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Biogeosciences
Discussions

Interactive comment on "Long term patterns in dissolved organic carbon, major elements and trace metals in boreal headwater catchments: trends, mechanisms and heterogeneity" *by* S. K. Oni et al.

S. K. Oni et al.

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Reviewer 2

We say thank you to the anonymous reviewer 2 for your comments and insights. These would be useful to improve the manuscript. We have gone through your comments and we provide detailed response following each comment

Review: Oni et al. 2012 General Overall this is generally a well written paper containing a lot of information which brings together into one place the research conducted over

the last 2-3 decades in the Svartberget catchment. There are some problems with mixing past and present tense.

Response: Thanks for your close observation. We have now carefully read through the manuscript and improved version would be uploaded.

One issue that is not discussed is the methodology used in chemical and DOC analysis and whether this has changed over the sampling period and could have an effect on the trends seen. For example DOC analysis has moved from persulfate digestion to combustion over the last 3 decades and could be responsible for increasing trends seen.

Response: Yes there was change in methodology used for DOC analysis. The following statement from Kohler et al. 2008 (doi: 10.1029/2007JG000629, page 3) further clarifies the change in DOC analytical technique:

"DOC analyses during the early period (1993-1994) were analyzed using a Dohrmann Carbon Analyzer while samples after 1995 were analyzed using a TOC-5000 Shimadzu".

It should be noted that our current study utilized data from 1993-2010, indicating that period when methodology changed was at the very early part of our study period. If we had started from 1995 (Figure 5) and (Table 1), the trend would be pretty the same. Therefore, the trend we observed could not be attributed to change in DOC analytical method. However, this important clarification has been noted and the method section would be updated in the manuscript.

Page 19123 Line 21. Aitkenhead-Peterson et al. 2009 suggested that increased DOC concentrations appeared to be a consequence of irrigation with sodic water on urban landscapes. I suggest then that change is inserted after land use to read "Other factors reported as drivers of DOC in the literature include drought (Worrall and Burt, 2005), landscape disturbance such as land use change (Aitkenhead-Peterson et al., 2009)

clear cutting (Schelker et al., 2012) and climate change (Oni et al., 2012a; Schindler et al., 1997)."

Response: Thanks for the insight. This important modification has been noted and the change will be effected in the manuscript

P19121 L 21 and Reference list. The wrong reference is attributed to this citation. It should be: Aitkenhead-Peterson J.A., Steele M.K., Nahar N. and Santhy K. (2009). Dissolved organic carbon and nitrogen in urban and rural watersheds of south-central Texas: land use and land management influences. Biogeochemistry: 96: 119-129 DOI: 10.1007/s10533-009-9348-2.

Response: We have taken note of this important error and we will make the appropriate change in the manuscript. Thanks

Page 19125 Line11: insert 'the' before riparian to read 'As a result, the riparian zone can contribute more to stream: : :: : ::.' or change to 'As a result, riparian zones can contribute more to stream: : :: : :: : :.'

Response: Thanks. This change would be implemented in the manuscript

Page 19125 Lines 17-21: Long sentence suggest splitting for a better flow.

Response: This long sentence would be reworded for better understanding. "Due to heterogeneity in the landscape, small scale effects . . . are not apparent at the catchment scale."

Page 19125 Line 26: suggest replacing 'are' with 'were' Page Response: This change would be made in the updated manuscript.

19125 Line 29: suggest use 'trends' and not 'trend'

Response: This change would be implemented. Thanks.

Page 19126 Line 3 replace 'use' with 'used'

Response: This word would be replaced.

Page 19126 Line 3 – 15. This section seems out of place here and my be better utilized in the site description and materials and methods and discussion sections.

Response; This sentence will be transferred to section 2.2, line 27, page 19127.

Page 19126 Line 23: should the SO4-s yr-1 be SO4-S yr-1?

Response: This will be adjusted in the manuscript. Thanks

Page 19127 Line 2: Perhaps use comprise instead of dominated by as you have stated that forests and mire dominate in the previous sentence. To read 'Forests in the catchment comprise approximately century old Norway spruce (Picea abies) and Scots pine (Pinus sylvestris) (Laudon et al., 1999)."

