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Discussions

Interactive comment on "Tracing the transport of colored dissolved organic matter in water masses of the Southern Beaufort Sea: relationship with hydrographic characteristics" *by* A. Matsuoka et al.

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Dear Reviewer #1, Responding to your comments, the text has been revised. Please find below our detailed response to your comments and suggestions.

The study provides novel data on CDOM in the western Arctic Ocean and uses an optical approach to characterize CDOM samples into 6 water masses. The description of water masses in the southern Beaufort Sea is well written and well supported by Table 1 and Figure 2.

Results Page 11012/11013 ". . ..except for some stations where waters were influenced by sea ice melt (dotted circle in Fig. 5a)": the a440 values were clearly lower for some stations but what's about the spectral slope? How did they compare with those in surrounding waters? Same for DOC data.

At very low salinity (< 6; end-members for both river and sea ice melt waters), values of SCDOM for river waters (0.018 – 0.021 nm-1) fell within the range for sea ice melt waters (0.018 – 0.022 nm-1). In contrast, aCDOM(440) values between river and sea ice melt waters were significantly different ($p < 0.0001$; Figure 5a). Those results suggest that not SCDOM but aCDOM(440) values are useful to distinguish river and sea ice melt waters at very low salinity (< 6). We added these sentences both in the results and discussion (lines 334-336 and 406, respectively).

While DOC concentrations for sea ice melt waters were not obtained in this study, those values are expected to be low, due to removal of DOC resulting from brine rejection [Amon, 2004], compared to those in river waters. As for aCDOM(440) values, DOC concentrations may thus be useful to distinguish river and sea ice melt waters at very low salinity (< 6).

Page 11013 "the river plume extended farther offshore in the western channel than in the eastern channel, ..." I think the manuscript would benefit if the authors would include a comparison of their results to these other recent publications in the field. For example, Retamal et al (2007) found high CDOM absorption more than 50 km offshore over the Mackenzie shelf. How does it compare with the data presented here?

While recent papers described the extension of the plume during their cruises [Retamal et al., 2007; Guéguen et al., 2007], it is hard to compare that with our observations because of their sparse data in the Southern Beaufort Sea. Nevertheless, the extension of the plume observed in this study is consistent with that reported by Macdonald et al. [1999]. We added the following sentences in the discussion (lines 412-414): "According to our observations, the river plume extended far from the western channel of the

river mouth to the northwest direction over 150 km. This result is consistent with that reported by Macdonald et al. [1999]".

Page 11015 "Our zero-salinity DOC values were significantly lower than in the Eastern Arctic Ocean (p<0.0001; Amon, 2004)." The zero-salinity DOC value (approximately 500uM) agrees well with DOC data found in previous studies (e.g. Osburn et al., 2009). The authors however should comment why their estimate is far below that found in the eastern Arctic Ocean.

At zero-salinity, DOC concentrations at the mouth of the Mackenzie River were lower than those measured in major Siberian Rivers [Amon, 2004; Raymond et al., 2007]. The lower zero-salinity DOC in the Western Arctic Ocean (486 μM obtained from this study) relative to that in the Eastern Arctic Ocean (694 μM obtained from Amon, 2004) is likely due to lower DOC concentrations in high latitude watersheds of North America compared to those in Siberia [Raymond et al., 2007]. We added these sentences in the discussion (lines 482-487).

Page 11015 "97% of DOC variability is explained by that in the colored fraction of DOM": The authors should compare this important result to this other recent papers.

In this study, we found that DOC concentrations were highly correlated with aCDOM(440) in the UPML (r2 = 0.97), which is consistent with recent papers [e.g., Mannino et al., 2008; Fichot and Benner, 2011]. In particular, our regression was similar with that obtained in the U.S. Middle Atlantic Bight [Mannino et al., 2008; DOC vs. aCDOM(440) relationship was obtained assuming a SCDOM of 0.018 nm-1 to convert aCDOM(412) to aCDOM(440)]. This result suggests that similar relationship can be applied to both areas to estimate DOC concentrations using aCDOM(440) values. We added these sentences in the discussion (lines 522-527).

Page 11017 Aagaard et al. instead of "Aaggaard et al."

Corrected (lines 101, 231, 256, 452, 643, 645, and 694).

Discussion Page 11016 "While CDOM absorption was measured onboard immediately after water sampling in this study, the measurements were achieved a few months after sampling in Belanger et al. (2006) on frozen water samples. The difference in the slope for aCDOM(440) versus salinity relationship could partly result from change in CDOM absorption properties over time." High CDOM samples are especially susceptible to loss of CDOM optical properties from freezing rather than time.

It is difficult to determine strictly the reason for the differences in the slope of the aCDOM(440) vs. salinity relationship between our study and that of Bélanger et al. [2006]. We modified this sentence by adding "or a result of freezing" at the end (lines 424-426): "The difference in the slope for aCDOM(440) versus salinity relationship could partly result from change in CDOM absorption properties over time or as a result of freezing".

Appendix A1: The authors tested whether there was a significant difference in CDOM absorption of surface waters between samples from the barge and from the CTD/Niskin. It is not clear if the p-value given here corresponded to the linear regression line or slope. Please clarify.

We tested whether the slope of the aCDOM(440)-Barge vs. aCDOM(440) -Niskin relationship was significantly different from 1. We clarified that in the figure caption (lines 884-886): "In both cases, the slope of aCDOM(440)-Barge vs. aCDOM(440) -Niskin relationship was found to be significantly different from 1 ($p < 0.0001$ for both figures a and b)".

Interactive comment on Biogeosciences Discuss., 8, 11003, 2011.