



EGUsphere, referee comment RC1
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Comment on egusphere-2022-137

Anonymous Referee #1

Referee comment on "Environmental Controls on Observed Spatial Variability of Soil Pore Water Geochemistry in Small Headwater Catchments Underlain with Permafrost" by Nathan Alec Conroy et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-137-RC1>, 2022

- Does the paper address relevant scientific questions within the scope of TC?

Yes

- Does the paper present novel concepts, ideas, tools, or data?

Yes.

- Are substantial conclusions reached?

Yes

- Are the scientific methods and assumptions valid and clearly outlined?

Yes

- Are the results sufficient to support the interpretations and conclusions?

The authors link water quality to vegetation, however I felt this link is rather qualitative. They have compiled vegetation data from the NGEA Arctic project. This section needs either more description or references to papers and reports on the methods used. Additionally it would greatly strengthen the paper to be more quantitative and descriptive with the vegetation. Are there photos of the sites that can be shown in supplementary material etc.

- Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Overall, yes, however they should provide a data table of their water chemistry dataset in a supplementary material table.

- Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes, the authors give proper credit to prior work and outline their contribution.

- Does the title clearly reflect the contents of the paper?

Yes.

- Does the abstract provide a concise and complete summary?

Yes

- Is the overall presentation well structured and clear?

Areas of the paper should be restructured, see detailed comments.

- Is the language fluent and precise?

Yes.

- Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes.

- Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

I have specific questions about parts of the discussion, see specific comments.

- Are the number and quality of references appropriate?

Yes.

- Is the amount and quality of supplementary material appropriate?

Yes.

Overall Comments

The paper "Environmental Controls 1 on Observed Spatial Variability of Soil Pore Water Geochemistry in Small Headwater Catchments Underlain with Permafrost" presents an evaluation of water chemistry data collected from two catchments underlain by permafrost terrain. Overall, the paper presents interesting data on a topic which is important given the changing environment in permafrost terrain caused by anthropogenic warming. While the paper is well written I think there are some significant changes needed prior to publication. I think the suggested changes are needed to be able to strengthen the conclusions of the paper and will result in a significantly better paper.

Two general areas for improvement are here and detailed comments are below.

- The information on the vegetation could be more quantitative, or at least include some photos etc. A significant portion of the discussion rests on the information provided in Table 1. The authors need to provide more information on how the vegetation assessment was done, and more information on the results of that, I have made a few more detailed comments on this below.
- The authors conduct numerous geochemical calculations which is great, however were samples collected of the soil for mineralogical analysis? It would greatly support the paper if there were some XRD analysis of the soil, or other relevant information (other reports, papers discussion the soil mineralogy in the study areas). If you have this or can easily do it, it would greatly improve the paper. I think your geochemical discussion needs to better reflect that the water chemistry suggests these are the mineral phases present, however this you don't actually know this.

Specific Comments:

Line 29: NO_3^-

Line 52: I have not reviewed this journals style guide, but is it correct to list Koch, Runkel, Striegl, and McKnight, 2013; most jurlals would be Koch et al. Please check.

Line 75 to 77: Much of your paper involves discussion about the role of alders and nitrogen fixing but rests on one reference, can you provide more. I think this is a well studied topic, it would be good to show its well established.

Line 100 – 146: This section provides a good general background. I find it lacking in real information about the geology. Based on the locations in Figure 1, I think the two catchments are underlain by different geology. I looked at "Preliminary Bedrock Geologic Map of the Seward Peninsula, Alaska, and Accompanying Conodont Data, By Alison B. Till, Julie A. Dumoulin, Melanie B. Werdon, and Heather A. Bleick, <https://pubs.usgs.gov/of/2009/1254/>" However you can probably find larger scale maps with more detail. Referencing this would help your description of the site, and can also be made consistent with the geochemical discussion.

Line 101, 103: km² should be superscript

Line 108 -109: Reword sentence, it is confusing.

Line 129 / Figure 3: The figure shows a watershed boundary, however I think the authors are trying to show a boundary of the area studied, as this cannot be a watershed boundary. On the west side the boundary is shown along a contour line which water will continue to flow over.

Line 174-178: More information is needed on the methods used for the vegetation assessment. If this assessment is part of this study how was it determined that the dominant plant function type was "Deciduous low to tall shrub (willow)". From the text it sounds like this was done part of another project "NGEE Arctic project", if so the text should reference where we can get information on how this was done, however, even with a reference, a sentence or two is needed to explain roughly how it was done.

Line 216: "Modelling exercises were performed at 25 °C utilizing the" why was this done at 25C when your studying water in permafrost terrain? Maybe necessary stability constants were only available at this temp. but you should comment on who it may differ with field temperatures.

Line 231, compounds measured as ions should be listed with their charge (eg SO₄²⁻, NO₃⁻, however Sr and Ca are likely measured as total concentration (so don't list charge))

Figure 4: I have had to zoom into 150% to be able to read this. Make it bigger, and you may also be able to use a crisper font.

Line 282-283: "NO₃ concentrations at both sites were generally low, with the exception of Kougarak Stations 3, 5, and 12, and Teller Station 7 (Figure 4). Kougarak Stations 3, 5, and 12 all have a significant alder presence."

Can you back up this statement further? This is very qualitative? Do you have photos of the different sites that you could compare on contrast? Do other papers talk about vegetation density?

Section 4.5 Mineral solubility Effects: Have you measured the presence of the mineral you discuss in soil samples? Perhaps you have done some XRD? If not, have other papers done soil analysis in the area? You can pull in reference to the local geological maps as well. I have had the experience myself where a given mineral is predicted by a geochemical software, but you don't actually have that mineral in your system and something more complicated is going on.