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Climate of the Past Discussions

Interactive comment on "Spatial and temporal oxygen isotope variability in northern Greenland – implications for a new climate record over the past millennium" *by* S. Weißbach et al.

Anonymous Referee #2

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In this paper a number of firn cores collected in the framework of the "North Greenland Traverse" (NGT), have been complied with the aim of investigating whether the stable isotope records are good climate indicators for this part of Greenland. In the light of the dramatic changes that we are now seeing in the Arctic, studies involving proxy-climate records, like this ice core study, are extremely valuable in order to improve our understanding of natural climate variability. Furthermore, it can also provide insight into the different processes and dynamics being important for this variability. My impression is that this study is both ambitious and thoroughly done and can potentially provide a

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good status of knowledge on the topic of oxygen isotope variability both in time and space in northern Greenland. However, the paper is quite heavy to read and would need a better overall structure in order to make the valuable data accessible to both for the scientific community (and policy makers). When this has been accomplished it definitely deserves to be published in “Climate of the Past”. Below is a summary of the main issues that I think should be addressed and also examples of some smaller tasks that the authors should consider.

1. As already mentioned the paper suffers from a poor structure and as a consequence it is far too long. There is a lot of unnecessary repetition. One way of avoiding this would be to combine “Results and Discussion”. I also suggest removing Fig 6 since it is included in Fig 8. I also wonder if it is necessary to show all the plots? For instance, can Fig 7 be left out?

2. I lack meteorological information which is the fundamental background for interpreting d18O so a section on this would be an important part of improving this paper. Some of this information is included in other parts of the paper (mainly in the discussion part) but I think that the paper would benefit from having it all collected in one section in the beginning.

3. I also lack a proper “background and previous work”. For instance there are several comments in the paper to how northern Greenland is different from Southern Greenland but few (if any?) specific examples. Please include some of these with proper references. For people not working with Greenland even terms like “southern Greenland” and “northern Greenland” need to be specified.

4. My main concern with this paper is that the accumulation records are not given the space and consideration for the results that I think it should have. I understand that some of the accumulation data has been published before but I think that these data has to be viewed in connection with the d18O data. Some of the questions that come to my mind that I do not find an answer for in the paper are: - What is the seasonal

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distribution of snowfall in Greenland? In Table 5 the seasonal impact of temperature on the d18O is investigated but the seasonal distribution of accumulation is not really discussed anywhere. - What does the long term (stacked) accumulation record look like for this area? Maybe some insight could be revealed from combing this with the d18O record for instance in Fig 8. I also wonder what the accumulation records from these cores look like over time? - Is there was any GPR data collected in connection with the cores that would indeed provide information to the questions asked; how representative single ice cores can be for a specific area.

I suggest to look at the literature from similar studies done in Antarctica where there are exactly the same concerns with low accumulation as in Northern Greenland.

5. The paper claims to provide a "new climate record" but it is not so clear what if there was a previous climate record- and if it was what it looked like. Like many things in this paper it might be buried in the text but it is not easy to find.

6. Results absolutely need some kind of error analysis both on the dating and the stacked record.

7. Regarding about the AMO impact in Greenland I suggest looking at this paper in addition to what is presented: Chylek, P., C. Folland, L. Frankcombe, H. Dijkstra, G. Lesins, and M. Dubey (2012), Greenland ice core evidence for spatial and temporal variability of the Atlantic Multidecadal Oscillation, Geophys. Res. Lett., 39, L09705, doi:10.1029/2012GL051241.

Some minor specific comments

Abstract: The first paragraph is including many unnecessary numbers which are not informative. I suggest to rewrite the abstract.

Material and methods: l. 20 please add reference to this method.

The expression "very low accumulation" is used on many places in the text without defining it.

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The language it generally acceptable but there are a number of typos that eventually needs to be fixed; as an example p 2352, l. 13: should be “firm” instead of “firn”.

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