

Where to GreenDrill? Site selection for cosmogenic nuclide exposure dating of the bed of the Greenland Ice Sheet

This paper focuses on possible locations suitable for drilling through the Greenland Ice Sheet to collect bedrock and/or sub-sediments for cosmogenic nuclide exposure dating. The main purpose of this, is to constrain the glacial history on a longer term scale and especially look into the respond of the Greenland Ice Sheet during past interglacials. Drilling through the Greenland Ice Sheet is a difficult challenge and only few places at the margin of the Greenland Ice Sheet are currently suitable for drilling with the available equipment.

The paper presents the different criteria for drilling which meets the demands of the drilling equipment as well as the geological aspect of valuable site locations. The paper presents the different criteria in a structured and short, clear way and follow up with a discussion on possible places to drill and also present the main selected sites available for drilling and part of this campaign.

The paper was easy to read and with a good presentation that makes the reader clearly understand the idea behind the research proposal and also the chosen localities.

I look very much forward to follow the campaign and the outcome of this project, which I am sure will bring very valuable knowledge to the research community, both regarding the method but also the glacial history of the Greenland Ice Sheet.

Beneath I have listed some areas in which I would like the authors to elaborate on the individual topics together with minor comments on the text and figures.

General comments

I would encourage the authors to elaborate on the possible outcome of this project in relation to what they can say about past GrIS history. You drill at the margin so do you only expect to be able to say something about the marginal ice sheet history or would you expect your results, together with previous studies, can open up for a wider GrIS history interpretation, when it comes to the spatial extent? In the abstract and introduction the is mentioning of studies showing an ice sheet wide history, and it would be good if you in a few lines very clearly could state the outcome of this project.

In lines 320-322 you briefly mention the other suitable areas, which meet your criteria, but that where not chosen. Can you elaborate more on why they are not suitable? Maybe give some specific location examples?

Title: This might just be me, but suggesting to change the title to “bed beneath”/”bedrock beneath” instead of “bed of”. You also refer to it in this way in lines 33-34; ...“cosmogenic nuclides in bedrock from beneath the Greenland Ice Sheet”....

Lines 113-115: Can you elaborate “direct constraints” here? I would consider to delete direct and in general maybe elaborate more. The studies I assume you refer to here place constraints, but as far as I remember do not conclude one unique solution/ice sheet burial/exposure history of measured concentrations in sub-ice material?

Lines 340-343: Can you elaborate on how you will look more into/determine if this area has local ice during past interglacials? How would that affect your modeling and interpretation, would you use a different approach than the other areas etc?

In the conclusion and introduction, you talk about the information retrieved from Camp Century and GISP2 as paradigm shifting and “direct” information, but for me to see they are both “most likely scenario” results, but still with more possible ice sheet histories to fit measured nuclide concentrations? I would consider to make it clearer that there are more than one solutions/result from those studies.

Minor Comments

You use both “ice sheet” and “ice-sheet” throughout the text, chose one for consistency

Line 87: Consider to delete “the” before MIS 5e

Line 87: Delete “age”? There is something in the sentence that doesn’t make sense

Line 92: “the” sub-ice bedrock exposure age

Line 115: “so far” instead of “thus far”?

Line 122: In the abstract you use “<700 m” and here “~700 m”, consider to make consistent

Line 158: This is the second section numbered “3.1”

Line 192: Delete space between “warm-“ and “and”? As you have it in line 187

Line 217: This line doesn’t read well, do you mean the criterion of being safe, so no air support is needed or the need of air support for transportation during fieldwork?

Line 248: Consider re-phrasing to “in its south, west and central areas” – it feels like something is missing when reading the sentence the way it is now.

Line 262: You change between writing “NASA’s Operation IceBridge” and “NASA Operation Ice Bridge” – chose one and make consistent

Line 376: is the “-“ after “100” intended?

Lines 282-292: This is up to the authors but it would be great if you could elaborate a bit on why you want the nuclides to be preserved. You want them for the modelling part, but just to elaborate a bit on how you can use “inheritance” and different nuclides, with different half lifes to model past ice sheet extent.

Line 386: Is a “shows” missing after “sparse radar data that”

Line 405: Consider abbreviating Northeast Greenland Ice Stream since you use the abbreviation in the caption for figure 8.

Lines 410-413: Either move to/place instead of lines 403-404 or delete lines 403-404, which also mentions the sparse radar data

Line 464: Consider to delete “to measure”

Figures

Figures: “A” or “(A)”, chose one and be consistent (same in the rest of the figures)

Figure 1: Suggesting to put the location of NEEM on the map, since it is mentioned several times

Figure 1: Just a suggestion, color either B or C with maybe grey instead of white so they are not both same color

Figure 1: Consider to add a scale

Figure 4: Consider to enlarge the figure or maybe just text in the white box, the text is very small as it is now.

Figure 8: Is its placement wrong? It should be before section 4.5?

Figure 8: This is up to the authors, but I would re-arrange this figure, so (A) and (C) would be in the top panel (with (C) first and then (A)) and (B) would be below in full length.

Figure 9: In (B), do you mean “KFJF” and not “KKJF”?