothly from one section to the next (a subsection in the introduction is also awkward). It is recommended that the introductory section (e.g. Section 1.1 is too redundant) be streamlined and that the final section of the introduction briefly summarizes the shortcomings of current nutrient or nitrogen isotope studies in the Arctic fjords and surrounding waters to better introduce the purpose of the study.

Section 3.2 titled Nutrient concentrations and isotopic ratios actually contains descriptions of parameters such as temperature and salinity, while other parameters in Figures 4 and 5 (e.g. dissolved oxygen and chlorophyll) are not described. It is suggested that this could be split into two sections on environmental settings and nutrient/nitrogen isotope results respectively.

Throughout **the discussion section**, the language lacks conciseness, and the same idea or description appears repeatedly. For example, in lines 505-510, statements like “nitrate uptake is complete with near-zero nitrate values” appear several times, and similar phenomena occur repeatedly throughout the text. The narrative and language of

the article needed major improvement, and **the manuscript needed significant refinement of language and reduction in length**. Another suggestion is to consider merging some of the sub-section and renaming the subheadings. For example, the analysis in 4.1 and 4.2 is mainly both derived from the nutrient stoichiometry relationship, these two sections can be combined and the description of 4.2 needs to be simplified.

Section 4.3, where it is mentioned that the slope deviation from 1 in Figure 13 may be due to the regeneration of nitrate, i.e., the occurrence of nitrification, is it possible to assess the magnitude of this process? Does the fact that nitrification may introduce ^{15}N signatures from particulate nitrogen mineralization have an impact on the assessment of the source of nitrate? These need to be carefully evaluated.

In general, the article deals with two well-characterized fjords, involving relatively trivial descriptions of features. **Consider using a table or conceptual figure** to summarize the commonalities, differences, and responses of the two fjords in this paper in terms of hydrology and nutrient cycling under climate change.

Specific comments:

1. **Figures 1-3** are suggested to be merged into one figure, and Figure 1 should be labeled with latitude and longitude.
2. For the paragraphs, some indent the first line and some paragraphs don't, please keep the format consistent.
3. **Line 42:** "Nitrate is the predominant form of fixed N..." should be "Nitrate (NO_3^-) is the predominant form of fixed nitrogen (N)..."
4. **Line 70:** in Eqn.2 " $^{14}\text{k}/^{15}\text{k}$ " should be " $^{14}\text{k}/^{15}\text{k}$ "; **line 229** " 1.8 ± 0.2 (USGS 34)" should be " 1.8 ± 0.2 (USGS 34)"
5. **Line 455:** "The degree of stratification, and its associated nutrient dilution effect, can be ruled out as salinity alone could not explain the isotope effect in Figure 12." How was this conclusion reached? For example: if the isotope effect is due to the above factors, how should salinity be reflected in this graph?
6. **Figure 13a** Why is it important to represent depth by color, this message doesn't seem to be utilized much, at the moment this chart is a bit confusing, could different

colors be used to represent groups?