Biogeosciences
Open Access

Discussions

EG

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.

The study addresses the scientifically relevant question on how to predict water chemistry of small headwater catchments that are not regularly monitored. The study combines two different approaches on how to predict headwater stream total organic carbon (TOC): (1) A map/GIS based approach including mainly land use, soil and geological data in combination with (2) river outlet TOC data of intermediate catchments that include the headwater catchments. The study is within the scope of BG and the combination of the two above mentioned approaches is clearly novel. Nevertheless, the manuscript suffers from several major shortcomings that make it difficult to judge about the quality of the results and the conclusions. Following, I will outline my concerns that I think need to be addressed before I might recommend the manuscript for publication:

C3893

Major concerns:

i) Loosing scope of what is promised in the title and the hypothesis

The title clearly states, that the study shows how downstream organic carbon observations can improve map-based predictions of organic carbon in headwater streams. One sentence in the abstract and two paragraphs in the text outline the goal of the study: (1) Testing whether river outlet chemistry can be used as an additional source of information to improve the prediction of the chemistry of upstream headwaters, relative to models based on map information alone (P007L3ff – Abstract); (2) finding out whether the combination of map and river outlet chemistry give better prediction than either one used separately (P9008L29f - Introduction); (3) determining whether models based on geographical data can be improved by adding concentrations measured at the river outlet (P9014L7ff). It is more or less clear, what the focus of the study should be. Unfortunately the focus of the study gets lost in the course of the manuscript. One of my major concerns is that only a small paragraph in the results sections (3.3.4 Evaluation of river outlets) is dedicated to the focus of the study. Moreover, the tables and figures (Table 5 and Figures 3-5) that are linked to this paragraph are too detailed and are not able to direct the reader to the focus of the study / the results of the study. Additionally, the above mentioned table and figures are not well described in the text. I would suggest a table or figure with reduced details and a clear emphasis on the focus of the study, that outlet measurements can improve map based predictions. Unfortunately the result hat outlet TOC measurements can improve map predictions is not adequately discussed in the discussion section. The first two paragraphs in the discussion section (P9021L6-18) should be rather shifted to the results section. In the discussion section, the result that the OutMap version gave 5-15% better prediction than Map only, should have been put in a broader context. What is the interpretation of this improvement? Additionally, it should have been discussed in more detail, what are potential explanations that including OutletTOC is leading to an improvement. In contrast to that, the major part of the discussion is about how the unexplained variance

C3894

could be explained; this is important to be discussed, but not to such an extent that the discussion about the focus of the study is marginalised. The conclusion section contains an additional major shortcoming: It is concluded that the mixed models approach is improving predictions compared to the predictions that are solely based on outlet TOC (which was done by the author in a previous study). This is contrary to what is written in the title and the abstract (OutletTOC is improving map based predictions).

Moderate concerns:

ii) The experimental setup and the environmental conditions during the sampling are not well described

In the methods section, it is not well described, how many headwater catchments were tested. How many headwater catchments are within each of the 9 larger catchments? How do the headwater catchments differ from each other in land use, soil, topography and geology? Moreover, the naming of the larger catchments is not consistent. Are intermediate sites/catchments congruent with the nine investigated catchments in figure 1? Additionally, information of the meteorological conditions shortly before the sampling and discharge information during the sampling would be helpful in the interpretation of the results. I am aware, that it is not possible to get detailed information about discharge anymore (although it could be of great importance to have discharge information, as TOC variations are often closely linked to discharge variations). Nevertheless, it would be helpful to have at least the information, whether there was rainfall before the sampling or whether we have high flow or low flow conditions.

iii) Figures are not self-explanatory, not clearly laid out and not well explained

Figures 2 to 5 are not directly able to show the message that they should transport. This is a combination of several points: They are not clearly laid out and the labels are too small. Moreover, figures 3 to 5 (including their captions) are not self-explanatory or just understandable after studying them for a long time (at least when it comes to the point of understanding the message they want to transport regarding the focus of the

study).

Minor concerns:

P9007L25f: Structure of the sentence: "The headwaters also combine to provide….."

P9008L10-16: These two sentences are contradictory to a certain extent; much of the small-scale heterogeneity is averaged out at larger spatial scales vs. monitoring of downstream sites might provide information about headwaters upstream. This needs further explanation and would be also an interesting question to be discussed in the discussion section.

P9009L27: "kNN": needs explanation when firstly introduced

P9009L27: Wasn't also TOC_Outlet used to derive TOC median and IQR values?

P9011L4: I would not call spruce the dominant tree species. In several catchments, pine is the tree species with the largest volume and in most of the other catchments, spruce is not dominating but has just moderately higher volumes then pine.

P9011L2: "All catchments": all headwater catchments? Is this paragraph only about the headwaters?

P9011L5: "Mires and small lakes made up most of the remaining parts": Clear-felled areas are larger than the sum of mires and lakes in many catchments. I would not consider clear-felled areas as forests, especially when it comes to a study about TOC.

P9014L25: Abbreviations like Cal_PLS_00_A are not helpful to read the manuscript in a fluent way. Maybe you can come up with a better solution, although it might be difficult to find a better solution.

P9014L27: Were the mesoscale catchments sampled or the headwater catchments?

P9015L11ff: The assumption, that headwaters within the same catchment are more similar to each other than to headwater from other catchment, needs further explana-

tion. I guess this depends on the similarity are heterogeneity of headwaters within a catchment and on the driving factors that control TOC behaviour.

P9018L4f: Sentence structure needs to be revised.

P9018L19: "that is all other data than 2007": Sentence structure needs to be revised

P9020L24: "Out of 27 different combinations": Isn't there something missing? Perhaps: In 25 out of 27 different combinations.

Table S1: What is the difference between no value and 0.00? Is 0.00 just a rounding effect or does it also mean no value?