Hydrology and Earth System Sciences

Discussions

HESSD

Interactive
comment

Interactive comment on "Ionic aluminium concentrations exceed thresholds for aquatic health in Nova Scotian rivers" *by* Shannon Sterling et al.

Anonymous Referee #2

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General comments

Overall the paper presents an interesting dataset for a topic that probably hasn't received as much attention as it should have. The paper in its present form is largely site-specific case study, highlighting high concentrations of Al that exceed toxicity limits across several river basins, despite reductions in acid sources.

I think the paper can be suitable for publication, following some revision. The introduction sets a good background and context, but the methods and results could be mistaken for a monitoring report and could be enriched to better highlight the novelty in approach and the significance of the findings.

There are three main points I think could be considered to improve the paper: âĂć I think the paper is missing a conceptual model. The mechanisms that could explain the observations are well described, but a conceptualisation of how they are inter-related could help frame the paper and give it a more general focus, making it more than just presentation of a site specific dataset – this is something that could be considered as a diagram for the discussion, and would help as a synthesis of the observations. âĂć Related to the above, the paper could enrich the link to hydrology – seasonality is discussed at one point, but could this be expanded to better frame in context of catchment behaviour? I feel that after reading this paper, the take away message was that concentrations are high, above toxicity limits, which makes it perhaps more suited to an environmental quality journal, but what seems to be missing is how hydrology may be mediating concentrations and speciation. Again, this is where a conceptual model may help. âĂć The statistics seems like it could benefit from a multi-variate approach to looking for patterns – currently the reliance on a series of independent correlations makes it hard to understand if there any interactions between variables. Use of GLMM is suggested at one point as a recommendation, but it's not clear why it wasn't done. For a paper in a top science journal, a full analysis of the data should be undertaken to come to a conclusion and show the results, rather than describe a possibility of showing something. In any event maybe there are other techniques that could be applied to better explain the variability?

Specific Comments

- Line 39-40. Sulfur emission reductions are mentioned here. But the paragraph opens straight away with acidification. Whilst most HESS readers I think will be familiar with the context, there may be readers without familiarity of this chemistry. I would therefore recommend extending the opening sentences to introduce the origin of acidification
- Following the above, the paper also maybe assumes the reader is familiar with the link between acidity and Al. Is this link predictable or depends on geology? Improving these contextual statement in the opening to highlight how sulfur, acid and aluminium

are related I think will help entrain readers (though I notice some coverage of this at the end of the intro). - Ln 46 – What is SWNS? - Ln 61 – Gibbsite is mentioned here. It would help to highlight the approximate pH where this kicks in (~4.5?), and maybe replace "formation" with "precipitation" in case people are not aware it is a solid phase. - Ln 70 – This sentence seems like it should have come earlier (see initial comment): "Lowered pH increases Al solubility and observations confirm that Ali concentrations are negatively correlated with pH". Currently this paragraph on Al sources, comes after a paragraph on speciation and toxicity. - Line 96 – Should the ":" be a ";"? - Line 101 – I don't recall NS is defined by this point. - Line 110 – Here the aim of the paper is outlined, but it is a bit vague – there is a general desire to "increase understanding . . . " – could this be more specific? Ideally it would be good if the questions could also link to hydrology . . . eg is Al linked to hydrologic dynamics? - Line 147 – The description of statistics is brief. It looks like univariate statistics were done. It seems like the sort of dataset which requires a multivariate approach? PCA? - Line 149 – the last sentence introduces the term toxic threshold, but it doesn't follow from the previous sentences. Are you setting a threshold to determine exceedance frequency? Or are other metrics related to toxicity computed? - This toxicity value of 15 is mentioned, but I think it needs more justification and a clear rationale – is it acute or chronic, what is the origin and basis of this number? - Figure 1 & 2. I would have thought concentrations should come before the fraction % of samples above 15, as the latter has a higher level of interpretation. - Line 189 – Seems like a significant finding – could this be better highlighted as specific focus when framing your research question in the introduction, and also highlighting in the abstract? - Line 221 – it is suggested in the results that you should do a GLM model – why don't you do it in this study and present it here? I would have thought that for a hydrology focused journal, understanding the link between seasonality in hydrology and pH / Al relationship would be an important area to explore in detail, rather than just hint at it? - Conclusions – this is a good summary, but framed as 4 short paragraphs. I felt this could be more refined, maybe as just a single paragraph that flows better. Recommendations for further research on recovery

approach's may be useful?

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Discussion paper