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Climate of the Past Discussions

Interactive comment on "Potential causes of 15th century Arctic warming using coupled model simulations with data assimilation" *by* E. Crespin et al.

Anonymous Referee #1

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General

The paper looks at climate model output with and without nudging towards the proxy observations - those that are available for the last 1000 years. I have difficulty with the phrase 'model reconstruction' for the simulation with nudging. It seems to me to be a case of telling the model the answer, then comparing the simulation with the answer! This doesn't add much to the modelling or to reconstructions of the past. We need more reconstructions and we need improved models.

I'd like to see two aspects considered. First, the proxy data used to nudge the model is not that complete prior to the instrumental record. So, why not try this whole exercise

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nudging towards the instrumental record for the period since 1850. How well can the instrumental record be produced? This could be undertaken with the full instrumental record and then with one masked according to the proxy data availability. This would give the reader an ideal of how much the nudging does.

Another thought is to nudge the model towards the 1000-year simulation from another climate model (e.g. one from GKSS or one from CCM in Boulder).

The other way of assessing the quality of the model simulations nudged towards the answer would be to undertake the comparisons with proxy data not used in the series that are nudged towards. This could be the less-resolved proxy reconstructions (from marine sources or from caves) that the authors say (probably rightly) can't be conventionally used in the reconstructions most recently exemplified by Mann et al. (2008).

Specific

1. The terminology used in the dates needs clarifying. The end of the 15th century to me is a period ending in 1500. This turns out later to be 1470-1520. It would be far simpler and avoid all misunderstanding if you used this 50-year period the whole time. Using centuries is and will be confused.

2. Several times the word 'warmth' is used incorrectly. The first of these is on line 26 on p2. Here it should be 'warm'. 'Warmth' can never be used in a comparative sense, which happened several times.

3. It is essential to define what you mean by internal variability of the climate system - it is used in the abstract.

4. Rather than refer to Bengtsson et al (2004) about the 1940s and 1910s refer to a data paper. The paper you have referred is looking as causes of the increase. The warming of the Arctic wasn't as much as 2 deg C either.

5. The paper by Kuzmina et al. (2008) doesn't use any more data than in Trenberth et al. (2007). The Kuzmina paper doesn't use any marine data for the Arctic. Instead

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they extrapolate from the land-based data over areas of sea ice and open water. Over the latter they could have used SST data.

6. The arguments on p3 (lines 14-20) do not make sense. Crowley (2000) is looking at the whole NH and you are looking at the Arctic. Arctic variability is much larger than global. You have to bear that in mind. It is much harder, as a result, to know whether changes in the Arctic are anything more than noise because variability is much larger there.

7. Corals are not present in the Arctic, so are not relevant.

8. There is a lot of instrumental data for the Arctic before 1850. See for example, Vinther et al. (2006) and then there are long series for northern Eurasia.

9. p4, you can't call the warm period from the 10-14th centuries the MWP. The MWP should be in the Medieval period. Discuss according to years, without preferring to named periods which is more confusing than using decades.

10. There is no need to put AD anywhere in this paper. The only time AD needs to go in is when there is a possibility of confusion with BC years. There is none here as you've mentioned the Medieval period and the period 1470-1520.

11. p10, 'relatively warmth' to either 'relative warmth' or 'relatively warm'. It does make a difference which, by the way.

12. p10, lines 10-27, the fact that you've 'reconstructed' two warmer periods than earlier (the period 1000-1200 if you really mean Medieval) is a direct result of your nudging technique. If the series you were nudging to were warmer in the earlier centuries, then presumably you would have nudge to warmer conditions then. Hopefully, now you can see why it is important to know what the nudging is capable of. To me, I can't see that this approach adds much to our understanding of the past.

13. p11, line 6, change 'short' to 'low'.

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14. Figure 4 is the key outcome of this paper. It is vital to show the series you are nudging to as well. If that series has these two peaks, is it that surprising if your so-called model 'reconstruction' does. It seems to me in Fig 4, that the 5 model simulations are very constrained when NH temperatures were very low or very high? These to me are periods where the nudging is working against the forcing.

15. p12, line 14, how few is few?

16. The last paragraph of the conclusions seems very speculative.

References

Vinther, B.M., Andersen, K.K., Jones, P.D., Briffa, K.R. and Cappelen, J., 2006: Extending Greenland temperature records into the late-18th century. J. Geophys. Res. 111, D11105, doi:10.1029/2005JD006810.

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