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Interactive comment on "Optical properties and bioavailability of dissolved organic matter along a flow-path continuum from soil pore waters to the Kolyma River, Siberia" *by* K. E. Frey et al.

Anonymous Referee #1

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This paper contains an interesting dataset of DOC in the Kolyma River watershed that follows closely from previous work by the authors in this system. In this paper, the authors build on their prior work on DOC and BDOC concentrations in the Kolyma River by also making these measurements on the soil waters draining into the small streams and eventually the main stem of the Kolyma. The data and methods are strong. A few ideas in the discussion and conclusions could be strengthened by comparing to similar findings in the arctic in other systems, and by broadening the interpretations as suggested below.

Methods:

It was not clear whether bioassay incubations were conducted on unfiltered water, or water with sediment? Also, bioassays were conducted at 15 °C but no rational was provided for this temperature. How representative is this temperature of the soil waters, streams and the river studied here?

Were the bioassays started right after sample collection, or were samples allowed to equilibrate with the atmosphere prior to incubation? The authors should provide information on whether any samples were sub or anoxic at the start of the experiment?

Incubations were conducted at 15 °C, but there was no information on how well the temperature was controlled over the course of the incubation, which is helpful to rule out influences from gas exchange (such as bubble formation if initial sample temperature at T0 in the BOD bottles is different than 15 °C).

The extra information on Winkler titrations in this paragraph (lines 5- 12) is out of place given that Winkler titrations are standard methods for O2 consumption; no further examples needed that were not used in this study.

Results and discussion:

The authors mention relationship of DOC and BDOC concentrations with water residence time "in the system", is this the water residence time in soils, streams or the river? What are the residence times of water in these different systems (none were provided directly or in citations to previous work).

The authors interpret decrease in DOC and BDOC concentrations from soil waters to small streams and rivers as evidence for rapid, in-stream processing, but the fraction of DOC that is labile is similar across all water types. If the most labile DOC is rapidly removed as water moves from small to large streams, how do the authors interpret that there is a consistent fraction of BDOC (% of DOC) in the waters studied? While the authors can't rule in or out the reasons for relatively consistent fraction of BDOC in their sites, they can do more to discuss alternative explanations within the context of

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the literature, such as photodegradation, changes in microbial community structure, or inputs of labile DOC along stream and river channels from soil waters.

For example, for photodegradation, the authors suggest that a decrease in CDOM slope ratio from streams to the river is consistent with photodegradation of DOC, which has previously been observed as a function of water residence times in arctic freshwaters (Cory et al. 2007 JGR-B, Merck et al. 2012 Hydrol. Proc.). The authors could strengthen their interpretation of CDOM and slope ration by comparing to these previously observed and similar patterns.

In addition, the authors seem to be interpreting the decrease in slope ratio from the streams to the river as evidence that photodegradation is important in this system. How might photodegradation influence the fraction of BDOC with distance downstream, given that light exposure has a substantial effect on DOC lability in bacteria in arctic freshwaters (for example, Cory et al. 2013 PNAS; Mladenov & Laurion 2013 Env. Res. Let).

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