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Climate of the Past Discussions

Interactive comment on "Glacial history of Inglefield Land, north Greenland from combined in-situ ^{10}Be and ^{14}C exposure dating" *by* Anne Sofie Søndergaard et al.

Anne Sofie Søndergaard et al.

annesofie@geo.au.dk

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We have addressed all comments and suggested changes and our responses and following changes to the manuscript are outlined below:

Overall, this is a very nice study and will make a nice addition to the literature. Like thetwo other reviewers, I have similar questions regarding Figure 5 and how it was constructed and some more detailed questions about the some of the data (e.g. lithologies of boulders). Rather than repeat their questions, some of which I also had, I have provided my figure related questions and a few other comments that I hope the authors will address prior to publication. Otherwise this is a very nice, succinct paper that I was

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very pleased to read and really liked. Great work folks!

Answer: Thank you!

Figure 3: It would be useful if the authors included the uncertainties on the figure. Perhaps just including the average 10Be and 14C uncertainty in the legend would suffice. This is important to readers who may not encounter these types of data often need some baseline to who precise the measurements can be. Authors choice on this one since I'm only suggesting it.

Answer: We have added range and average of age uncertainties in the figure caption and refer readers to Table 1 if they want more specific information on individual samples.

Figure 4: I'm not sure I find this figure particularly useful. Does it provide anything more that the table doesn't already provide the reader?

Answer: The figure does not provide more information than the table does, but we find it useful to represent data in a figure for better overview and clarity of the age distribution between the two glaciers and two sample materials.

Figure 5: I have the same sentiments as Nicolas on this, so will let you address his comment.

Answer: Please see our response to the comment from Nicholas Young.

Figure 7b: How does this work compare with the raised beach records from Bennike, 2002 or the modeling work from Lecavalier et al. 2017? The schematic in part b of this figure is interesting and makes me wonder how it might compare to those relative sea level curves and ice margin reconstructions. It might be worth mentioning something in this regard within the text.

Answer: The schematic part in Figure 7b is partly based on our results and partly on previous work (some of it used in Bennike (2002), which we mention in the discussions

section 5.2. In this section we specifically discuss our result in relation to previous studies and how to find the best fit from both regarding the ice sheet history.

Figure 8b: I like these figures that the authors provide. However, it isn't clear to me how they derive some of these numbers. For instance, in Washington Land to the north of their site the authors provide an outer coastal retreat around 9.0 ka and present day ice margin around 8.6 ka. Based on my read of the Ceperley et al. 2020 paper, it seems like the ice margin was at Crozier Island at 8.5 ka and within the interior around 7.6 ka based on taking the youngest 10Be ages. These ages are consistent with what is being found in Inglefield Land and would indicate to me that over this entire area in the Northwest that the glaciers were largely acting in unison with no significant leads/lags. Perhaps the authors have recalculated these ages which is the reason for the discrepancy but regardless this should be addressed and explained assuming this is the case.

Answer: For the outer coast estimate at 9.0 ka, we have taken the mean which Ceperly et al. 2020 provide from Cozier Island and Joe Island. We find this mean representative for an outer coast deglaciation age of Washington Land: "The Holocene exposure ages from Crozier Island and Joe Island within Nares Strait have a mean of 9.0 $\pm$ 1.1 ka (n . 7; 1-s)." For the inner coast estimate at 8.6 ka, we chose the average for "widespread ice sheet retreat" in Washington Land as stated by the authors. We acknowledge that a better estimate for when the ice what at its present-day extent might be the estimate from the authors at 6.9 ka for when "widespread glacial ice was absent". We have therefore changed the estimate for the inner coast deglaciation accordingly in the text (section 5.3) and Figure 8b.

Lines 209-210: I'm not sure how you get inheritance for 14C in this region but I agree with the authors that this age seems unrealistic. Based on Figure 5, the authors have suggested that during MIS 3 this location was ice free. This is a really interesting hypothesis and I think the authors should explain how this might be possible (e.g. climatically,glaciologically) given most people typically don't think of MIS 3 as that much

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different than the LGM, yet the authors Figure 5 would make MIS 3 seems similar to the present day. More should be said here since this hypothesis has some implications for what the climate might be like in the past and the authors could weigh in on it.

Answer: Following our conclusion of the 14C age being affected by inheritance we comment on the possibility of a smaller than present day extent of the GrIS during MIS3, which fits with other studies from northern Greenland, which have concluded the same: “This scenario is to some degree consistent with other studies in northern Greenland that suggest a restricted GrIS during MIS 3 (Larsen et al., 2018; Søndergaard et al., 2019) and a late coalescence of the GrIS and Inuitian Ice Sheet around 22 cal. ka BP (England, 1999)”. In the following lines we state that we can’t make any firm conclusion due to the lack of data, which is why we have not elaborated more on the specific climatic conditions which would cause a MIS3 comparable to our present-day situation.

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