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Interactive comment on “Modern to millennium-old greenhouse gases emitted from freshwater ecosystems of the eastern Canadian Arctic” by F. Bouchard et al.

Anonymous Referee #1

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Generally I think this is a great paper, which addresses important questions related to GHG in the Arctic. With extrapolations of GHG fluxes across the Arctic becoming ever more popular, I find it refreshing to read a paper that hones in on the governing processes of GHG production at the local scale. This paper reminds up that gross up scaling of fluxes should only be done if accounting for differences in water body type. I recommend this paper for acceptance.

Specific Comments

(1) I want to know more about the C-13 and D stable isotopes in the lakes. Figure 7 only shows 6 lake samples simply labeled as “lake”. From my own research I have seen

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large differences in these isotopes based on where they were collected in an Arctic lake. Samples collected from the perimeter and the surface tended to show more AM influence while samples collected from the surface interior and even more so at depth in the lake showed more HM influence.

In Figure 4 I see 5 lake samples that show large differences in age based on their location, which is interesting. It would be nice if the data of Figure 7 was similarly labeled with the location, allowing for more of a direct comparison between the two figures of these data points.

(2) Despite of this paper's great attributes, it is a dense read. There are a lot of long paragraphs and long sentences, which make all of the information difficult to digest and the paper difficult to read. I think the paper would appeal to a broader biogeochemical group of scientists if the authors broke up some of the long paragraphs and sentences to shorter versions. This is a suggestion, but I think it would benefit the paper in the long run greatly.

(3) The presences of the nutrient data confuses me. There is one table and one paragraph describing the nutrient data. The nutrient data adds nothing to the discussion, yet it is present in the results. Either the nutrient data should be expanded on or cut.

If the authors chose to keep the nutrient data in the paper they should discuss specific nutrient species (TN vs NO₃, etc.) rather than all grouped together (how it is currently presented). Also lacking are statistics on the nutrient data. Are there real statistical differences in TN, Fe, Mn, etc., between the lakes or all they the same? A simple ANOVA analysis would answer that question.

I think the nutrient data could help the readers understand the differing biological regimes of the lakes and ponds better (like why there are algal mats in some), but it needs to actually be discussed in the text not just shown in a table.

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