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Climate of the Past Discussions

Interactive comment on "Reconstructing Late Holocene North Atlantic atmospheric circulation changes using functional paleoclimate networks" *by* Jasper G. Franke et al.

Anonymous Referee #1

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The authors use a network approach to analyze the connections in a set of paleo-records in the North Atlantic region. The connectivity in the network is then related to a previous NAO reconstruction. This relation is used to expand the NAO reconstruction back in time.

The improvement of reconstruction techniques is an important subject and the NAO is a dominant mode of variability. I don't doubt that the authors have a deep knowledge of networks and that the analysis is well performed. However, there are many steps in the analysis which are not familiar to the average reader. I will strongly suggest that the authors try – wherever possible – to relate the network properties to more physical properties. If the paper gets too long they could delete section 5.4 which seems a bit

out of topic.

So, as I see it. the paper certainly deserves to be published but it could benefit from a more pedagogical approach.

Major comments:

1) While I in general find that the paper is well written I also find that it is very technical. The analysis includes several steps and it is not always easy to see the physical content. For example, what does Fig. 5 actually mean? It looks a little as the impact of the NAO on the temperature; negative correlations between the NAO and temperatures in middle Europe and positive correlations in Greenland and Scandinavia. But I guess it is more a picture of how tele-connection (or coherent?) patterns depend on the NAO which in itself can be seen as a tele-connection? Perhaps the authors could use observed temperatures to demonstrate how the tele-connection patterns look in the two phases of the NAO? The spatial coherence is already used for the spatial clustering of proxies.

More generally, I think it would be good if the authors tried (even more) to relate the network results to quantities of a more simple and well-known character.

2) I noticed that the reconstruction does not perform well regarding the correlation in the cross-validation test. Nonetheless, the authors use it to predict the sign of the NAO for which the method seems to be correct about 70 % of the time. I don't really understand the explanation the authors give (p13). It would help if a figure of the Ortega reconstruction and the new reconstruction was shown.

As for the comparison of the present reconstruction with other reconstructions it should be noted that both the reconstruction methodology and the proxy selection will be important. I would suggest that the authors produce a reconstruction from their proxies using a simple multiple regression scheme between the NAO and the proxies. This might help getting an idea of which improvements the network method actually brings.

3) Section 3.2: It seems that the similarity is defined from the p-vales alone. In my understanding it should be based on a combination of the size of the correlation and the p-value. As a large correlation can be insignificant so can a small p-value be connected to a weak correlation.

The similarity does not seem to take the sign of the correlation into account. From a physical point of view there is a big difference if two point are positively or negatively correlated. So is not a lot of information lost in this process?

4) Introduction, page 2: Networks probably have some advantages in some situations. However, networks were developed for studies of discrete phenomena such as those in sociology. In the study of climate we deal with fields that are continuous in both space and time. It therefore seems backwards to reduce the problem to a network. We must loose information that other methods based on fields take into account. I know that the present paper is not the place for a philosophical discussion but the concern could be mentioned.

Minor comments:

Is the A in Eq. 1 used anywhere?

Caption to Fig. 4 should be improved.

Page 7, top: I don't see how the AAFT procedure can be applied to the 4 incomplete proxies. The AAFT includes a Fourier transform.

Fig. 5: The bright areas are not easy to see. By the way: Is CE an accepted standard? It always takes me a while to figure out the direction of the axis.

P9,l5: More recent and complete references are Christiansen 2014 (10.1175/JCLI-D-13-00299.1) and Christiansen and Ljungqvist 2017 (10.1002/2016RG000521).

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