Laurent Biogeosciences Reviews & Response to reviewers:

We thank the editor for the helpful comments and suggestions, which help to improve our manuscript. In response to the thoughtful and constructive comments from the editor, we made minor revisions to this manuscript.

Lin 95: Which layers? Please specify.

Based on your comment, we rephrased the sentence:

"Sediments from the Yedoma IC contain on average 3% total organic carbon (TOC) (Strauss et al., 2013a)but the TOC content can exceed 20% in organic-rich layers contained within the ice complex sediments (e.g. buried peat horizons, Andreev et al., 2009)."

Line 125: Provide also details of exact type and supplier.

We used a 0.6 µm MOM rhizon from Rhizosphere.

Line 137: Provide also manufacturer, city, [state,] country.

Mastersizer 3000, Company Malvern, Malvern, UK.

Line 148/149: Gravimetric or volumetric water content? Please specify.

We used the gravimetric water content.

Line 166: Which kind of gas?

By "gas", we mean the sampling gas. We revised the manuscript based on this comment.

Line 192: Provide information of supplier, city, [state,] country.

We revised the manuscript based on your comment:

"GeneMATRIX Soil DNA purification kit (Roboklon, Germany)"

Line 198: Provide information of supplier, city, [state,] country.

We revised the manuscript based on your comment:

"mlas-F/mcrA-R (Microsynth, Balgach, Switzerland)"

Line 238: What does "this amount" refer to? Please specify.

We clarified in the manuscript: "The floodplain permafrost core (P17-F) produced 1% of the amount of CH_4 produced by the active layer from the same core"

Line 273: I would expect an F value here, not the name of the test. Delete, if you don't have an F value to report.

Thank you for this remark. After checking in the literature, we corrected how we reported the results from the Kruskal Wallis test. As recommended, we used the Chi squared value.

Line 275: Do you mean the value 1? If yes, write "unity" here.

You are right, we mean the value 1. However, since this value is a ration, it is dimensionless. We edited the manuscript based on your remark:

"The P17-A-20 CO_2:CH_4 ratio decreased rapidly during the first 14 days. The CO_2:CH_4 ratio reached one after 40 days and remained stable until the end of incubation (Table 2)."

Line 281: Because you show the square root of the cumulative flux values, you have to indicate that also in the y-axis labels.

Alternatively, you can choose a logarithmic scale, then you don't have to change the y-axis labels.

We decided to have a square root scale because the cumulative bar plots start at 0. Since log(0) → - ∞ the display of the bar plots do not work with a logarithmic scale. Also, we use the square root scale to have a better display of the data. However, the values showed on the graphs are the real values and not the square root of the cumulative flux.

Line 294: What does that mean? Please specify.

Here, we explain that the glucose factors were calculated based on the cumulative C productions, 7 days after the glucose addition.

"Glucose factors were calculated based on cumulative C production 7 days after glucose addition."

Line 327: per gram what? Please specify.

We revised the manuscript: "Means of gene copies per gram". We changed the y-axis labels.

Line 331: As above, why not using a logarithmic scale?

As for comment Line 281, we use cumulative bar plots starting at 0 and the values showed on the graph are the real values.

Line 350: What do you mean with difficult? Please specify.

By "difficult", we mean, "non suitable conditions". We added a citation to support this statement: (Eskelinen et al., 2009)

Line 368: Between what? Please specify.

Here we, compared lag times and CH4 production rates from several previous studies. The lag times and CH4 production highly differed between the studies.

"As explained above, lag times measured from former studies differed".

Line 384: What is meant here with disturbance? Length of thawing period? Please specify.

Yes, by thaw disturbance we mean the length of thawing period (brutal thaw or sequential thaw).

Line 389: What does that mean, specify.

Here, we explain that since methanogen communities are ecologically and phylogenetically narrow microbial communities; the establishment of their community is highly controlled by random environmental factors (stochastic processes).

We defined this term in the manuscript line 385: "For ecologically and phylogenetically narrow microbial communities, like methanogens, random environmental processes like microtopography (stochastic processes)"

Line 413: What do you mean here? A pool with low C content? Or a small C pool? Please specify.

Here, we mean low C content pool. We revised the manuscript based on this comment.