Biogeosciences Discussions

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Comment on bg-2021-13

Anonymous Referee #1

Referee comment on "CO_2 emissions from peat-draining rivers regulated by water pH" by Alexandra Klemme et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-13-RC1, 2021

The manuscript by Klemme et al. presents a study explaining why tropical peat draining rivers are only a moderate source of CO2 to the atmosphere, which stands in contrast to what was assumed for global estimates. Klemme et al. test the hypothesis that decomposition and thus CO2 production in these organic C rich waters is limited by pH and O2 availability. For this, they use a comprehensive dataset of observations of DOC and CO2 concentrations, pH and other relevant physical and chemical parameters from SE Asian, peat draining rivers in combination with a conceptual model representing limitations of DOC decomposition by low pH and O2 concentrations. They find that DOC decomposition in those peat draining rivers is likely more limited by pH than by O2, and suggest that increased loads of carbonates due to agricultural liming or enhanced weathering could increase decomposition of DOC and thus CO2 emissions from those peat draining rivers.

The study is original and of great interest for the readership of Biogeosciences. The manuscript is well written, the methodology is clearly described, and results are clearly presented and support the main findings of this study. I suggest publication after minor revisions. Please, find my comments below.

L15-17 : Other studies have shown that large amounts of CO2 evading rivers are actually put in as dissolved CO2 from soil respiration (both heterotrophic and root respiration) (Abril and Borges, 2019; Lauerwald et al., 2020). Maybe you should mention that source as well.

L17-18: These are actually not model based studies that would represent peat soils. Those are more upscaling studies that lacked observations from these important systems

L42: In peat draining rivers, is there also less instream production by algae that would otherwise be a source of O2 to the water column?

L48-51: You should link these quite specific objectives here again to the more general research objective (or hypothesis to be tested): explain the moderate CO2 emissions from peat draining rivers by the effect of low pH and O2 limitation.

L95-97: I don't understand why you have used such a projection for determining areas. For that purpose I would rather use an equal area projection, like an equal area projection after Lambert or the EckertIV projection.

L110-112: The exponential limitation factor related to pH, which is defined as negative decadic logarithm of H+ activity - would that be comparable to a linear factor relating to the H+ activity? That might be worth discussing here in one or two sentences.

L122-123: That would require that dissolved CO2 inputs via groundwater inputs and CO2 consumption by autotrophic production is negligible. These are strong assumptions that would be worth mentioning here explicitly and some discussion later on.

L140: "spatially as well as temporally"

Figure 3: The grey lines, are those regression fits or the 1:1 line, or both?

For figures 3 and 4, it would be great if you could report in addition the RMSEs.

L184: There's a "c" missing in "concentration".

L189-191: Do Borges et al. also report CO2 emission rates or CO2 concentrations which are comparable to those in your study?

References:

Abril, G. and Borges, A. V: Ideas and perspectives: Carbon leaks from flooded land: Do we need to replumb the inland water active pipe?, Biogeosciences, 16(3), 769–784, doi:10.5194/bg-16-769-2019, 2019.

Lauerwald, R., Regnier, P., Guenet, B., Friedlingstein, P. and Ciais, P.: How Simulations of the Land Carbon Sink Are Biased by Ignoring Fluvial Carbon Transfers: A Case Study for the Amazon Basin, One Earth, 3(2), 226–236, doi:10.1016/j.oneear.2020.07.009, 2020.