

Earth Syst. Sci. Data Discuss., referee comment RC1  
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## Comment on **essd-2021-155**

Anonymous Referee #1

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Referee comment on "Multi-year, spatially extensive, watershed-scale synoptic stream chemistry and water quality conditions for six permafrost-underlain Arctic watersheds" by Ariel J. Shogren et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-155-RC1>, 2021

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### Summary

The work by Shogren et al. represents a thorough evaluation of a unique (and challenging to collect) dataset using really interesting metrics to compare diverse sites. Specifically, they evaluate synoptic water chemistry across six watersheds in northern Alaska using secondary ecosystem metrics. As I was not familiar with these metrics, I appreciated the descriptions that were provided. The article is a nice introduction to these metrics and presents examples of their application without going into extensive interpretation of each solute, which seems appropriate for this journal. I have provided comments below with respect to the datasets as well as interpretation.

### Specific comments

Regarding the datasets, both datasets are accessible and are well structured and supported by metadata. However, I did not see any indication of detection limits in the Abbott/TFS dataset or data flags that would indicate values below quantification. This omission limits proper use of the dataset (my apologies if I've missed it somewhere?).

An underlying assumption of the secondary ecosystem metrics is that measurements at the outlet conservatively integrate measurements of the subcatchments. Given that these solutes may not behave conservatively in the streams, can you speak to how in-stream processes might affect the metrics being used here?

It is important to distinguish between nominally dissolved Fe (< 0.7 um) from the TFS sites and total Fe (unfiltered) from the NPS/USGS sites. Is there any information on how these values compare?

I'm unclear on the interpretation of subcatchment leverage. It is described as how subcatchments produce or remove solutes relative to what is measured at the outlet. As such, should the average across subcatchments (e.g., Figures 6 and 7) equal zero, where production and removal are balanced? If these values are not zero, does that indicate that the watershed was not fully captured?

I think my question is partially addressed by lines 363 – 365, but I could use some interpretation of that statement. That is, what does it mean in practice for landscape template to exert strong control on biogeochemical signals in Arctic rivers?

Using spatial stability as a metric to generate hypotheses about processes driving stability or instability is really intriguing!

#### Technical comments

Line 299. Please quantitatively define the "statistical collapse in variance of concentration". As I understand it, this was calculated as the difference between a subcatchment concentration and the catchment mean divided by the catchment standard deviation. Would a collapse in variance indicate the catchment area at which the stream concentration is within the standard deviation of the catchment mean?

Line 313. Should this be that sigma (not s) indicates standard deviation?

Line 378. Says "sapling" instead of "sampling"

Equation 1-2. Leverage is said to be expressed in terms of mass/volume/time, but doesn't volume cancel out of equation 1? E.g., mass/volume \* area/area \* (volume/time)/area = mass/area/time. Since % is used here, that specific equation should be used for equation 2 or placed as equation 3 (e.g., subcatchment leverage (%) =  $100 * [(C_s - C_o) * (A_s/A_o)]/C_o$ ).

Figure 4. Please define the boxplot metrics (for this and all figures). Why are the scales for Trevor Creek different? Ranges for DOC and SRP are comparable to ranges for the other watersheds.

Figure 5. Dissolved Si is present as an oxyanion in solution, not a cation. I suggest dissolved Si (or total Si) rather than  $\text{Si}^{4+}$  here and elsewhere. Please also make y-axes consistent (e.g., 0.1, 1, 10, 100, 1000 or  $10^{-2}$ ,  $10^{-1}$ ,  $10^0$ ,  $10^1$ ,  $10^2$ ,  $10^3$ ) rather than 1e+01 or such.

Figure 6.  $\text{NO}_3^+$  in legend should be  $\text{NO}_3^-$ .

Figure 8. Different date specifications are used here than elsewhere (month, season, year). Were data partitioned differently?

"Season" is used as the x-axis label for graphs where it should be "month" or "year".

Table 3. Needs to be edited for typos (e.g., u instead of mu symbols, superscripts, missing letters, degree symbol missing, units for SUVA)