Response to reviewer document

We sincerely appreciate the feedback from the reviewer, which has improved the quality of our manuscript. Following the reviewer's suggestions, we have included a more detailed explanation of the methods (including reference materials, and quality checks) for the trace metal analysis. We have also expanded the discussion of nutrients in the results section. We believe these revisions have improved the manuscript.

Reviewer 1

Main comments:
I would like to see more details regarding the trace metal and nutrient analyses in the methods section.

Line 138 states that the samples were calibrated against a "pre-made solution". I think the authors need to give more details about this solution (commercial? In-house? What was its composition?).
Thank you for the comments on the trace metal methodology section. We agree with the reviewer that adding a more detailed description of the methods will ensure replicability and transparency for the reader. We have added a more detailed description of the laboratory methods used to analyse the trace metal samples as follows (Line 137):

The elemental concentration of trace metals was measured on Perkin Elmer Avio 200 Inductive Coupled Plasma-Optical Emission Spectrometer (ICP-OES) at the Sustain Lab (Danish Technical University, Denmark). Based on repeated measurement of certified in-house standards (SCP Science EnviroMAT), the relative standard deviation (RSD) of the measurements was calculated.

In particular, matrix matching is very important for ICP measurements (i.e., making sure that calibration standards have the same composition, as close as possible, to samples). This means that the calibration standards would need to be made up to an appropriate salinity using artificial seawater (and different standards may well be needed for river vs fjord samples). It would be good to verify if the authors have considered such matrix effects (at least show that they do not impact the accuracy and precision of the final measurements).

The sea water samples were diluted 10 times to decrease the salinity, and the calibration curves and standards were prepared in a corresponding matrix solution made with artificial pure NaCl. This has been added following the text from the comment above, on line 143.

Line 138 states that “certified standards” were measured. Please include details of, and measurements of, these reference materials as this will help determine the accuracy (and precision) of the sample analyses.

The standard used for any water samples was EnviroMAT. We added this in the paragraph answering the comment on line 138, as follows:

Based on repeated measurement of certified in-house standards (SCP Science EnviroMAT), the relative standard deviation (RSD) of the measurements was calculated.

Line 137 states that each sample was measured three times – what do these replicates indicate about analytical precision?

Each sample injection was analyzed 3 times, in order to estimate the RSD of each individual measurement. This has been added in line 140, following the answer to the comment below about line 138, as follows:

Furthermore, each injection of the sample was measured three times, in order to estimate the RSD of each individual measurement. The method detection limit (MDL) was calculated from the calibration curve. To enhance the measurement precision (lowest point ~0.05 mg/L), axial view setting was used for measurement of concentrations <1mg/L and radial view for concentrations >1mg/L. Processing of the data was carried out in the Syngistic™ for ICP Software v. 2.0 from Perkin Elmer.

Line 138 says that “Background levels” were analysed, but what do these background levels represent? MilliQ water that was processed the same way as the samples (i.e., a laboratory blank) or an instrumental blank?

The background level from laboratory blanks were analyzed and included in the corrections and detection limit calculations. The concentration in blanks is normally lower than the lowest calibration point. This is included in line 144.

Section 2.4. Were reference materials run for the macronutrient samples? If so, please report these data as well. If not, this needs to be stated. What is the precision of the measurements in each case?
The information of reference materials and reagents for nutrient samples are described in the cited reference (Grashof, 1983, and Grashof et al., 2009).

We provide detection limits for all the nutrient in section 2.4. The nutrient ranges are well above the detection limits.

Note that the data table in the appendix (Table A2) does not show the individual measurements or the uncertainties associated with each measurement. I would either put in the data for each replicate (probably more straightforwardly) or include a standard deviation or standard error.

Thank you for this suggestion. We agree with the reviewer that using standard deviation or standard error will be more helpful for the reader. Following this suggestion, we have updated table A2 and included all replicates for transparency.

