

## Response File – Climate of the Past Manuscript cp-2017-34 Fredrik Charpentier Ljungqvist's comments

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We thank Fredrik Charpentier Ljungqvist for his insightful comments and suggestions which will help to improve the manuscript. Below we provide responses to the comments and indicate our plans to revise the manuscript. Author responses are shown in ***bold italics***.

This is a very well written – and very timely and important – article that I hope will be published speedily after only minor revision. It serves both as an excellent review article of the state-of-the-art knowledge about the hydroclimate signal in various hydroclimate proxy records from the Arctic/sub-Arctic region and at the same time presents new important findings leading the research forward. Because the article to a considerable extent discusses a recent article of mine (Ljungqvist et al. 2016), I have read it very carefully with great interest and found some minor things that the authors may want to correct or improve prior to final publication.

The article, with new additional proxy records, represents a clear improvement of the understanding of centennial-scale Arctic hydroclimate variability compared to Ljungqvist et al. (2016). The new reconstruction shows more variability during the Little Ice Age. Although this likely partly is because of new additional proxy records it may also be related to slightly different filtering techniques to extract centennial-scale variations.

***Response: Thank you for the positive comments and encouragement of the new synthesis presented in our paper.***

I have listed my comments below after page number and line number:

Abstract, line 29: To mention the Arctic amplification phenomenon in the introduction to the Abstract seems a bit out of place here in this article devoted to the study of long-term Arctic hydroclimate variations.

***Response: Given the influence of Arctic amplification on regional hydrology, we do feel that mentioning this already in the beginning of the abstract is appropriate.***

Page 2, line 8: It would be clearer to write “anthropogenic greenhouse gas emissions” here instead of the more vague “human activities”.

***Response: changed as suggested***

Page 2, line 11: Add the reference Hind et al. (2016) to the discussion of Arctic amplification.

***Response: reference added***

Page 2, lines 29–30: Add Shi et al. (2012) to the list of references here.

***Response: reference added***

Page 6, lines 8–11: References should be provided to the statement that lake cryosphere has not changed during the past two millennia. I am not so sure that this statement is fully correct, at least not at all locations in the Arctic.

***Response: Reference will be provided and statement made more clear.***

Page 6, lines 29–30: These processes are partly dependent on the depth of the active layer. In regions with a depth active layer (e.g. permafrost regions with warm summers) it is less the case.

***Response: Noted, will be added in the revised version.***

Page 10, line 9: Southern Scandinavia is south of 60N and not in the Arctic. Better to write Central Scandinavia – a region that still is “less harsh” from an Arctic point of view.

***Response: changed as suggested***

Page 13, line 17: Also cite Borgmark and Wastegård (2008) here.

***Response: reference added***

Page 14, lines 12–14: Please, double-check the time periods here.

***Response: Yes, these will be revised (thanks for noting)***

Page 15, lines 24–25: Add the also very relevant references Esper et al. (2002), Schneider et al. (2015), and Stoffel et al. (2016) here.

***Response: reference added***

Page 15, line 26: Add Shi et al. (2012) to the list of references here.

***Response: reference added***

Page 17, line 14: Medieval Warm Period/Medieval Climate Anomaly – medieval is too vague and a different meaning (as a time period) in history than as a climate period.

***Response: Quite right, a mistake and now changed as suggested***

Page 18, line 11: Maybe it is worth to mention that a tree-line as high as 73N only occurs in parts of central Siberia (e.g. the Taimyr Peninsula)?

***Response: changed as suggested***

Page 22, line 31: “GISP-2” should be written “GISP2”.

***Response: Yes, changed as suggested***

Page 22, line 32: “O” in “Ymer O” should be with upper case “O”.

***Response: Indeed! Changed as suggested***

Page 23: line 2: Geirsdóttir with “ó”.

***Response: changed as suggested***

Page 25, line 2: Why this two time periods for the MCA and LIA, respectively? Some motivation for the choice of time periods would be good. Most data for Fennoscandia indicates pretty old cold conditions during parts of the 12th century whereas many regions

appear to have been rather, or very, warm during the 10th century (which also seems to have been the warmest century of the MCA in the Northern Hemisphere).

**Response: Quite right, this will be changed in the revised version.**

Page 26, line 29: Add a reference to the new article by Helama et al. (2017) about the DACP here. The reference to Ljungqvist (2009) is wrong here: Ljungqvist is misspelt (“k” instead of “q”) and it should be Ljungqvist (2010) – that discusses the DACP – and NOT Ljungqvist (2009) that does not do so.

**Response: You are completely right. Helama et al. (2017) added and the right Ljunqqvist paper cited (and so sorry about the misspelling)**

Page 26, line 30: The word “disturbed” is ambiguous and vague here. It was cold but in what other ways “disturbed” compared to other periods. Larger variability in the climate?

**Response:**

Page 27, line 16: The word “variability” is misspelt here.

**Response: corrected**

Page 28, line 3: “PAGES” should be written with upper case letters (e.g. PAGES and not Pages).

**Response: Oops, changed as suggested**

Page 29, line 28: Also cite Schmidt et al. (2012) here.

**Response: reference added**

Line 31, 26: There is an error here: Ljungqvist et al. (2016) does NOT present a calibrated reconstruction. It is an uncalibrated index, ranging from –2 to +2, and with exceeding values truncated to –2 and +2, respectively. All values are standard deviations with respect to the mean of 1000–1899 CE. In some aspects, the approach in Ljungqvist et al. (2016) has some similarities with PDSI and other hydroclimate indices. So, in this respect it is no real differences between Ljungqvist et al. (2016) and the new hydroclimate index in this article.

**Response: Thank you for spotting this mistake. We have now amended this in the text.**

Page 42, line 8. “ans” should be “and”.

**Response: changed as suggested**

Page 61, line 20 (and in numerous citations throughout the article): Weissbach should be Weißbach.

**Response: Found the  $\beta$  symbol, so changed as suggested**