

# ***Interactive comment on “Arctic hydroclimate variability during the last 2000 years – current understanding and research challenges” by Hans W. Linderholm et al.***

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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

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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.

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.

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

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

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

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, a least not at all locations in the Arctic.

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.

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

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

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

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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.

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

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.

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

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

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

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

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).

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.

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?

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

Page 28, line 3: “PAGES” should be written with upper case letters (e.g. PAGES and

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not Pages).

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

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.

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

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

References:

Borgmark, A. and Wastegård, S.: Regional and local patterns of peat humification in three raised peat bogs in Värmland, southcentral Sweden, *Geologiska Föreningens i Stockholm Förhandlingar (GFF)*, 130, 161–176, 2008.

Esper, J., Cook, E. R., and Schweingruber, F. H.: Low-frequency signals in long tree-ring chronologies for reconstructing past temperature variability, *Science*, 295, 2250–2253, 2002.

Helama, S., Jones, P. D. and Briffa, K. R.: Dark Ages Cold Period: A literature review and directions for future research, *Holocene*, doi:10.1177/0959683617693898, 2017.

Hind, A., Zhang, Q., and Brattström, G.: Problems encountered when defining Arctic amplification as a ratio, *Scientific Reports*, 6, 2016.

Ljungqvist, F. C.: Temperature proxy records covering the last two millennia: a tabular and visual overview, *Geogr. Ann. A.*, 91A, 11–29, 2009.

Ljungqvist, F. C.: A new reconstruction of temperature variability in the extra-tropical Northern Hemisphere during the last two millennia, *Geogr. Ann.*, 92A, 339–351, 2010.

Ljungqvist, F. C., Krusic, P. J., Sundqvist, H. S., Zorita, E., Brattström, G., and Frank, D.: Northern Hemisphere hydroclimate variability over the past twelve centuries, *Nature*, 532, 94–98, 2016.

Shi, F., Yang, B., Ljungqvist, F. C., and Yang, F.: Multi-proxy reconstruction of Arctic summer temperatures over the past 1400 years, *Climate Research*, 54, 113–128, 2012.

Schmidt, G. A., Jungclaus, J. H., Ammann, C. M., Bard, E., Braconnot, P., Crowley, T. J., Delaygue, G., Joos, F., Krivova, N. A., Muscheler, R., Otto-Bliesner, B. L., Pongratz, J., Shindell, D. T., Solanki, S. K., Steinhilber, F., and Vieira, L. E. A.: Climate forcing reconstructions for use in PMIP simulations of the Last Millennium (v1.1), *Geosci. Model Dev.*, 5, 185–191, doi:10.5194/gmd-5-185-2012, 2012.

Schneider, L., Smerdon, J. E., Büntgen, U., Wilson, R. J. S., Myglan, V. S., Kirilyanov, A. V., and Esper, J.: Revising midlatitude summer temperatures back to A.D. 600 based on a wood density network, *Geophysical Research Letters*, 42, 4556–4562, doi:10.1002/2015gl063956, 2015.

Stoffel, M., Khodri, M., Corona, C., Guillet, S., Poulain, V., Bekki, S., Guiot, J., Luckman, B. H., Oppenheimer, C., and Lebas, N.: Estimates of volcanic-induced cooling in the Northern Hemisphere over the past 1,500 years, *Nat. Geosci.*, 8, 784–788, doi:10.1038/ngeo2526, 2015.

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Interactive comment on *Clim. Past Discuss.*, doi:10.5194/cp-2017-34, 2017.

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