

## ***Interactive comment on “Impact of precipitation intermittency on NAO-temperature signals in proxy records” by M. Casado et al.***

### **Anonymous Referee #2**

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### Summary

The authors investigate the impact of precipitation intermittency on climate reconstruction such as the North Atlantic Oscillation (NAO). In particular, they analyze the stability of temporal correlations between the NAO and temperature fields showing that in some parts of the North Atlantic the intermittency plays a role by reducing the correlation.

Overall the manuscript is well written und clearly structured. The topic is certainly of interest for the paleo-climate community as it shows how model simulations and observations could be used to assess the ability of proxy archives to reconstruct climate variations (in this case the NAO). Therefore I recommend publication after a few minor revisions listed below. One major concern is that the authors are not precise with the seasonality of the phenomena NAO (comments 13, 30, 35, 37). This needs to be

addressed in the revised version.

### Comments (not ordered by importance)

1. P4958,I15-17: This is a rather long sentence which is hard to read. So I suggest clarifying it.
2. P4958,I23: This sentence is a bit awkward. – suggestion: “ of precipitation for NAO reconstructions.”
3. P4959,L1: Please include the publication of Wanner et al. (2001, Surv Geophys): “(e.g., Wanner et al. 2001; Hurrell et al. 2003).”
4. P4959,I17: I suggest to also include the publication Luterbacher et al. (2001, Atmospheric Science Letters), Casty et al (2007, Clim. Dyn) and Kuettel et al. (2010, Clim Dyn) to the list as the latter two show climate field reconstructions of pressure with archives which are only pressure sensitive.
5. P4959,I22: The publications for the stalagmites are rather old, please include a new one, e.g., Fleitmann et al. (2009, GRL). Fleitmann, D., H. Cheng, S. Badertscher, R. L. Edwards, M. Mudelsee, O. M. Goektuerk, A. Fankhauser, R. Pickering, C. C. Raible, A. Matter, J. Kramers, O. Tvein, "Timing and climatic imprint of Dansgaard-Oeschger events in stalagmites from Northern Turkey", Geophysical Research Letters, 36/L19707, 2009
6. P4960,I5: Please include Raible et al. (2006, Clim Change) after teleconnections as they show the variability of teleconnection pattern in the North Atlantic.
7. P4960,I20: Please include Hangartner et al. (2012) for the tree ring cellulose. Hangartner, S., A. Kress, M. Saurer, D. Frank, M. Leuenberger, "Methods to merge overlapping tree-ring isotope series to generate multi-centennial chronologies", Chemical Geology, 294–295, 127-134, 2012
8. P4961,I7: Replace “They showed” with “It was shown”.

9. P4961,I17: “assures a physical and dynamical consistency”
10. P4961,I18f: Recommend to reformulate the sentence in order to make it easier to understand: “however, the precipitation amounts calculated by the atmospheric models are prone to biases of the models themselves, despite the models being constrained by assimilation of several observational products.”
11. P4961,I26: Replace ‘are’ with ‘is’.
12. P4961,I27: Put ‘December-March’ in text and ‘DJFM’ in brackets. Same for JJAS.
13. P4961,I27: This is maybe an important issue for the entire manuscript. In summer the dominant mode is not the NAO so the authors need to be clear about it. Later in the manuscript they use on the one hand a ‘station-based’ index to define the NAO. This is fine also for summer, but they also use an EOF analysis. The leading mode using EOFs is different in summer – sometimes it is called East Atlantic pattern. I think the authors need to discuss in the introduction that the leading mode in summer is not the NAO and they need to clarify this later also in the analysis part of the manuscript.
14. P4962: Please be consistent in the use of ‘half a degree’ vs. ‘ $0.5^\circ \times 0.5^\circ$ ’.
15. P4962,I19: Please write “first, ...”
16. P4963,I18: The authors could start the sentence with “To compare ...”
17. P4964,I1: I think it is not astonishing that there is a warm bias over Greenland, given that the models are coarsely resolved and the orography is lower. I suggest quantifying this effect.
18. P4964,I 15ff: Recommend reformulating to improve readability: “A subset of GNIP stations, for which summer and winter measurements are available for at least 10 years was extracted to evaluate the link to the NAO variability. This 10 years threshold yields a reasonable spatial coverage and allows for statistical analysis.”
19. P4964,I22: A figure which shows the geographical locations of the proxies might

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be helpful.

