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Climate of the Past Discussions

Interactive comment on "Pseudo-proxy evaluation of Climate Field Reconstruction methods of North Atlantic climate based on an annually resolved marine proxy network" *by* Maria Pyrina et al.

Anonymous Referee #2

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The paper investigates the skill of two different field reconstruction methods when applied to a handful of proxy locations in the North Atlantic ocean. The authors generate pseudo-proxies based on SSTs from two different models and an observed data set. They conclude that proxies at these locations have skill in reconstructing the temperature field in the eastern North Atlantic.

Several previous papers have studied the skills of field reconstruction methods. The present paper differs from these by focusing on a smaller region and on a very small set of proxy locations (5 or less). I find the paper somewhat limited in scope and I can only recommend that the paper is accepted if the authors expand their analysis to include more and deeper explanations of the results.

Major comments:

1) The pseudo-proxy experiments seem to be done for only one realization of the AR1 noise even though several models are used. Many of the conclusions – which are based on rather small differences in the correlation maps – could be different if another noise realization was used as shown in, e.g., Christiansen et al. 2009 (doi: 10.1175/2008JCLI2301.1). Preferably an ensemble of realizations should be used. Alternatively different realizations should be performed and the (possible) differences discussed.

2) Both the considered methods depend on EOF analysis and section 4.1 discusses the stationarity of the calibration coefficients. However, the paper does not include any comparison of the EOFs or the spatial correlation structure. I would advise the authors to compare the EOFs from the different data-sets and the different periods. The stationarity of the teleconnections could also be investigated by looking at the map of correlations between a grid-point with proxy-data and all other points

3) In the conclusions and the abstract it is mentioned that the marine network can produce skillful spatial reconstructions for the eastern NA basin. But even in this area there seems to be a massive underestimation of the amplitude. I think this underestimation in general could be described more in both the text and in the abstract.

4) I guess the reconstructions are best in the areas close to the proxies. But I don't think this is discussed much in the paper. The position of the proxies could be indicated on the maps.

5) It would be nice to see a plot of the time-series of the 5 real-world proxies. This would also allow the reader to judge if the AR1 process used for the pseudo-proxies is sound. By the way, I am surprised that the authors did not show a real-world reconstruction based on the 5 Arctica islandica.

6) There has been a discussion in the literature of the reconstruction methods ability to

get the amplitude right. Methods with temperature as the dependent variable, as those used here, are prone to underestimate the variability (Christiansen and Ljungqvist 2017, doi: 10.1002/2016RG000521 and references therein). The results in this paper seem to get an underestimation of the variability even in the case with noise-free proxies. The reason for the underestimation of the variability should be investigated and discussed.

Minor comments:

line 35: I think the abbreviations such as NA and PPE should also be defined in the text and not just in the abstract.

line 54: Perhaps another word than "aggravating" should be used here.

line 92: grid point -> gridded.

line 111 and 30: It is confusing that "reconstructions" are used for different things.

line 119: Why 1999 and not 2005?

line 142: A degree sign is missing.

Section 2.2.1: It would be better if single-letter symbols would be used in the formulas instead of Proxy, EOF, CC etc.

line 193: The sentence beginning with "The key .." does not make much sense to me.

l205: The pseudo-proxy review Smerdon 2001 (doi: 10.1002/wcc.149) should be cited somewhere.

line 200: With only five (or less in section 3.3) proxies it does not seem to make any sense to make a EOF transformation of the proxies and keep all five modes. This step is usually done to reduce the number of degrees of freedom which is not necessary here. This should be discussed.

line 223: What are the correlation of the other 4 proxies? It could be noted that values

around 0.4 are quite characteristic for many other proxies.

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