

Review of: The water column of the Yamal tundra lakes as a microbial filter preventing methane emission

General Comments:

This manuscript contains information that appears to be of considerable value in understanding the role of methane production and consumption in both deep and shallow Yamal tundra lakes. It likely has valuable application to understanding these processes in thermokarst lakes across the arctic. However, there are some significant adjustments/edits needed.

The manuscript needs a thorough proof read. There are many grammatic errors/issues, I've outlined a fair number in the technical corrections, but this is by no means comprehensive.

Further, this manuscript needs to be more focused and organized. A more clearly outlined hypothesis/research statement at the end of the introduction would be helpful. There is a wealth of information presented here, but it is not immediately clear how some information relates to the stated goals. E.g. the information presented in section 3.1 seems to be fairly important to the processes involved in methane production, but there is minimal discussion of these results in section 4.

Specific Comments:

Line 42: Thermokarst lakes are also widespread in Northwestern Canada and the Hudson Bay Lowlands – eg. Marsh et al. (2009): Marsh, P., Russell, M., Pohl, S., Haywood, H. and Onclin, C.: Changes in thaw lake drainage in the Western Canadian Arctic from 1950 to 2000, Hydrol. Process., 23(1), 145–158, doi:[10.1002/hyp.7179](https://doi.org/10.1002/hyp.7179), 2009.

Table 1: This is a small sample size of lakes, and characteristics appear to be quite different depending on the lake, especially temperature. I think some discussion of possible reasons for these differences is merited. Also, I have a hard time believing the bottom temperatures for the deep lakes? How is it that LK-004 has a temperature of 14.2 °C at a depth of 11m while LK-002 is only 11.7 °C at the surface? This seems like a very weak temperature gradient for 11m of depth? Do you have temperatures (and other variables) available for all sample depths? It would be helpful if they were all presented here.

Fig 2 & Lines 206-208: Define what is considered to be the photic layer. Is this the integral of the entire water column? In line 207, the term photic depth is used instead? Also, it is not apparent from Fig 2 that LK-003 has higher PP than LK-002 as claimed? This requires further explanation.

Line 209 & Fig 3a: LK-004 appears to contradict the claim of $< (\pm 0.5 \text{ mg L}^{-1})$ variability in DOC within the water column?

Line 203 & Fig 4: Should this figure show the DCA values for the near-bottom layer of the lakes as well for better comparison?

Fig 2 & 4: The integrated values would be better shown in a separate subplot or with a secondary y-axis to make it more apparent they are in different units.

Line 315: What are the other mechanisms of formation?

Lines 384 – 397: I think this point needs further clarification? Why did you only measure hydrogenotrophic methanogenesis if it is likely to be only a small fraction of total methanogenesis? The methane production vs. oxidation figures presented in here make it seem like there should be no methane emissions because rates of oxidation are orders of magnitude higher than production?

Line 471-474: From the results presented here is it possible to get some sense of the relative magnitude methane emissions from the surfaces deep vs. shallow lakes? What are the implications of these findings in regards to climate change?

Technical Corrections:

Fig 1, Table 1, & throughout text: Would it not be better to refer to LK-010 as LK-001?

Line 22: (90–1000 $\mu\text{mol CH}_4 \text{ dm}^{-3}$) – What timeframe is this over? One day? The whole summer? Clarify the temporal unit.

Line 37: Consider rewording- e.g. These lakes have been classified as thermokarst lakes in continuous ice-rich permafrost (Dubikov, 1982) although other origins have also been proposed (Arctic and Antarctic Research Institute, 1977; Kritsuk, 2010).

Line 41: Change “in case if the topography of the area is flat” to “in flat areas”.

Line 47: Change “the increase of total lake area by 12% is observed” to “an increase in total lake area of 12% has been observed”

Line 70: Change “are usually revealed” to “usually occur”

Line 76: Define acronym OM

Line 78: Remove the word therefore

Line 80: Change “widely presented” to widespread

Table 1: Define or be clearer with use of acronyms (e.g. NL/WL – Lat/Lon). EC, this acronym isn’t used in the text, but you spell out electrical conductivity on line 134. Be consistent. What is secci depth? Also, LK-004 is missing a “)” after the depth in the left-most column.

Line 260: This sentence as is reads like it might be more appropriate in section 2.2. You could reword to say something like “Bottom sediment samples from the bottom surface and to the depth of 14–15 cm are described in Table 3.”

Line 273-274: Be consistent with acronym usage, you use methane oxidation in one sentence then MO in the next.

Line 442: annual methane what? Production? Emission?