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Biogeosciences Discussions

Interactive comment on "Temporal and spatial trends for trace metals in streams and rivers across Sweden (1996–2009)" *by* B. J. Huser et al.

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Reviewer #1

Specific comments:

1. "Data correspond to total concentrations and give not any idea of the proportions of dissolved or particulate concentrations. This should be given even from litterature review because one question not treated here is the possible role of particulate inputs in these temporal trends."

Response:

We agree that the differentiation between metal fractions (dissolved, colloidal, particu-

late) is important and propose to add information to the Introduction section as follows:

The form of metal (e.g. dissolved, colloidal, or particulate) may also be an important factor when describing temporal variation of metal concentrations (e.g. copper (Cu), lead (Pb) and zinc (Zn)) in surface waters. Sherrell and Ross (1999) showed that dissolved trace metal concentrations were generally correlated to stream flow and, to a lesser extent, pH but in some cases in-stream processes (pH and solution particle partitioning) were not able to explain temporal variations due to low particulate to dissolved metal ratios. Colloidal and particulate size fractions of trace metals (e.g. Fe, Cu, Zn, and Pb) have been shown to vary independently temporally (Ross and Sherrell, 1999) and metals such as vanadium (V) and arsenic (As) are generally associated with colloidal or particulate Fe fractions (Wällstedt et al., 2010). A recent study on the partitioning between filtered and particulate metals in a large number of the same Swedish running waters studied herein indicates that the median values of the fraction of some metals (Cu, Zn, Cd, Cr, Co, Ni, As, V) in the particulate fraction are all close to or less than 25% of the total metal concentration (Köhler 2010). Higher fractions occur for Pb (39%), Fe (38%), and Mn (34%) and there are strong indications that particulate Pb is co-transported with particulate Fe.

2. “The criteria choose to separate north and south regions in unclear for me. I understand that it is based on ecosystem but why in this context ? Why don’t they used geology for example ? What are the main factors expected to change with this limit: temperature, soil degradation...?”

Response:

The limit is based on biological (forest/plant) type canges but is more broadly defined by differences in climate. We propose adding the following text to the definition of the limes norlandicus boundary used to separate northern and southern Sweden to the Methods section:

Climate also varies between the regions with the major difference, outside of ecosys-

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tem type, being the southern region is warmer than the north. Thus, the limes norlandicus represents the boundary separating areas where flow is low during winter with pronounced snowmelt in spring (the north) and flow is more or less continuous during the year with little to no accumulation of snow during winter (south).

Reviewer #2

Specific Comments

1. "At the end of section 2.1 (general description), the authors state that Sweden was divided into "two regions based on the limes norrlandicus eco- tone". The criteria for the limes norrlandicus ecotone boundary are not stated – this would be useful information as it would more clearly demonstrate the contrast between the two regions. A description of the difference between the two should definitely be included in the published version of this paper."

Response:

We have added to the discussion on the criteria for the limes norrlandicus boundary. Please refer to the response to Comment 2 by Reviewer 1.

2. "For the authors' consideration - it looks to me as though there is a similarity in the pattern of strong relationships (as determined by Kendall's tau coefficients) between in-stream trace metal concentrations and two of the drivers, Fe and TOC (Table 5). Could this be some form of co-variance? Possibly the TOC is binding both the Fe and the trace metal? Was this examined, or tested for in the lab? Perhaps this should be discussed briefly?"

Response:

There is indeed a pattern of strong relationship between TOC, Fe and some metals in this study. We discuss this in the introduction (page 803 last paragraph) and on page 811, line 5 with respect to colloidal Fe interactions with metals such as As and V. We propose to add the following discussion and reference (Pokrovsky and Schott, 2002)

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to the discussion for Pb (page 812, line 19):

While Pb correlated well with TOC and Fe (Table 5) and has been shown by others to correlate will with colloidal Fe (Pokrovsky and Schott, 2002)...

Although Co appears to follow this pattern (in northern Sweden only), we have (as stated in the text) tried not to speculate as much on the reasons for trends with this metal (covariation, colloidal Fe, etc.) due to the low number of trending sites detected (there were only three trending sites in the northern region) in the study.

Technical Corrections:

1. "Page 805 lines 20 – 21: The sentence beginning "The number of less than values. . ." is unclear. Do you mean less than detection values?"

We propose to reword the sentence on page 805, lines 20-21 to read:

The number of values that were lower than the detection limit in the chemistry data set was low (between 0% and 2.3%) for all parameters included in this study.

2. "Page 814 line 19: Lettenmaier et al."

Page 814, line 19 will be changed to Lettenmaier et al.

3. "Page 816 line 7: "affect in-stream processes and metal dynamics. . ."""

Page 816, line 7 will be changed to "affect in-stream processes and metal dynamics. . ."

4. "Page 816 line 8: "that can drive changes in in-stream chemistry. . ."""

Page 816, line 8 will be changed to "that can drive changes in in-stream chemistry. . ."

5. "Figure 3 spans 2 pages – the maps on the first page of the figure (for Ni, As, V, Pb, Cu, Zn) are small. Please enlarge the figure so that the symbols are more clearly visible."

We will adjust Figure 3 and work with the editor so that the panels in the final document

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are more legible.

Interactive comment on Biogeosciences Discuss., 8, 801, 2011.