Interactive comment on "Organic carbon characteristics in yedoma and thermokarst deposits on Baldwin Peninsula, West-Alaska" *by* Loeka L. Jongejans et al.

Anonymous Referee #2

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Permafrost affected soils and sediments of the Northern hemisphere are a major terrestrial C reservoir, highly vulnerable to climate change. A better knowledge on the amount and composition of organic matter is thus crucial (e.g. to improve earth system models). Thus the authors report on a very important topic in biogeochemical research. However, the authors miss to get a clear central theme. It seems the group of authors tried to include a bit of everything in a very descriptive manner rather than providing a synthesis of the extensive data set. Another major drawback is the rather one-sided citation of studies either from the co-author list or affiliated colleagues. Especially with respect to organic matter quantity and quality a growing number of biogeochemical basic research is going on in the Arctic. For instance Gentsch et al. worked on the

bioavailability of specific OM in Siberia, or Mueller et al. worked rather "close by" on OM quantity and quality on thaw lake basins in the Alaskan North slope region.

See detailed remarks below:

line 21 Volumetric OC content in your case is OC stock. With giving soil OC stocks you are closer to what gets reported for soils.

page 3 line 6, To which OC pool do you refer here? Are you aiming to model specific OC pools with respect to decomposability, or are you just aiming to differentiate OC stocks with respect to different research sites?

page 3, line 7 The used biomarkers only represent a minor portion of the organic matter. Although useful for reconstruction of OM origin, these proxies are lower in explanatory power for the bioavailability of the sequestered OM. So I would not speak of "molecular composition of each OC pool and its quality" as it only represents a minor part of the bulk OC.

page 4, line 10-23 - What was the reason to go to this site? How representative is it for Arctic permafrost soil landscapes with respect to the studied OC distribution and composition?

page 3 line 28 - What do you mean by representative? How did you test representativity? How are the five locations connected to each other with respect to the choice of sampling spots?

page 5 line 2 - How were the samples pre-treated? Did the authors test for Carbonates in the samples, or is the TC representing OC and IC?

page 5 line 8 - Was it not possible to increase the sample amount to get into the measurement range?

page 5 line 15-28 - You are extracting free lipids, and thus you can make assumptions about the composition of the extractable lipid fraction of your samples. You can not

draw conclusions about the "molecular composition of the OC" in general as proposed. Please be more precise in the writing.

page 6/7 line 30 and following - You are taking some samples at one small edge of the Island and estimate based on this the OC stocks for the whole Island? Do you have any data on the representativity of the sampled locations for the rest of the Island? And what is the aim of such a very vague approximation? I miss a consequent central theme in the manuscript. Is it the quantification of OC stocks in a permafrost affected landscape? If yes, you clearly miss representivity (e.g. just one lake core!). Or is it the study of the composition of the extractable lipids in concert with C and N contents? If yes, you could possibly dig deeper into that by looking for correlations between all the measured data. Results - How are all the single proxies/data correlated? You are just reporting every single measured proxy, but how are things related to each other?

page 9 line 7 - What is the uncertainty based on the spatial heterogeneity of sediment and soil properties including BD, C content, horizon depths etc.? How did you account for the spatial heterogeneity on the Island with respect to only 5 sampling spots at the edge of the research area?

page 9 line 20 and following - What does this paragraph in its extensive form have to do with "organic carbon characteristics" as proposed in the title? I recomend to at least shorten the "origin of the material" section, or put very reduced parts of it into the site description in the M&M section. The parts with 14C and 13C etc. should go into a condensed discussion of the OM composition in the subsequent section.

page 11 line 2 - So if it is comparable, why should one keep on reading? Put your data first and get the central theme out of it, not just repeat other peoples work at a new fancy sampling location.

page 11 line 8 - "a significant OC pool is expected" - do you have data to prove it? Otherwise stay away from vaque approximations.

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page 13 line 13-27 - This whole paragraph is purely hypothetical. You have no data on OC vulnerability to climate warming nor for OC bioavailability. What is the central theme of your work? It reads like the authors wanted to have a bit of everything in it, paleo reconstruction, large scale OC estimates and OC composition. It would be great to get a synthesis of these parts rather than a descriptive manuscript.

Conclusions – This is just a summary of your findings, but what are the take home messages and especially the implications of your work?