

Interactive comment on “Impact of Holocene climate variability on lacustrine records and human settlements in South Greenland” by T. Guillemot et al.

Anonymous Referee #2

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General Comments This manuscript by Guillemot et al presents evidence for flooding events in two small lakes in southern Greenland. The major conclusions of the paper are that increased flooding frequency occurred during intervals that were colder and/or wetter during the past 4ka, and that the human settlement patterns on Greenland can be understood in the context of rapid climate changes that led to these increased episodes of flooding. While I think the authors provide a very interesting and technically sound data set, I don't believe that their conclusions are warranted based on the evidence. More specifically, I think the authors are over-interpreting their data in the time domain – that is to say, I don't think the so-called “flooding intervals” can be interpreted at such fine time scales, due to the scarcity of events detected in the

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cores. I also don't think the discussion follows logically from the data set. The human settlement and climate-human interaction discussion takes up the largest part of the discussion section, however it is a review of discussions found elsewhere in the literature (and cited by these authors), rather than being a direct outgrowth of the new dataset. Because of this, the discussion feels contrived and does not really add any value to the paper, nor does it add any new information to the overall understanding of climate-human interactions on Greenland during the late Holocene. I do not think that the paper in this form is suitable for CoP, but I do think that the authors should rewrite it and send it to a more specialized sedimentological or paleolimnological journal where the physical and chemical attributes of the flood deposits can be discussed in more detail (I think this to be the greatest value of the manuscript), and the human settlement discussion can be minimized, if not eliminated entirely. While I understand the inclination to bring a human dimension to paleoclimate investigations, particularly in this region where the Norse settlement was so dense and the footprint so large, I do not think this is necessary in all cases - and in this case the archaeological discussion detracts from the sedimentological value of the study. In summary, I think these data will make a fine scientific contribution, just not to CoP in the manner they are presented in this manuscript.

Specific Comments 1. You often refer to “global” climatic variations and “global” glacier advances, but the evidence for synchrony in glacier behavior and climate during this time certainly indicates they are not global. I suspect you mean “regional”, but even there, it is controversial whether there were synchronous climate changes during centennial-scale intervals of the Neoglacial. The spatial teleconnections are such that we don't expect the entire Arctic to cool in concert during abrupt events. If your discussion is to argue for synchrony regionally, you will need to include the datasets that you think demonstrate this synchrony. Also, please note that there are “synchronous” climate changes that are not necessarily the same in sign, due to spatial patterns of climate variability associated with climate transitions. Thus, you will not find warm temperatures during the Medieval Climate Anomaly everywhere and you will not find cold

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temperatures associated with the LIA everywhere. 2. You refer to the lakes in this study as proglacial, but I don't see glaciers in the catchments. 3. In the flood frequencies discussion you have identified 5 periods with increased flood frequency. This is not reasonable. Looking at the record of flood events, I think you can convince me that the period from 2,000 to 1200 yr BP had no flooding events, the period from 1200 to present had many, and the period from 4 to 2ka had some. To cut the record down into finer temporal units than this is not possible. The most striking aspect of the flood data is the LACK of floods between 2ka and 1.2 ka. This is very interesting, and seems to be a robust feature of your records. You might want to consider why the interval 2-1.2ka might be different in S Greenland than the than millennia preceding and following this interval. 4. Figure 5. You don't need the TSI record on here. You also don't need to discuss solar forcing and volcanic forcing unless you have some explanation for how these forcings would lead to changes in flooding frequency. Unless you can explain this mechanistically, I think you should primarily report this as a record of flooding and have only a small discussion about the potential links to larger scale climate changes (again, at the millennial scale, rather than centennial)– this is all very speculative and tenuous in the way it is written right now. 5. The associations that you cite in the text between the different climate records plotted on Figure 5 are not clear at all. I do not look at those records together and see synchrony. Therefore, the basic premise of your conclusion, that the floods occur at times when other records all show a clear picture of change that is well understood, is faulty. 6. You mention the average age-model error is 200 years. How is this determined? 7. The discussion in section 5.2 is so speculative that it is not really of much value for the paper. Here you are trying to build a case for how cold conditions could lead to increased flooding. This is great, and you should build that case, but I think you'll need a more thorough discussion of this. Also, this discussion is based on the 5 units of increased flooding, which I think is too fine temporally to discuss. 8. In section 5.3 you bring up the important point that farming practices by the Norse may impact the flood record. Is this true? Can it be evaluated in any way? If this is the case, then this is quite problematic for ascribing the floods

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after 1200yr BP to a change in climate, rather than a change in land use initiated by the Norse. 9. It is not quite so clear that climate change was the main trigger for the abandonment of Greenland by the Norse. The archaeological literature has wide ranging discussions concerning the role of trade networks and social interactions, and pressure from the Thule culture. Also, a new paper by Young et al in Science Advances in Dec 2015 challenges the idea that there even were cold conditions during the end of Norse occupation that were any different from the temperatures when they arrived. Thus, it isn't such a simple story that climate changes of the LIA led to the demise of the Norse in Greenland. I'll reiterate here that I think you can leave this discussion of the human settlements out of the paper, anyway.

CoP guidelines

1 Does the paper address relevant scientific questions within the scope of CP? YES. The paper examines a record of flooding in S Greenland and discusses this in the context of regional climate. 2 Does the paper present novel concepts, ideas, tools, or data? YES. The paper presents a new flood record. 3 Are substantial conclusions reached? The paper reaches conclusions, but I do not think they are justified based on the data presented. 4 Are the scientific methods and assumptions valid and clearly outlined? YES, for the most part. However, it is unclear how they chose the intervals of increased flood frequency – this is very subjective. 5 Are the results sufficient to support the interpretations and conclusions? NO. 6 Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? YES 7 Do the authors give proper credit to related work and clearly indicate their own new/original contribution? YES 8 Does the title clearly reflect the contents of the paper? YES 9 Does the abstract provide a concise and complete summary? YES 10 Is the overall presentation well structured and clear? YES, however, the discussion is largely based on literature review, rather than being a direct outgrowth of the data presented. 11 Is the language fluent and precise? YES – minor grammatical problems, but it reads well. 12 Are mathematical formulae, symbols,

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abbreviations, and units correctly defined and used? YES 13 Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? YES – see my review. 14 Are the number and quality of references appropriate? Is the amount and quality of supplementary material appropriate? YES

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