

Interactive comment on “A new dataset of soil Carbon and Nitrogen stocks and profiles from an instrumented Greenlandic fen designed to evaluate land-surface models” by Xavier Morel et al.

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Response to reviewer #1

Thank you very much for your review and your constructive comments on this manuscript. I hope that the explanation given below, and the changes to the

C1

manuscript, will provide an adequate response.

Referee comments are indicated as “RC” and author responses as “AR”.

RC: Dear authors, the paper is very interesting, well-documented and novel. The information included can be very useful to help the scientific community to understand the carbon cycle and the soil dynamics in arctic and boreal areas.

AC: Thank you

RC: However, I found some issues that must be solved prior to accepting this paper. 1. There are a lot of typographical mistakes (parenthesis, spaces, etc.).

AC: We will have the paper corrected by a professional native speaking editor when the reviewers agree with its content.

RC: 2. I miss some literature about soil geography, soil mapping and soil catena. Why? Because you talking about soil variations at different spatial positions.

AC: We will add geographical information in the text and on figure 1 but we don't think a description and discussion in terms of soil catena is meaningful here. Indeed, this dataset focusses mostly on the carbon present in the fen and not on how it is related to the soils around the fen. So, we don't think it needs a description in terms of soil catena. However, we will also rewrite the study area section (section 2) because some parts could have led the reader to believe we were interested in the whole Nuuk Research Station (the whole drainage basin) while we only studied the fen.

RC: 3. I miss a complete discussion, using these above-mentioned terms, related to differences among different years or transects, other studies in boreal and arctic areas. Are these data representative for other regions? Or this region?

AC: All the samples were taken during the same field campaign in July 2017 as mentioned on p4 l14. The two transects are located within the fen. The other similar sites are mentioned on Table 1. We will add a short discussion comparing our C stocks and

C2

profiles with those sites.

RC: 4. The results and discussion must be merged since the authors included several references there. Please, do not include equations here, this is methodology.

AC: We first reorganized the “Materials and methods” and “Results” sections. The beginning of the Results section (p7 l2 -18) is now in the Materials and methods as is the beginning of section 4.4 (p 8 l 28-30 and p 9 l 1). We also renamed the Results section into Results and Discussion. Section 5 is now section 4.6.

RC: 5. The conclusions must be included without references. Please, check them.

AC: We renamed this section “Conclusions and perspectives”. We removed the references in the conclusions part but left them in the perspectives.

RC: 6. Figures: They are very nice, but in figure 1, you have to include coordinates. See more comments in my attached, pdf.

AC: We will add the coordinates of corners points for each subplot of Figure 1 in order to not surcharge figures. For information, coordinates for every sample points (T1-0, T1-5, etc) are available in the data repository (<https://doi.org/10.1594/PANGAEA.909899>). We will mention that in the text, and write explicitly the coordinates of the first and last points of each transect.

Supplementary comments P1; L4: RC Why is Nuuk fen a well-instrumented site? AC: We don't understand the reviewer's question. We believe Nuuk fen is well instrumented because there is monitoring of many soil physical variables and greenhouse gas fluxes. This is said in the same sentence. Is the sentence unclear?

P1; L8: We will add the longitude and latitude coordinates of the site

P1; L 16: We will add a reference to the Global carbon projet (LeQuere et al, 2019)

P2; L4: We will add a reference to Xu et al, PEATMAP, Catena, pp134-140, 2018 for the fraction of land area covered by peatland, and GORHAM, Eville. Northern peat-

C3

lands: role in the carbon cycle and probable responses to climatic warming. Ecological applications, 1991, vol. 1, no 2, p. 182-195, for decomposition vs productivity

P2 L18: We will add a reference to Limpens et al, Peatland and the carbon cycle : from local to global implications - a synthesis, Biogeosciences, 2008.

P2 L26: We will add: "such as Abisko in Sweden (Jammet et al, 2017), Samoylov in Russia (Siewert et al, 2015, 2016) or Zackenberg in Greenland (Pirk et al. 2016, 2017).

P3 L11-16: We will keep the first and last sentences where we present the dataset. We will add: "These soil carbon and nitrogen data will complement the existing dataset of greenhouse gas fluxes from the fen. The combined dataset will allow to evaluate the fluxes and stocks simulated by land-surface models in a completely consistent manner."
“

P3 L17: agreed we change the title to “Study area”

P3 l27: agreed

P3 l29: the meaning of NERO is explained on line 19, albeit with a typo (research instead of resaerch)

P3 l30: as mentioned in the response above, we will rewrite this section so that the reader doesn't get the impression that we are studying the whole valley.

P4 l7-9: This is a very qualitative sentence, as the center of the fen is clearly darker than the extremities. We did not measure the albedo, though. If this is problematic, we can suppress this sentence.

P4 l22: changed by “we estimated”

P4 l26: done

P6 l 1-5: We will add in the text a reference to Djukic et al., 2018, Early stage litter decomposition across biomes. Science of the Total Environment.

C4

P7 I1 Results and discussion

P10 I10: We don't really agree with the reviewer. Here, we are analyzing our results by comparing them with a published relationship. This is not how we calculated the carbon density in our dataset.

P11 Conclusion and perspectives (See response to RC5) P11 "In this paper, we provided a complete description of a new dataset of current distribution of soil organic carbon storage at the Nuuk peatland. All data are in the range of previous studies. Our soil carbon samples were taken in the same spots as the automatic flux measurement chambers, making Nuuk-fen dataset an ideal candidate for evaluating the ability of land surface models to reproduce both soil carbon profiles and greenhouse gas emissions at the scale of the site. It will allow in the near future a complete evaluation of the biogeochemical model presented in Morel et al. (2019a). Completing this evaluation could help eventually resolve issues raised by Chadburn et al. (2017). It could also be used further validate recent developments in carbon and/or peatlands modules for larger scale studies, such as the specific peatland module developed by Llargeron et al. (2018) or the soil carbon representation specific to fen and peatlands of Qiu et al. (2018).

References : Djukic, I., Kepfer Rojas, S., Schmidt, I. K., Larsen, K. S., Beier, C., Berg, B., et al. (2018). Early stage litter decomposition across biomes. *Science of the Total Environment*, 628, 1369–1394.

Xu et al, PEATMAP, *Catena*, pp134-140, 2018

Limpens et al, Peatland and the carbon cycle : from local to global implications - a synthesis, *Biogeosciences*, 2008

GORHAM, Eville. Northern peatlands: role in the carbon cycle and probable responses to climatic warming. *Ecological applications*, 1991, vol. 1, no 2, p. 182-195.

Le Quere et al (2018), Global Carbon Budget 2018, *Earth System Science Data*, vol

C5

10, , no 4, pp 2141–2194

Interactive comment on *Earth Syst. Sci. Data Discuss.*, <https://doi.org/10.5194/essd-2019-225>, 2020.

C6