



## ***Interactive comment on “Where can the Arctic oscillation be reconstructed? Towards a reconstruction of climate modes based on stable teleconnections” by G. Lohmann et al.***

**Anonymous Referee #2**

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Review of “Where can the Arctic Oscillation be reconstructed?” by G Lohmann et al.

This paper proposes reconstructing atmospheric indices using proxy data only from locations with temporally stable correlations with the indices over long periods. This is a sensible aim and if carried out in practice would give more confidence to reconstructions of past climates. However, such reconstructions are only ever going to be good if the region of stability remains so. The authors examine several records for reconstructing the Arctic Oscillation of order a century and locate regions where this stability holds, but the approach is still subject to uncertainty from centennial or millennial-scale drifts in climate forcing. The authors do not address this. One way to limit such problems is to reconstruct variables using more than one combination of stable regions, something that would be a good test of sensitivity of longer reconstructions than attempted here.

The paper is well structured, but sometimes unclear in detail. There are also a number of decisions that need justifying or points that should be expanded. I therefore discuss the more major of these first and then the minor points of clarification.

Major Figure 7 shows the general idea behind potential reconstructions. A set of time-series from certain locations are combined in some manner, here in a Principal Component Analysis, and the resulting timeseries is the Index reconstruction. The authors combine quite wide areal averages (15x15o). In practice, proxy data will be point measurements and a better test would be to carry out the analysis using individual gridpoints, as even these are already smoothed compared to proxy data.

Precipitation data is analysed but not pursued. Were the results sufficiently discouraging for proxies of this variable to be less reliable as a reconstruction tool? For example, in Fig. 9 I doubt that there are any truly statistical significant regions in spring precipitation correlating with winter AO. However, the regional pattern of stability in winter precipitation is somewhat different to temperature so a combination of proxies for different variables from different areas might be a good predictor.

The stability maps are somewhat misleading. When we see the correlation plots there are some examples where the correlation does not change sign but is not statistically significant, even at the 90% level for long periods (eg China in Fig. 10). It would be helpful to give some extra prominence to those squares which remain above the significance threshold throughout, or for more than 90/95% of the time. Would your patterns be significantly degraded by this?

The use of the Greenland ice core data was not justified from the stability maps. Its SST correlation pattern (Fig. 12) is strikingly different from that of the AO, except in the northern Atlantic. It appears to be a poor choice for reconstructing the AO, yet is then used to construct the PCI of Fig. 17. I would also argue against use of the tropical Pacific corals. Figure 16 picks out an ENSO signal, not a correlation with the AO. The Pacific signal in the latter is from the tropical North Pacific, not the equatorial Pacific.

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While the idea of combining data/proxies from several regions is a good one I do not think the choice made will maximise the AO signal.

Some discussion of why stability in the correlation occurs in particular regions would be helpful.

Minor On p. 21 I was not clear what all the different SST fields mentioned were used for. What made up the base SST set? A combination of all? p. 25. The Red Sea coral &#948;18O is presumably responding to sea surface temperature rather than air temperature. p. 26. Stalagmite proxies will reflect autumn-spring precipitation rather than temperature perhaps? The poor precipitation correlations, particularly over the British Isles, could then explain the unstable pattern suggested from Fig. 14. Comment on why the Glueck and Stockton reconstruction appears less consistent than the Cook et al one. Did Cook et al. fortuitously choose data only from places with a stable response to the AO?

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Interactive comment on Climate of the Past Discussions, 1, 17, 2005.

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