



EGUsphere, referee comment RC1
<https://doi.org/10.5194/egusphere-2022-582-RC1>, 2022
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Comment on egusphere-2022-582

Anonymous Referee #1

Referee comment on "Mid-Holocene reinforcement of North Atlantic atmospheric circulation variability from a western Baltic lake sediment record" by Markus Czymzik et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-582-RC1>, 2022

Comment on Mid-Holocene reinforcement of North Atlantic atmospheric circulation variability from a western Baltic lake sediment record by Markus Czymzik et al.

This is a very interesting study which attempts to provide insights into the North Atlantic Oscillation (NAO) variability throughout most of the Holocene. The detailed sedimentology from lake Kalksjon, west-central Sweden, is excellent and provides some justification for its use as a qualitative reconstruction of the NAO. Overall, I found the manuscript well written and will be of high interest for the paleoclimate community studying the climate during the Holocene for this region. It is therefore suitable for *Climate of the Past*. However, to assess this archive as a reconstructed "qualitative" record of the NAO, I believe there needs to be further examinations.

Major comments:

Different NAO reconstructions show periods of coherency and often no coherency at all. This is partly because the NAO itself exhibits non-stationary behavior, so the use of one single location may not capture the whole variability. One aspect that may have been overlooked in this paper is the other existing NAO proxies. Have you explored other records that may be sensitive to large-scale and long-term NAO fluctuations? That said, from 1800BP to the present, the NAO from Olsen et al. (2012) and the TOC record don't seem to match quite well, but perhaps if you plot different reconstructed NAO, a better co-variability (correlation) may be seen. I am thinking of speleothems in Europe and North Africa as well as the new one from Becker et al. (2020). See also Wassenburg et al. 2016 *Nat Geosci*, Baker et al. 2015, etc.

Figure 12 shows the relationship between paleo NAO (Olsen et al. 2012) and the TOC content in the studied lake. When sampling both records to the lowest resolution of the corresponding record; do you find any significant correlations? Same comment for the

Siberian High.

Also, the lack of coherence between your record and other NAO proxies could be explained by other mode of variability that may have been more persistent in the past. The Scandinavian Blocking, for example, accounts for ~27% of the winter North Atlantic variability. A persistent Scandinavian Blocking in winter would translate to cooler conditions in the region, thereby presumably increased ice cover time (in turn less productivity). Any thoughts on this? I suggest to add more discussion around line 345.

Some other minor comments:

Figure 3: Given you are dealing with decadal to centennial scale variability, I think an average (monthly?) of temperature and precipitation would improve visualization.

Figure 4 shows the composite with the XRF cluster stratigraphy. It should be located after figure 7 (PCA of the elements).

Figure 4: Add average temporal resolution for each cluster, i.e., mm/year

Figure 10: the sharp decline in TOC falls within 4.2k BP. Do you consider that your proxy responded to the 4.2k event?

Figure 12: we don't see much the Trouet et al. NAO, the color is too pale. Also, why not the selection of the Ortega et al. reconstructed NAO?

Figure 12: the lines of the SH index are outside the x-axis.

Figure 13: the spectral peaks don't seem to match quite well, perhaps a cross-spectral analysis would give something better. I would suggest moving this to the supplement.

Line 89: could you provide more information as to how the grain-size was extracted?

Section 3.3: provide information on how many thin-sections were produced.

Section 3.5: Why no pollen analysis on other SDU?

Section 4.3: Add a Table showing the matrix correlation between μ -XRF data

Line 104: 3s is deem low. Is this a typo?

Line 105: why only these elements? For example, why is Ca omitted?

Line 106: How did you build the μ -XRF composite? Elements often decrease (increase) their values at both edge of the sediment sections. Did you remove those data?

Line 239: There is no Ca profile showing these peaks. Maybe add into supplement.

Line 364-365: Please rephrase