Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2020-347-AC2, 2020
© Author(s) 2020. This work is distributed under
the Creative Commons Attribution 4.0 License.

Biogeosciences Discussions

Interactive comment on "Characterising organic carbon sources in Anthropocene affected Arctic upland lake catchments, Disko Island, West Greenland" *by* Mark A. Stevenson et al.

Mark A. Stevenson et al.

mark.stevenson@newcastle.ac.uk

Received and published: 31 December 2020

This is a solid paleolimnological study. It combines several lines geochemical evidence to investigate changes in composition and concentration of organic matter. The MS is clearly written and it is scientifically sound. I have some comments that I hope authors find them positive and constructive.

Reply: Thank you for your positive comments on the manuscript's approach.

Chronology. Have the chronology data been published elsewhere? Authors should show 210Pb and 137Cs activities, from which the chronological/sedimentation model

was calculated and inferred. What is the correspondence between de 210Pb and 137Cs models?

Reply: We adjusted the 210Pb model based on 137Cs peak at a specific time point (1963 - atomic 'bomb' peak), to develop a composite CRS (continuous rate of supply) model. We can certainly provide more information in the supplementary information regarding plots of total 210Pb activity, unsupported 210Pb, and 137Cs and 241Am concentrations versus depth. This will highlight the good correspondence between simple 210Pb and adjusted 137Cs models, requiring only a 1.75 cm offset. The chronology has not been published elsewhere. This response also helps address questions concerning the dating model used from reviewer #1.

Composition of organic matter, C and N isotopic data. Authors made an excellent effort in measuring samples of different nature and origin. In addition to what is presented in Fig. 4, authors should perform analysis in SIAR (https://maths.ucd.ie/âĹijparnell_a/media/SIAR_For_Ecologists.pdf). Why didn't you try this tool if you probably have nice endmember information? This will improve the results and discussion of the MS.

Reply: Thank you for the positive feedback and the additional suggestion. We have explored the use of the SIAR tool in R setting down-core δ13C and C/N data (grouped by sedimentary zone, Fig.7a of the manuscript) as consumer data and catchment δ13C and C/N as source data. In our trial plot (Fig. 1) from the suggested modelling we can see that changes in vascular plants are able to explain a greater proportion of the variation in group 1 (2013-1830 AD), compared with groups 2 (1830-1530 AD) and 3 (1530-1300 AD) which have more mixed contributions. This provides confirmatory support to the notion that changes in terrestrial vegetation (driven by warming) in the catchment since the end of the LIA (group 1, 2013-1830 AD) are probably helping stimulate (or at least correlate with) the clearly identifiable recent response in autochthonous algae (evidenced by β-carotene in Fig. 7a of the manuscript).

Further analysis at the species level (not shown here, but we suggest could also be included in a revised supplementary information section) suggests that although mixed, changes in Betula nana, Chamerion latifolium, Eriophorum, guano and soil explain variation in group 1 (2013-1830 AD) the most. For both groups 2 (1830-1530 AD) and 3 (1530-1300 AD), although mixed, the aquatic group is the most important, of which benthic algae is the greatest contributor. We suggest to include plots deriving from the SIAR tool in the supplementary information section of a revised manuscript and make supporting reference in the relevant section of the discussion.

Title. The way the title is presented, it focuses rather on a methodological aspect and geographical location of the study. It would be better if authors can think of a title describing the paleoenvironmental process involved (i.e., warming and eutrophication), to make more attractive to other scientists.

Reply: Thank you for your comment. We suggest an alternative title suggestion which encompass the paleoenvironmental and environmental change processes involved:

Anthropocene climate warming enhances autochthonous carbon cycling in an upland Arctic lake Disko Island, West Greenland

This revised title should be more impactful and should help readers gain the best possible overview of the manuscripts content.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-347, 2020.

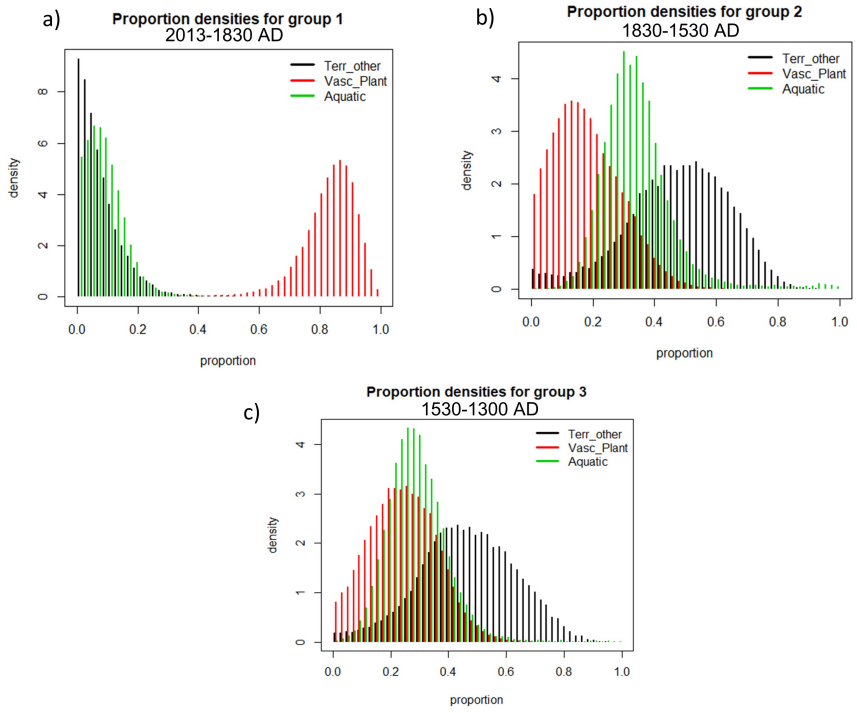

Fig. 1. Trial proportion histograms produced in SIAR for a) group 1 (2013-1830 AD), b) group 2 (1830-1530 AD) and c) group 3 (1530-1300 AD).