Biogeosciences Discuss.,
doi:10.5194/bg-2016-293-RC2, 2016


Biogeosciences Discussions

# *Interactive comment on* "The effect of warm summer 2012 on seasonal and annual methane dynamics in adjacent small lakes on the ice-free margin of Greenland" *by* Sarah B. Cadieux et al.

**Anonymous Referee #2**

Received and published: 19 August 2016

With a little focusing this interesting study could be a gem. The study demonstrates two mechanisms by which warming temperatures in Greenland could affect methane dynamics in small lakes. The first is during open water, increased stratification of the water column, which would presumably result in greater methane release during fall overturn and less overall methane oxidation. The second mechanism is that greater temps will result in less overall ice cover which would cause less methane storage under the ice and presumably more overall oxidation. These two processes or effects of increased temperature would seemingly have contradictory effects. I don't know the extent to which these two processes effects have been expounded in the literature, but this is the first time I've seen them presented. I would thus suggest to the



authors that they make more of these observations, highlighting them in the abstract, and particularly in the article titles, which is rather weak right now, in my opinion. Perhaps something like " The contradictory nature of warming effects on lake methane emissions: increased stratification during ice free periods versus reduced ice cover." Needs work, but something along those lines. I would also suggest that these unique observations be expanded into a conceptual model in the discussion and conclusions.

Specific comments.

1. abstract. See above. ALSO focus on the effects these processes will have on overall annual lake methane emissions. That's what's important. You may not have the data, but speculate, and call for attention to what your have observed so it can be followed up.

2. page 3, lines 90-95. Your hypothesis. Why did you hypothesize that warmer conditions would lead to higher methane concentrations? Say "increased stratification" here. Explicitly state it. Advance a hypothesis about ice cover. Return to these hypotheses in your discussion.

3. Lines 95-100. Permafrost soil? Anything you can tell us about it? Peat? Mineral soil? OM content? Does it thaw under the lake (thaw bulb) to make the methane you observe?

4. line 112. define GIS

5. line 126 define EVV

6. line 211. what is Clinograde?

7. line 225. "moderately brackish salinity? What was the salinity in o/oo? Is "brackish" the right term? Like 5-10 o/oo?

8. Line 307-308. confusing. Is the sentence messed up?

9. Line 308 do you mean figure 8? Not 7?

10. Line 315 sulfate reduction not sulfur.

11. Line 352. Inversely related?

12. Lines 415-425. I don't follow this too well. How do you know that the % of CH4 oxidized is the same over the two years? Do you have measurements of MOX> ? Doesn't this kind of blow your theory that more temp and more stratification will result in more methane release with fall overturn? How is the MOX the same across years, or even known at all?

13. Develop around line 425-460 the effects of a shorter ice covered period. Make a solid conceptual model centered on your figures. What is the interplay between increased stratification during ice free in contrast with less ice cover? How does this interplay affect annual methane flux as temperatures warm> I would think that there would be less MOX under stratified conditions, and certainly less under ice.

14. Conclusions. Point out that these two processes are contradictory.

---

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-293, 2016.