Response: The word "dominated" would be replaced with "comprise"

Page 19127 Line 6: Suggest change 'Total annual precipitation in the catchment averages about 610 mm/yr, of which about 35–50annual precipitation in the catchment averages about 610 mm/yr, of which 35–50falls as snow (Kohler et al., 2008).

Response: This sentence would be rephrased as suggested. Thanks

Peak precipitation occurs in late summer.' Page 19128 Line 17: suggest deleting 'listed in' and placing 'Table 1' in parenthesis

Response: This will be modified accordingly in the manuscript.

Results

Terms such as 'mean temperature was about 1.7: : :' do not give the reader confidence in your results. I would suggest including the mean and standard deviation for all in section 3.1.

Response: Thanks for this observation. We realized this from the other reviewer too. We have checked through and all mean values in section 3.1 would be replaced with

3.3 ± 0.7 (for water temperature), 320 ± 97 (for runoff) and 610 ± 109 for precipitation. However, we found this not so informative for air temperature since we used annual mean here but large seasonal difference usually exist between the minimum and maximum values.

This would be done for all mean values stated in section 2.1 and depositional fluxes in section 3.2 as well. Wrong variance values in section 3.3.1 (as pointed out by the other reviewer) would also be corrected.

On page 19127 Line 6 the authors state that average precipitation is 610 mm yr-1 then on page 19130 Line 7 in the results section the authors state that precipitation was about 610 mm yr-1 as a reader I would like to see a measure of the variance about the mean.

Response: measure of variance around mean would be added to all our mean values. Thanks

Discussion P19135 L5 remove 'has' prior to concluded for better flow.

Response: 'has' would be removed from the sentence as suggested.

P19135 L9 I assume 'flow' is discharge?

Response: Yes. This would be changed to discharge in the manuscript.

P19135 L23-25 "The drop in the flashy spring [DOC] in the later period of record in (C2 and C7) suggest that stream DOC is driven more by intermittent rainfall flushing 25 the top or subsurface layers than prolonged soil inundation from rising groundwater level." See next comment: : :: : :: : :

P19137 L9-11 "The drop in the flashy spring DOC from the upper soil layers 10 suggests that stream DOC is driven more by intermittent rainfall flushing the top or subsurface layers than prolonged soil inundation from rising groundwater levels." This is too similar to the sentence on P19135. I realize that here the authors are describing the

soil solution but suggest they find another way of describing the potential mechanism.

Response: Yes, we were describing the soil solution here but we realised the statement is the same with line 23-25 in page 19135. The similar sentence in this section 4.2 would be rephrased

P19138 L3-5 Suggest change "Our result therefore showed that dry-wet cycle has pronounced effects on [DOC] in intermittent C2 stream, which might be more susceptible to drought conditions." TO "Our results showed that the dry-wet cycle has pronounced effects on [DOC] in the intermittent C2 stream, which might be more susceptible to drought conditions."

Response: This change will be effected in the manuscript. Thanks

P19139 L3 Suggest rather than state biological controls are more important under 'this condition' state 'more important with higher moisture and temperature conditions'. Is there a reference for this?

Response: The end of the sentence would be replaced with "more important with higher moisture and temperature conditions" as you suggested. Reference for this will be Berggren et al. 2008 (already in our reference list).

P19142 Description of PCA and what positions chemical constituents hold need some refining. As is this is hard for a reader to follow.

Response: We will revise this section in the updated manuscript to make it clearer for the readers. Thanks

References Aitkenhead-Peterson et al., (2009) wrong reference for citation. This paper in the reference list was published in 2011 and did not discuss DOC.

Response: Thanks for this close observation. The reference we wanted to use is stated below and would be replaced with the 2011 paper currently listed in the manuscript accordingly.

Aitkenhead-Peterson J.A., Steele M.K., Nahar N., Santhy K. 2009. Dissolved organic carbon and nitrogen in urban and rural watersheds of south-central Texas: land use and land management influences. Biogeochemistry 96: 119–129. DOI: 10.1007/s10533-009-9348-2.

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