Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-98-AC3, 2019
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Interactive comment on "Methane oxidation potential of the arctic wetland soils of a taiga-tundra ecotone in northeastern Siberia" *by* Jun Murase et al.

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Received and published: 3 June 2019

Thank you very much for your valuable comments. Please see our response to your comments below and also the supplement for our revised ms.

We suggest that the authors explain in a bit more detail how the study, the experiments and the findings are new and why they are important.

–>We revised our manuscript to the comment including further information in introduction, materials and methods, and discussion.

The purpose of the inhibitor experiment remains unclear.

–>We revised added more background information in introduction.

Certain aspects of the experimental design are not clear to us.

–>Materials and methods were rewritten to the recommendations.

We do not fully understand Figure 6. We would encourage the authors to explain the methods and results in more detail and to engage more in the discussion of the results.

–>We add more explanation of the inhibitor experiment.

the implications of the results on methane dynamics is not discussed. It might be helpful to elaborate on how researchers should do future studies.

–>We include them in the conclusive remarks.

There were several statements that were unclear to us, which we list below: P.3, line 12: "the potential methane oxidation rate is typically one order of magnitude higher than that of methane production (Segers, 1998)".

–>Thank you for your comment. We cited another reference. "It is estimated that 50 Tg of methane are annually produced in boreal wetlands and 15 Tg are consumed before emitted to the atmosphere (Reeburgh, 2007)." (P3L13)

P.3, line 25: what are polygon depressions and polygon rims?

–>Polygon depressions are the central part of a polygon where the ground water level is generally high and methane cycle is active due to the water-saturated conditions of soil. Polygon rims are the surrounding area of polygons where the ground water level is low and methane production and thus methane oxidation are less than polygon depressions.

P.7, line 10: We are unsure as to how "potential atmospheric deposition" fits into this sentence.

–>We rephrased it.

P.9, line 15: It is stated that there was no dissolved oxygen found below 10 cm. In the same paragraph, it is mentioned that immediate methane oxidation was observed in the frozen layer at a depth of 30-40cm. Is this not a contradiction? Does this refer to anaerobic methane oxidation? Please elaborate.

–>We measured the potential methane oxidation where we incubated the soil samples under oxic conditions with a relatively high methane concentration to target a low-affinity methane oxidation.

P. 10, line 1 & Figure 5: What is meant with threshold temperature for methane oxidation?

–>We mean that the threshold temperature is the lowest temperature that allow methane oxidation. We omitted our discussion regarding the threshold temperature according to the reviewer's comment.

P.11, line 22: Why is methane oxidation compared to carbon respiration? The sentence is long and confusing, maybe splitting it and explaining in more detail could help.

–>We deleted the phrase.

P.12, line 4: What is meant with "potential over the soil depth was estimated at 15 C"?

–>We changed the expression: "The depth profile of methane oxidation potential was estimated at 15 °C," (P13L17)

P.12, line 11: What is meant with "did not affect the methane flux with any rates"?

–>We meant that a wide range of methane flux was observed in the first measurement and these flux rates were unchanged in the second measurement after adding the inhibitor. We revised the parahraph.

P 27, figures 5 a, b, c: Why was "ppmv" instead of "ppm" used as a unit?

–>We use ppmv to clarify the concentration is a volume basis.

We suggest proofreading by an English native speaker. Language issues sometimes led to confusion. Below we list some things we found:

–>Thank you very much for your carefully checking our English writing. We corrected all the points you raised.

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2019-98/bg-2019-98-AC3-supplement.pdf

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-98, 2019.

Table 1. Summary of samples used and experimental setup

Year	Bottle incubation experiment		Methane flux with the inhibitor
	Soil layer (cm)	Effect of	
2012	0-10	Nutrients	-
2013	0-2, 4-6, 8-10	Depth (1)	-
2014	0-10	Temerature	Short exposure time
2015	0-10, 10-20, 30-40(moss), 37-46(sedge)	Depth (2)	Long exposure time

Fig. 1.

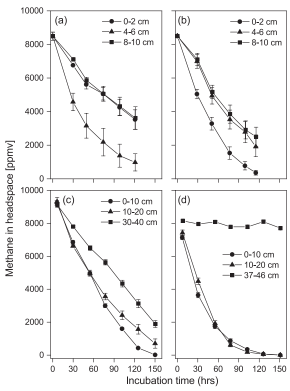

Figure 3. Methane oxidation by the different depth layers of moss (a, c) and sedge (b, d) dominated soils in 2013 (a, b) and 2015 (c, d). Bars indicate the standard error (n=3).

Fig. 2.

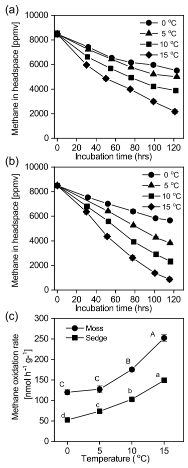

Figure 5. Effect of incubation temperature on methane oxidation by (a) moss and (b) sedge dominated peat samples and (c) the temperature dependence of the methane oxidation rate (0-10 cm) (2014). Bars indicate the standard error (n=3). Data marked with different letters are significantly different ($P < 0.05$, as determined by Tukey' s honestly significant difference test).

Fig. 3.

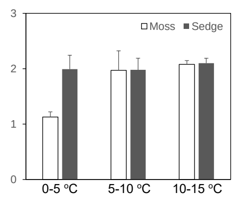

Fig. 6. Temperature coefficient (Q_{10}) of methane oxidation estimated between different temperature ranges .

Fig. 4.

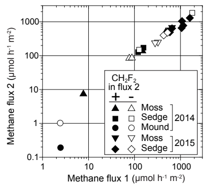

Figure 7. Effect of CH_2F_2 on methane flux from wetland estimated by the closed chamber method. Methane flux 1, 1st measurement without CH_2F_2; Methane flux 2, 2nd measurement after injection with (filled symbols) or without (open symbols) CH_2F_2.

Fig. 5.