

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2020-462

Piotr Kowalczyk (Referee)

Referee comment on "The impact of the freeze–melt cycle of land-fast ice on the distribution of dissolved organic matter in the Laptev and East Siberian seas (Siberian Arctic)" by Jens A. Hölemann et al., Biogeosciences Discuss.,
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General opinion

Authors have presented a study based on unique data set collected during ship based and ice based expeditions between 2010-2019 in the Lena River delta and Laptev Sea. Based on this data set Authors have established a sound relationship between CDOM absorption coefficient $a_{\text{CDOM}}(350)$ and DOC concentration in the Laptev Sea and East Siberian Sea. Using salinity and oxygen isotopes data together with $a_{\text{CDOM}}(350)$, they have established water mass balance and calculated the organic carbon budget in the Lena River delta. Authors calculations revealed that ca. 15. TG of carbon is rejected from land fast ice with brine during ice formation, and is exported from Laptev Sea shelf into Transpolar Drift and to the East Siberian Sea shelf waters. Author have also concluded that melt water from mealting land fast ice in the Laptev Sea shelf dilutes the CDOM contained in the Lena River plume. The additional source of fresher water with lower CDOM content explained the mixing anomaly indicated in the CDOM vs. salinity mixing diagram.

Findings presented in the manuscript by,

The manuscript is very well written, and well edited serving as very important source of information on poorly described and quantified part of the DOM cycle in the Arctic Ocean. I found it very interesting and providing new and very relevant information. In my opinion this study deserved prompt publication after minor revision.

Detailed remarks Hölemann et al, are particularly important in the context of the current questions on the organic carbon flux exported from Arctic Ocean through Fram Strait. For this reason I recommend this paper for prompt publications.

The weak point of the manuscript is within discussion on the land fast ice annual cycle of freeze and thaw. This is especially important in the context of the CDOM. CDOM is not only rejected from the ice with brine but also its composition is significantly altered. I do recommend inclusion of findings presented in papers by Müller et al., 2011 and 2013 (Ann. Glaciol. 52 (57), 233–241; Mar. Chem. 155, 148–157), who studied the composition modification of CDOM contained in the ice during field studies and during controlled experiment. Further modification of CDOM in the ice results from biological activity in spring and summer. Studies by Granskog et al., 2015 (Ann. Glaciol. 56 (69)), Retelleti-Brogi et al., 2018 (Sci. Total Environ. 627, 802–811), and most recent by Zabłocka et al., 2020 (Mar. Chem. 227, 103893), have documented that CDOM produced by sympagic algae leads to overall dominance of the protein-like fractions in the CDOM/FDOM composition.

I also suggest minor correction in the abstract. Specifically, phrase “ Laptev (LS) and East Siberian Seas (ESS) receive enormous amounts of tDOM rich” should be rewritten in the sentence containing a approximate quantitative information about riverine discharge.

Except suggested short paragraph in the discussion, on the alteration of the CDOM/FDOM composition due to brine rejection during freeze and biological production during spring, that should be added during revised manuscripts edits, I did not find any weak point in this presentation.

Piotr Kowalczuk

Please also note the supplement to this comment:

<https://bg.copernicus.org/preprints/bg-2020-462/bg-2020-462-RC1-supplement.pdf>