Apologies if I've missed it, but I can't find the original macronutrient data in the paper submission portal. I would suggest including these too, or at least a link to a published and openly accessible dataset. My general suggestion would be to make these datasets available in a usable format i.e., .csv format or similar. (I would recommend an external data repository to do this for full accessibility).

Thank you for this comment. The nutrient data is going to be published in the public database of ICES as: Nutrient and CTD-data are archived at ICES (http://www.ices.dk/). We have included this in the Data availability statement. All the trace metal data are presented in themanuscript.

Minor comments:

Line 34: I found the addition of the two sentences on toxic metals a little out of place. There is more literature out there on toxic metals and glacial weathering that are not referenced here, and two sentences doesn't really do the topic "justice". Given that these elements were not discussed in the manuscript, I would suggest taking these sentences out.

We have deleted these sentences.

Line 49: The authors rightly point out that there is iron limitation in regions of the North Atlantic in summer, but it might also be interesting (and useful for the paper) to mention that there is evidence also for season silicon limitation of diatom production in this region and elsewhere in the Arctic 1-3 .

Thank you for pointing this out, we definitely agree with this comment. We have added a mention of the Si limitation based on the references provided, as follows (Line 42):

Silicon limitation of diatom production is also present in this region and in other parts of the Arctic (Krause et al., 2018, 2019; Ng et al., 2024). Hence, alongside macronutrients such as phosphate and nitrate, levels of silicate and trace metals regulate oceanic biological production in this region.

Line 124: Some of this methods section (e.g., “surface salinity showed a minor change along the transect…”) fits better in the results section. I would suggest the authors check through their methods and move any results to the appropriate section.

We removed the following sentences from the methods section 2.2. and moved to the results section 3.1.
Line 160: **Thus, surface salinity showed a minor change along the transect (Fig. 3c).**
Line 174: **The change in Fw of ~0.5 m reflected that the depth of the surface plume decreased along the transect into the fjord (Fig. 3b, Table A1).**

Line 205: I agree with the authors that the observation that the highest concentrations of many of the trace metals were where the freshwater content was highest, indicating an “impact from runoff”. Do the authors mean glacial runoff specifically, or all types of runoff? As stated in the methods section, Fw also reflects freshwater from precipitation and sea-ice melt. Could these other sources be complicating the picture here? Or can the authors argue that Fw is dominated by glacial runoff? (which I suspect it probably is!). It might be worth just clarifying that here.
This is mainly from glacial run off. Sea ice melt and precipitation can not explain the large amount of freshwater in the inner part of the fjord, as described in the added text below. We have clarified this in the sentence as follows (Line 206):

The gradient in Fw is dominated by river runoff. The impact of sea ice melt would approximately be equal along the fjord and of the order of 1 m under the assumption of a typical sea ice thickness of ~1 m in the fjord. The precipitation on the surface makes a small contribution as this period was relatively dry (section 2.1). Thus, the freshwater gradient decreasing from ~3 to ~1 meter at the outer stations mainly represents river water.

Line 284: I agree that the macronutrient data points towards additional sources due to lake runoff or in situ dissolution, but I would suggest expanding “remineralization of organic matter” to include “remineralization of organic matter and GRF”, or similar, to be consistent with Lines 289-290.
Thank you for this suggestion. We have added “and GRF” to the sentence as follows:
Thus, additional sources of nutrients are present between the glacier and the fjord, likely due to runoff from lakes and possibly remineralization of organic matter and GRF.

Section 4.2. could be expanded. I would suggest to the authors to include some brief comparisons with published findings on macronutrients in Greenlandic fjords (similar to that in Section 4.1).

We acknowledge the reviewer's suggestion about adding a more detailed discussion of the macronutrient distributions. This is also the focus of an ongoing manuscript and analysis of macronutrients and phytoplankton in the fjord. The focus of this study is on the trace metal distribution and therefore we have decided to keep the discussion of nutrient distributions as it is.