

Interactive comment on “Winter and summer blocking variability in the North Atlantic region – evidence from long-term observational and proxy data from southwestern Greenland” by N. Rimbu and G. Lohmann

Anonymous Referee #2

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The authors correlate temperature in southern Greenland reconstructed from ice cores with several blocking indices, with the aim to extend the time series of blocking in Greenland by means of ice core data. The paper is generally well-written, but below I identify several major issues that need to be addressed in a revised version of the paper.

1. North Atlantic blocking and the NAO are known to be inversely correlated (Scherrer et al., 2006, Croci-Maspoli et al., 2007). The authors mention that Greenland temperatures are known to be correlated with the NAO, but do not talk about the known

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relationship with blocking. However, since it is known that the NAO and blocking are inversely correlated, then using a temperature time series that has been used to reconstruct the NAO for creating a time series of blocking is trivial and does not justify a separate publication. You should address this severe issue in the introduction and provide some justification as to what your study is contributing in addition to making use of these known facts. In the discussion of the results I also miss an attempt to separate or distinguish the influence of the NAO and blocking.

2. If a Greenland temperature record from ice cores should be used as a proxy for blocking, I would expect some explanation of the physical mechanisms by which the actual measured quantity in the ice cores, i.e. stable isotopes, are influenced by blocking. I do not see this relationship established in the paper, instead the ice core temperature signal is used almost as a thermometer record. A helpful reference in this context may be Sodemann et al., 2008. If the blocking-isotope relationship is not established on a physical basis, there is no guarantee that the correlation remains equally valid throughout time.

3. The authors use several different blocking indices throughout their paper, some based on Z500 and one based on SLP. The different indices should be directly compared based on the same dataset, and the difficulties and limitations of an SLP-based blocking index discussed.

4. A separate Discussion section which addresses the uncertainty of the reconstruction and the similarities or differences to the NAO should be added. Such a section could also contain more discussion of the blocking variability during past periods as promised in the Introduction.

Pg. 2412

L. 17: See also Croci-Maspoli et al., 2007, Scherrer et al., 2006

Pg. 2413

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L. 18: A direct relation would require a physical explanation, which is not given in the paper.

L. 23: The blocking variability during past periods is not really discussed in this paper.

Pg. 2414

L. 11: How does the linear detrending affect the results? How is the detrending justified?

L. 23: A discussion of why this blocking index is used is required. There several other, more recent blocking indices available (see references in Scherrer et al., 2006)

Pg. 2415

L. 27: a reference is needed here

Pg. 2416

L. 1: Is this not one of the main hypotheses of this paper? Then this should be part of the introduction, and underpinned by more evidence than a claim without reference in the sentence before.

L. 3: Mention what fraction of the temperature variance is explained by the PC-1 time series. What are the caveats and uncertainties of such an approach?

L. 16: Clarify that you use the TM blocking index here

L. 20: Since you are separating into warm and cold Greenland temperatures, this is not really different from separating into negative and positive NAO phases. How is your approach different from previously published NAO reconstructions?

Pg. 2417

L. 9: clarify what you mean by "important"

L. 12: How does this result compare with the NAO time series and previously published

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time series of blocking (Crocini-Maspoli et al., 2007)

L. 14: What is ultimately needed is a physical relation between blocking variability and how surface temperature is recorded in an ice core (see Sodemann et al., 2008). You should at least point this out as a requirement (or limitation)

L. 17: How extreme are the examples, e.g. in terms of standard deviations?

Fig. 3 does not display a lot of useful information and should be removed.

L. 26: Clarify, is this a 2-dimensional TM index? How is it different to previously published indices, and can it be directly compared to the figures in Scherrer et al., 2006?

Pg. 2418

L. 3: over THE North Sea

L. 4: How similar/different are the findings and why?

L. 29: A correlation of $r=0.4$ leaves quite a bit of unexplained variance, this should be discussed.

Pg. 2419

L. 4: How good and reliable is this information, what are the uncertainties?

Fig. 10 does not display a lot of useful information and should be removed.

Sec. 4 has very little explanation or discussion in relation to the number of Figures shown. There should be either more discussion or less figures.

Sec. 5 should be renamed "Summary and conclusions". There is no actual discussion of the results in this section.

Figs. 1 and 8: The area ± 1 sigma around the curves could be indicated by shading or error bars

Figs. 2 and 9: Obvious differences and time lags between the two time series should

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be mentioned and discussed

Figs. 6 and 13: Panel (a) could be removed, as the difference between panels (b) and (c) is quite obvious.

Fig. 7: A separate panel with a zoom on the period where the two time series can be compared would be helpful to evaluate differences or correspondence.

Fig. 14: The periods with large differences should be identified and discussed

References

Croci-Maspoli, Schwierz, Davies: Atmospheric blocking: space-time links to the NAO and PNA. *Climate Dynamics* (2007) vol. 29 pp. 713-725

Scherrer, Croci-Maspoli, Schwierz, Appenzeller: Two-dimensional indices of atmospheric blocking and their statistical relationship with winter climate patterns in the Euro-Atlantic region. *Int. J. Climatol.* (2006) vol. 26, pp. 233-249

Sodemann, Masson-Delmotte, Schwierz, Vinther, Wernli: Inter-annual variability of Greenland winter precipitation sources. Part II: Effects of North Atlantic Oscillation variability on stable isotopes in precipitation. *J. Geophys. Res.* (2008), vol. 113, D12111

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