

Interactive comment on “Dissolved organic carbon mobilized from organic horizons of mature and harvested black spruce plots in a mesic boreal region” by Keri Bowering et al.

Anonymous Referee #3

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The study by Bowering and coauthors presents a thorough survey of carbon exchanges between above and belowground terrestrial pools, compared across pristine and harvested boreal Canadian landscapes. The findings are linked to environmental conditions, in the context of changing climate and hydrology in the region. The relatively high temporal resolution of the dataset provides insight into cross-season differences in the controls on soil DOC export between harvested and pristine plots, a clear strength of the paper. Also, I really liked how the authors explicitly discuss the importance of their findings for the parameterization of larger forest carbon cycle modelling efforts. I recommend below a few general and specific changes to the current manuscript that could further strengthen the paper.

C1

General:

-Introduction as written does not cover the effects of forest harvesting and the state of knowledge regarding forest/soil C cycling impacts. A bit of context here is important because the cross comparison of plot types is a big theme. Also, page 11, lines 22 and on contains key findings that would be better showcased if the effects/unknowns related to harvesting are introduced earlier in the paper. To that end I recommended below citing a recent review on this topic (James & Harrison. *Forests* 2016, 7, 308; doi:10.3390/f7120308) that could be used as context in the introduction and discussion.

-Consider adding a simple drawing that summarizes the fluxes and pools of C measured here, perhaps boxes and arrows sized to pool sizes and flux rates, respectively. Not critical since table 1 has much of the information, but a figure like this could really help readers follow key findings as they are presented in the discussion.

-The concept of the net ecosystem carbon budget (NECB; Chapin et al. 2006 *Ecosystems*; Webb et al. 2018 *Ecosystems* for a nice review) is not directly presented, but could be useful context. Even though not every single C flux is measured here, the discussion does revolve around this concept, and the authors are measuring a key flux term (hydrologic DOC export) that has often been overlooked in earlier efforts to build C budgets. Consider introducing this early in the introduction and again in the first 2 paragraphs of the discussion. Such discussion would fit nicely with the summary drawing figure suggested above.

Specific:

P1, l. 18-26. Abstract could be shortened. Consider summarizing results/correlations more succinctly.

P1,l.25. Flushing means what exactly? DOC removal? Maybe say flushing of DOC.

P3,l.16. grammar

P3,l.20. Could add conclusion sentence summarizing the outstanding issue that is

C2

motivating your study.

P7,l.4. Add short sentence explaining how soil respiration calculated.

P7,l.20. What package in R was used for the LMEs?

P8,l.26. Introduce the soil thickness measurements shown in Table 1 here too.

P8,l.26. In Fig. 1, reorder the panels so that soil respiration is numbered according to when it is introduced.

P8,l.31. What do you mean by partial melt?

P9,l.7. Should current fig. 1b be current fig. 1c?

P10,l.3. reword "were not found" to "was" if singular.

P10. Order of figure introduction is confusing throughout entire page. Could rearrange existing text so that corresponding panels from Fig. 1 introduced first, Fig. 2 second.

P10,l.11. How much? Consider adding a percentage value.

P10,l.16. Snow depth?

P10,l.18. Rain throughfall?

P11,l.9. Add "was" before "observed".

P13,l.12. Take pgph 1 step further with conclusion sentence that links back to your results.

P13,l.24. Why is winter included here? Don't 3a and 3b depict linear increases, while 3c depicts the plateau? Should the reference to fig. 3b be included in line 25? Maybe I missed something but this could be clarified.

P14,l.1-3. Excellent conclusion. Consider repeating exactly like this in the abstract to shorten there.

C3

P14,l.5. Tough to support the statement that winter fluxes were "dynamic" with only 1 measurement there, so consider rewording that.

P14,l.18. Could end this section with stronger discussion of the implications of these results. Same comment goes for the next section too. Is the timing of the precipitation the key? How well is this established in earlier studies? Could take this back to the broader literature.

P15, l.5. Important end to the sentence, but awkward as currently written. Consider rewording.

Fig. 1. Center the Y-axis titles on each panel.

Fig. 3. Consider adding trendlines to quantify the different seasonal relationships.

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C4