20. P4965,I13: Please include 'means': "(6-hourly, daily or monthly means)".

21. P4965, I14: Please rearrange 'respectively': "[. . .] lon are the latitude and longitude, respectively; [. . .]"

22. P4965,I25f: Please write "[. . .] identical when calculated from both 6-hourly and daily output [. . .]"

23. P4966,I12: Please remove 'same'.

24. P4966,I13: Please replace 'for' with 'from'.

25. P4966,I24: Please include also the publication Raible et al. 2006, Clim Change.

26. P4966,I24: As stated before the leading mode of SLP in summer is not the NAO!

27. P4968,I13: I think Fig. S8 seems to be important, so that it could be included in the main text.

28. P4968,I21: "reanalyses"

29. P4968,I28: I also suggest to include Fig S9 in the main text. Concerning the sensitivity to the centers of action, how is this assessed in the analysis?

30. P4969,I1-3: Again this is an issue with summer NAO definition. It is clear that there are changes in the correlation structure as EOF 1 in summer is not the NAO whereas the station-based index resembles the NAO pattern. So the authors compare apples with oranges. This paragraph thus needs substantial changes.

31. P4971,I10f: Recommend to reformulate the sentence: "[. . .] datasets and during which the reanalyses systems are most strongly constrained by assimilated observations."

32. P4971,I24: Recommend to split up the sentence: "[. . .] conditions. However, the observational records [. . .]"

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33. P4972,I21f: Recommend to write: “[. . .] relationships provides an ideal test bed for searching for [. . .]”.

34. P4973,I27: Recommend to replace “and moreover” with “while at the same time”.

35. P4974,L9-15: Again be clear about that the leading mode is not the NAO in summer.

36. P4975,I2: Recommend to write “Overall, the consistency [. . .]” to more clearly detach this sentence from the previous one. Otherwise it sounds like you found “robust results” even though you “could not compare to direct observations”.

37. P4975,I23-25: Still the winter signal which is recorded in such records will be mixed with the summer signal, so how could this problem be handled? The authors need at least state that this could be a problem.

38. The following publications seems to be important for this publication:

Yoshimori, M., C. C. Raible, T. F. Stocker, and M. Renold, 2006: On the interpretation of low-latitude hydrological proxy records based on Maunder Minimum AOGCM simulations, *Clim. Dyn.*, 27,493-513: Although not directly linked to the North Atlantic, I think it is one of the first studies which show how models could be used to help in interpretation of moisture sensitive proxies. It also shows that the thermodynamic component in moisture sensitive proxies is important. This fits perfectly to this manuscript.

Zorita, E., González-Rouco, F., 2002. Are temperature-sensitive proxies adequate for North Atlantic Oscillation reconstructions? *Geophysical Research Letters* 29: This is an important paper as it already postulates that precipitation sensitive proxies might be better suitable for NAO reconstructions. Please include this in the introduction and conclusions.

39. Fig. 2: Please denote (a) and (b) at the panels and mention units at the color-scales. More important is that the color-scale of the lower 6 panels shows white for 0.5 to 1, but in the panels for the LMDZ model there is no white, but only green and red

colors. This makes no sense.

40. Fig4: The color-scale should be the same as in Fig. 3 to allow for better comparison. Also the dots in the right panel are nearly invisible, please clarify.

General technical comments:

- References all seem to appear in brackets, whether they are actively embedded in a sentence or not. Please distinguish.
- Recommend to put units next to color-bar in all figures; makes it easier to read.
- Please be consistent with the use of the word 'anti-correlation' vs. 'negative correlation' (e.g., p4968, 4973) and the term 'strong correlation' vs. 'large correlation' (I suggest to use 'strong correlation'); this should improve readability.
- Along the same lines, please be consistent in the labeling of the datasets: 'CRU-NCEP' vs. 'NCEPCR' (text vs. figures)
- Please refrain from using '...'; write 'andsoforth' or something similar.
- Recommend to either consistently label figures with (a), (b), (c) andsoforth or not label them at all. I would prefer labeling and then also more often refer to the label in the text (such as 'see Fig. 2c') to make it easier for the reader to tie text and figures together.

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Interactive comment on Clim. Past Discuss., 8, 4957, 2012.

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