

## ***Interactive comment on “Improved landscape partitioning and estimates of deep storage of soil organic carbon in the Zackenberg area (NE Greenland) using a geomorphological landform approach” by Juri Palmtag et al.***

### **Anonymous Referee #2**

Received and published: 3 January 2018

This paper addresses an important research field and is well written and structured. Despite some weaknesses in the discussion (what is the bigger picture, what could this great dataset be used for. . .) I recommend an acceptance of the manuscript after including some revisions. Please find my detailed comments below.

TC review criteria

1. Does the paper address relevant scientific questions within the scope of TC? The paper addressed a crucial topic of permafrost research: The inventory of organic mat-

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ter, which is needed for climate-response assessments of the Arctic

2. Does the paper present novel concepts, ideas, tools, or data? The paper provides updated numbers on organic matter for the Zackenberg area. The methods are based on a well-tried approach following Hugelius et al (2013, 2014) as well as the geomorphological map by Cable et al. (2017). Thus, there are no new concepts, ideas, or tools, but new data with improved upscaling techniques.

3. Are substantial conclusions reached? Yes, there is an improved estimate on the organic matter inventory

4. Are the scientific methods and assumptions valid and clearly outlined? Yes

5. Are the results sufficient to support the interpretations and conclusions? Yes

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes

8. Does the title clearly reflect the contents of the paper? The title is very long; I recommend shortening and strengthening it. But yes, in this version the title reflects the paper in very detail

9. Does the abstract provide a concise and complete summary? Yes

10. Is the overall presentation well-structured and clear? Yes, the manuscript is well written and presented.

11. Is the language fluent and precise? Yes

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced,

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combined, or eliminated? See detailed comments below: There is some potential for another figure like changing a table to boxplots or a figure addressing the discussion

14. Are the number and quality of references appropriate? In general yes, except for the discussion

15. Is the amount and quality of supplementary material appropriate? There is no supplementary material attached

Detailed comments Page 1 L1 (title): Very long title, but the nitrogen is missing. What about "Deep storage of organic matter in Zackenberg, Greenland". The methodical approach ("geomorphological landform approach") is not needed here

L13: Please add an introductory sentence before stating the paper aims. General comment: are all the included samples soils in the sense of soil science? If yes, SOC is an appropriate abbreviation, otherwise please change to OC. Please add to the abstract a short discussion sentence including "what is deeper than 3 m" (you did this in the paper text already for fan/delta) and "how representative" could this study area be for Greenland/or other Arctic areas (missing right now)

L30: Please add a reference here

L31: Please concretize "most regions". Permafrost regions, Arctic regions? Despite IPCC, please add a primary reference here

Page 2 L4: As you know first assessment was not Tarnocai et al 2009, there have been a lot more before, like Post et al 1982, Tarnocai 2003, than Zimov 2006

L16: add a dot after ...2016)

L29 and following: I like the concise presentation of the specific aims. Please be consistent and use this order and number for the conclusion sections

L36: please delete the c. or introduce this abbreviation for the coordinates.

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L38: Please add the rain/snow percentages of the precipitation (if available)

Page 3 L15: Please add the GPS uncertainty here

L19: Not the motor head, but the core barrel system is of relevance here. Please add this information here.

L32: How many samples were measured for TOC/TN. TOC and TN in one run and same device? Or did you decarbonise the samples before to get rid of the TIC? Did you calibrate your 950 TIC measurements as well?

Page 4 Line 9: Please add the units to the formula, this would explain the percentage /100 and g to kg as well as the cm<sup>3</sup> to m<sup>2</sup> conversion factor

L16: Please explain the mentioned "data limitations"

L22: please delete "time or"

Page 5 L3: Is your data Gaussian distributed? Did you test this (e.g. Shapiro-Wilk test). Why not using more robust median and interquartile ranges? Please explain and justify your decisions here.

L16: Same for CI, which requires Gaussian distributed data

General comments results section: I understand you n is the number of sites, but could you add a n for the number of measurements as well? Is the percentage a result of Cable 2017 or this study? I recommend transforming the major information of Table 2 into a boxplot figure (which is allowed for a n<5 for n (measurements, nit sites) and include table 2 into a supplementary chapter. Is the data available (embargoed, e.g. PANGAEA). Then you can add a doi of your data.

Page 7 L7: First estimated for Zackenberg or Greenland or similar landscapes?

L24: please delete c., which is not coordinates for which this abbreviation was used before

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General comments discussion: Please include and discuss a number of how much is perennially frozen/seasonally unfrozen of you carbon and nitrogen stocks Please include comparisons of your and other comparable case studies, which you all know because of author overlap (e.g. Fuchs et al. Biogeosciences Discussions, Hugelius et al. 2009 etc.) To my opinion 5 references (4 actually, as Palmtag 2015 is mentioned twice) for a discussion are not enough. I do not care about the number of references, but this shows that the authors should discuss their findings a bit bigger context. Frozen/unfrozen percentages, what are the consequences for the carbon pool → modelling... any back on the envelope calculation of the <3m pool of the fans etc. Discuss the satellite product comparisons (Bartsch and other ESA DUE or GlobPermafrost-related publications). Rough discussion of carbon qualities (using C/N) and compare this to literature concepts (for C/N Schaedel et al 2014) Maybe an additional “discussion figure” (right now just 1 intro and 1 results figure) would be helpful

Page 8 L18: Keep using introduced abbreviations (here CI) and do not introduce them twice.

Page 9 L6: Making an rough estimation by stating the assumption of a <3m pool could be a nice first guess for future work

General comments for the conclusions: Please repeat the paper’s aims here and answer this in the same order like in introduction. Please include your nitrogen calculations here as well.

L9: “new additional” sounds strange

Figures and Table: Figure 1: hard to read the site labels. Maybe a hillshade and transparent colours could improve the geomorphological understanding for the reader. According to figure 2: use A and B instead of “top right”

Figure 2: A is redundant with Table 1, right? An option could be deleting a and put the

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spotlight on B-C

Table 2: pleas add n measurements to the table. Moreover switching from CI (in the manuscript text) to SD could be puzzling for the readers

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-255>, 2017.

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