

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-109

Anonymous Referee #2

Referee comment on "Fluvial carbon dioxide emission from the Lena River basin during the spring flood" by Sergey N. Vorobyev et al., Biogeosciences Discuss.,
<https://doi.org/10.5194/bg-2021-109-RC2>, 2021

General comments

The manuscript by Sergey N. Vorobyev et al. deals with carbon dioxide emissions from the Lena River basin during the freshet. The amount of data presented here is of high importance as too few studies are available on riverine carbon export to the Ocean, and especially during the spring flood, as most studies are biased towards summertime. However, some of the drawn conclusions are lacking proof, and likely overestimate the annual carbon emissions.

Comment to line 167-169. A fixed k_{CO_2} value for the entire open water season of 4.6 m day^{-1} is rather high, especially since floating chambers often overestimate the fluxes (Long et al., 2017; Ribas-Ribas et al., 2018). Particularly when using floating chambers during the freshet, where the water velocity and turbulences are several times above the summer low which then lasts for 4 to 5 months. Used reference measured a median of $4,464 \text{ m d}^{-1}$, which were all sampled during June. In addition, since many k measurements were made, I would suggest separating main stems and tributaries. Also, when looking up the k values from the given ref. Serikova et al., all reported k values were given in $\text{cm}^{-1} \text{ h}^{-1}$, ranging between 5.1 and $16.5 \text{ cm}^{-1} \text{ h}^{-1}$ (which is 1.2 to 4 m day^{-1}). Please double check that the proper k value unit was used.

Comment to section 3.4 on aerial emissions. As your own data shows, there are strong temporal and spatial variability in pCO_2 levels. Upscaling spring flood concentrations, where $>50\%$ of annual water masses discharges, for the remaining 4 summer months is highly uncertain. Summer concentrations from e.g. the Kolyma are reported to be $0.35 \text{ g C m}^{-2} \text{ d}^{-1}$. Also, in line 266 you report that 5022 km^2 water area are seasonal. This area needs to be removed when calculating the areal summer fluxes.

Comment to line 358ff: What published data and I would like to see a table with this

literature data. What are the numbers? If available with seasonal resolution as this is what you are comparing with.

Comment to the discussion section. Especially here English needs to be revised and restructured. Some parts can be shortened, while several other parameters which were introduced, were not discussed at all.

Figure 1 and S1 A: Since you have graticules, you do not need a north arrow. Actually, your north is not always "up" on the figures. Please remove them.

Figure S1 A: Change Landscape to Landcover map. Also, reference for this data.

Figure 2. This data is very interesting, but what I am missing is the discussion on that. Are the peaks where conflux occurs? Higher fluxes due to turbulences? More information on differences between the tributaries.

Table 1: CH₄ concentrations are illustrated twice. Please remove or exchange one

Organic C and OC, choose one and use consistently.

Additional data from tables (DIC, pH) not really discussed and incorporated