Biogeosciences Discuss., 12, C4840–C4842, 2015
www.biogeosciences-discuss.net/12/C4840/2015/

Biogeosciences
Discussions
Open Access

Interactive comment on "Map-based prediction of organic carbon in headwaters streams improved by downstream observations from the river outlet" *by* J. Temnerud et al.

Anonymous Referee #2

Received and published: 31 August 2015

Review of the manuscript "Map-based prediction of organic carbon in headwaters streams improved by downstream observations from the river outlet" by Temnerud and colleagues.

This manuscript describes an attempt to model the DOC concentration in headwaters (catchments smaller than 2 km2) from nine boreal catchments (from 30 to 235 km2) combining GIS-landscape information with DOC observations from the downriver outlet of each catchment. Authors consider this study a step forward with respect to a previous similar study (Temnerud et al., 2010). In this new manuscript the step forward consist to: i) integrate into the analysis the landscape catchment properties and; ii) the implementation of complex statistic tools. Finally, the modeling effort helps to explain

up to the 52% of the TOC variance in headwaters. Authors recognize that the proportion of the explained variance is not satisfactory. However also they remark that it is better than the previous work (Temnerud 2010). Therefore the main conclusions are that: i) DOC information from outlet alone is insufficient for predicting DOC (median and variability) in headwaters and ii) that, at least in these systems, GIS based catchment data is useful to improve partially the DOC prediction in headwaters. The manuscript is well written and objectives are well stated. Tables are appropriates however figures are difficult to understand. In any case, it is extremely arduous to follow and understand the modeling approach and results description. Overall, this contribution is interesting especially in a context of water quality monitoring and management. In a scientific context this study reveals that, although the GIS provide valuable information, it is a limited tool to model accurately DOC in small catchments. This suggests that important potential explanatory variables are missing in the analysis. My most relevant comment pivots around the selection of the potential explanatory variables. Without being and expert on PLS and mixed model and being conscious of my limitation in understanding these sophisticated approaches, it surprises to me that some explanatory variable that does not emerge in the PLS are, a posteriori, included ad hoc in the mixed model. This is the case of the "proportion of lake surface". As point out by authors, this variable is considered important for DOC in boreal rivers (see references in the manuscript). Authors reveal that some explanatory variables are not included in the PLS analysis as "consequence of " large number of zero values" (pag 9015). Is this the situation of "proportion of lake surface"? According to figure 1 and Table S1 most of the catchments have lakes in their drainage network. Therefore this variable should not have a "large number of zero values". Then the question is: Why the "proportion of lake surface" disappear from PLS output? If this apparently important variable cannot be included into the PLS analysis does it suggests that the PLS is an inappropriate tool? If Lake surface coverage is important and it emerges as significant variable in MM I wonder if the model calibration should to include an additional fourth version: "OutLsc": DOC outlet + lake surface coverage but no map information. This additional model run might

help to weight the effective importance of the landscape parameters included in table S1…. Is the GIS information overrated? Moreover, the importance of the "proportion of lake surface" also suggests that morphological structure of the river network (and the terrestrial zones surrounding the river network as well, i.e. riparian strips) might have some importance on DOC in headwaters. This comment leads inevitably to wonder why the list of potential explanatory variables do not include any parameter that might incorporate the hydro-geomorphology properties of the study streams/rivers (average main stem longitudinal slopes. . ...river length. . .# of confluences. . ..drainage densities. . ...). Finally, I found anomalous the absence of some basic hydro-climatic parameter. At the discussion the authors affirm that sets Cal07 and Cal08 are measured during "different flow situations and seasons". It exists a very rich and abundant literature form the authors that explicitly explore the importance of discharge, winter climate/snowmelt and antecedent hydro-climatic biogeochemical conditions on DOC variability at the Vastrabacken catchment (see Agren et al., 2010 for an example). This headwater stream drains into the larger Nyanget catchment which is included in the present manuscript. In these studies it appears clear the importance of these hydro-climatic parameters on DOC concentration in these boreal headwaters. Therefore, having in mind this knowledge, I strongly suggest that some hidro-climatic parameter (although approximate and coarse) should be included in the analysis otherwise it will be really improbable to obtain satisfactory DOC estimation with GIS information only.

Reference cited: Ågren, A., Haei, M., Köhler, S. J., Bishop, K., and Laudon, H.: Regulation of stream water dissolved organic carbon (DOC) concentrations during snowmelt; the role of discharge, winter climate and memory effects, Biogeosciences, 7, 2901–2913, doi:10.5194/bg-7-2901-2010, 2010. Temnerud, J., Fölster, J., Bu_am, I., Laudon, H., Erlandsson, M., and Bishop, K.: Can the distribution of headwater stream chemistry be predicted from downstream observations? Hydrol. Process., 24, 2269–2276, doi:10.1002/hyp.7615, 2010.

Interactive comment on Biogeosciences Discuss., 12, 9005, 2015.