

Interactive comment on “Permafrost thawing exhibits a greater influence on bacterial richness and community structure than permafrost age in Arctic permafrost soils” by Mukan Ji et al.

Anonymous Referee #1

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This is a technically correct manuscript on a currently relevant topic in the context of climate change and biogeochemical cycles - the response of microbes to permafrost thawing. The study shows changes in bacterial community structure and richness of drained lake basins with permafrost soil age and permafrost thawing status (active, transition and permanently frozen soil layer). In addition there is data on soil carbon and nitrogen. The results are presented clearly and the figures are well prepared.

Major concerns:

1. Are the samples in this study from the same soil cores as those in Kao-Kniffin et al. 2015, which is cited in the section on sampling? Kao-Kniffin et al. 2015 also describe

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bacterial communities with permafrost soil age and thawing status. If the soil cores are the same, please make it clear in the aims why a second analysis of bacterial communities in these samples is needed and explain what new this study adds. In any case, please take the results of Kao-Kniffin et al. 2015 into account in the discussion, especially as their conclusion (communities in active layers converge) seems to be the opposite from this manuscript (no convergence of active layer communities).

2. I am concerned that the connection of soil layers to thawing status is too simplified and does not take into account variation in the soil profile. Was the soil structure/chemical composition of the profiles homogeneous with depth? The description of organic layer on l. 94-96, Fig. 1 and Kao-Kniffin et al. 2015 and Mueller et al. 2015 cited in the manuscript suggest they were not. In this case, the differences in bacterial communities between soil layers cannot be directly interpreted as a thawing response (l.37., l.318), because the state of the system before thawing is not known and the differences between the layers can be due differences in other soil properties (for example organic vs. mineral layer). It is possible to compare the active, transition and frozen layers with permafrost age but that seems to have already been done by Kao-Kniffin et al. 2015? In any case, the issue of other differences between the soil layers than thawing status should be better taken into account in the manuscript. Do soil carbon and nitrogen explain the community changes?

Minor comments:

l. 82-91 Please indicate where your replicate samples come from and how many there are. Here it is mentioned that there are four age classes and one soil core per age class, but the figures show a lot more data points (over 40?).

Table S6: I am confused how mean relative abundance can be over 100%. Could you clarify? Please also check the definition of SD (should be standard deviation?).

Minor comments on spelling and grammar:

C2

- I. 30 Deltaproteobacterai -> Deltaproteobacteria
- I. 95 vary -> varies
- I. 253 early -> earlier
- I. 270 Alphaproteobacterai -> Alphaproteobacteria
- I. 272 Please check language. What enhances their richness?
- I. 292 have -> has
- I. 280 results is -> results are

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-39>, 2020.