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Interactive comment on "Partial coupling and differential regulation of biologically and photo-chemically labile dissolved organic carbon across boreal aquatic networks" *by* J.-F. Lapierre and P. A. del Giorgio

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Reviewer:

General Comments

This manuscript describes an extensive study of biodegradable (Bd-DOC) and photo-chemically degradable (Pd-DOC) dissolved organic carbon across a large range of boreal lakes, rivers, and wetlands (mostly beaver ponds) in Quebec, Canada. The authors quantify percent and total concentrations of Bd-DOC and Pd-DOC, and relate

these pools to specific optical DOM properties, including fluorescent components, and to nutrient concentrations (total N, total P). Based on these relations, they conclude that terrestrial landscapes are important sources of both Bd-DOC and Pd-DOC pools to aquatic systems, and that autochthonous sources of Bd- DOC are important in some systems but that terrestrial inputs of Bd-DOC can be large enough to overwhelm the significance of the autochthonous pool.

I very much enjoyed reading this manuscript. It is well-written and the authors thoughtfully and effectively present the current state of knowledge of degradable DOC in aquatic systems, the gaps in our knowledge, and how this study aims to address some of those gaps. I found the approach to be technically robust, and while broad conclusions are made the authors are careful not to overstate their significance. The topics addressed are very relevant to the scope of the journal, and the results and conclusions are certainly of interest to the broader scientific community studying terrestrial-aquatic linkages and carbon dynamics.

I have some specific comments about issues that the authors should address, listed below.

Authors:

We thank the Reviewer for the very positive comments and the following constructive suggestions. Reviewer:

Specific comments 1. Section 2.4: Some details on the incubations need clarification. Specifically, were the Bd-DOC incubation samples on Day 0 and Day 14 re-filtered at 0.45um prior to DOC analyses for DOC loss determination? Also, were the Pd-DOC incubations conducted on water filtered at 0.45um or at 2.8um?

Authors:

Bd-DOC samples were not re-filtered and Pd-DOC incubations were conducted on water filtered at 2.8μm; we now specify these points in section 2.4. Furthermore,

related to the same comment, we added this sentence in section 2.4:

"We assumed that most bacteria could not survive the very strong UV dose and thus significantly contribute to the DOC loss in irradiation experiments; even if that were not the case, the DOC loss rates (expressed per day) were always at least one order of magnitude higher in photochemical degradation experiments compared to biological degradation experiments conducted in the dark (Lapierre et al., 2013)."

Reviewer:

2. Section 3.2: It would be instructive for readers if the maximum excitation/emission wavelengths for each PARAFAC component were provided, either in the text or a table/figure caption.

Authors:

We now report the peaks coordinates in the figure caption.

Reviewer:

3. Section 3.2, and Table 1: In presenting and discussing fluorescence component "concentrations", I think it is important for the authors to state that these are still relative concentrations rather than absolute concentrations, and that they are expressed in Raman Units. This would clearly convey that the authors do not mean concentrations in mg/L.

Authors:

We added a sentence at the end of section 2.3 that acknowledges that point (specified in our reply to Reviewer #3)

Reviewer:

4. Section 3.4: Did the authors test the effect of stream Strahler Order on Bd-DOC or Pd-DOC within the rivers dataset? It would be interesting to know if there was any

relationship.

Authors:

This is an interesting suggestion. We tested it, and there was very weak (negative) relationship across all the rivers and streams. When sites were grouped by the region in which they were sampled, some relationships were stronger (always negative) and some were not significant. Thus the overall pattern of Bd-DOC and Pd-DOC with stream Strahler order is coherent with our other results. This is a somewhat complicated point to make, however, because we would need to discuss why the overall relationship is weak and why we have explored the intra-regional patterns for a subset of the data (i-e rivers and streams only).

We considered that the additional support provided by these results did not outweigh the additional discussion needed to adequately address this point and its implications, and thus that including it would not strengthen the manuscript.

Reviewer:

5. Section 4.1: It is unclear what exactly the authors mean by "freshness". In some places it is discussed in the context of time since export to aquatic systems. Is what the authors mean, or is it more in the context of extent of prior decomposition (both biological and photochemical)? Some clarification is needed

Authors:

This comment echoes comments by other reviewers. We now state more explicitly that freshness is defined as:

" [...] the time relative to when DOM left its site of production (e.g. soil, aquatic organisms) and was imported into the aquatic environment"

and we have reworked a sentence in the 4th par. of the "Introduction":

"[...] and carbon pools that are considered recalcitrant from a geochemical perspective

(based on their molecular properties and degree of prior processing) may actually be biologically degradable under the right environmental conditions, in soils (Schmidt et al., 2011) or in the water (Marín-Spiotta et al., 2014;Ward et al., 2013)."

to acknowledge that "freshly imported" material may be degradable in aquatic environments even if diagenetically altered.

Reviewer:

Technical comments 1. Section 2.3, line 20: “was” should be “were” 2. Section 2.4, line 5: “that” should be “than” 3. Section 2.4, line 26: “alters” should be “alter” 4. Section 4.1, line 4: delete “of” 5. Section 4.1, line 21: change “synonym of” to “synonymous with” 6. Section 4.3, lines 8: “: : :not only may biologically labile DOC be produced: : :”

Authors:

We have made all the suggested changes.

Reviewer: 7. Fig 3, caption: I don’t understand the equation presented for 3b (what is C.I.0.58?) Authors: C.I. represented the 95% confidence interval around the parameters. Following a comment by Reviewer #3, however, we now also include the individual equations for lakes, rivers and wetlands in the caption, and we have removed the CI from the equation of the overall (lakes + rivers + wetlands) pattern.

Interactive comment on Biogeosciences Discuss., 11, 6673, 2014.