

## ***Interactive comment on “Constraining the temperature history of the past millennium using early instrumental observations” by P. Brohan et al.***

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This is an interesting paper, which has two goals: (1) to present a new comprehensive dataset of meteorological observations made on board on ships that travelled across the Atlantic and Indian Oceans in the 1790s-1830s, and (2) to demonstrate the usefulness of these early instrumental observations, exemplified by an attempt to assess the reliability of both climate model simulations and proxy-based temperature reconstructions. Overall, it is a fine paper that contains material well worth publishing in CP. There is a clear distinction, though, between the character of the two parts of the paper. The first part, which describes the new dataset, is well written and clearly demonstrates

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that lots of efforts have been made to produce a well-documented dataset. This part of the text is fine and can be published essentially as it stands (after some few very minor adjustments).

The second part, about the comparison with GCM simulations and proxy data, is more problematic in that the scientific analysis and discussion seems to be done more in a haste and is not characterized by the same rigorousness as the work done while producing the new dataset. There are some issues, both regards the comparison with GCMs and proxy data, that need to be addressed before I can recommend publication in CP.

As regards the comparison with GCMs, G. Schmidt has posted a short comment where he points out some important aspects that need to be considered. I need not go into any details here, as they are already given in Schmidt's comments with which I agree. The most crucial points being: (1) show simulations that are corrected for drift, and (2) discuss the different choices of volcanic (and I would add also solar) forcing used by the different PMIP3 teams and write the text such that it logically reflects the different choices of forcings. Schmidt's comment on how well the models simulate the effect of Pinatubo, should also be considered in the discussion and interpretation of the results.

As regards the comparison with proxy data, I don't agree with the authors' view that they have undertaken "a powerful validation for the proxy reconstructions – demonstrating that the proxies can be used to extrapolate back into the past, and into different climates, with success". In my opinion, a "powerful validation" would require some kind of statistical testing of a null hypothesis relating to the ability of the proxies' ability to extrapolate past climates. This has not been done here. Rather, what has been done is a simple visual comparison of the temporal evolution in temperatures observed on board on the ships and in proxy-based NH temperature reconstructions over a four-decade long period. No analysis has been done on any aspect of uncertainty in this comparison. Moreover, an analysis over a four-decade long period is not sufficient to judge if the proxy data provide reliable estimates of past temperatures over an entire millen-

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nium. In particular, by subtracting the mean over a part of the analysis period, nothing can be concluded about the proxy series' ability to estimate the long-term temperature evolution outside the analysis period. Thus, the final sentence in their conclusions, which seems to be one of the authors' main points with this paper, is not backed-up by any sufficient analysis of the data.

I recommend that the authors more carefully write their discussion and conclusions, taking better account for complexities and difficulties in the comparison with both GCMs and proxy-data. As such a more careful analysis will certainly affect the main conclusions, I judge that a major revision is needed – even if this may not require a major amount of work, but perhaps just a major care in how the analysis is undertaken and how the results are discussed, interpreted and summarized.

Minor comments, suggestions and questions:

1. The title is a bit misleading. When I first saw it, I expected to see more analysis related to the entire millennium and not just of a four-decade long period.

p 1654, l 20: insert 'over the Atlantic and Indian Oceans' after 'large-scale temperature response'

1655, 23: insert 'tree-ring based' before 'proxy reconstructions systematically'

1657, 17: Does "all" in 'all their contemporaries' include also companies from outside England (e.g. Netherlands, Spain)? Or should it be 'all their English contemporaries'?

1660, 2: I suppose it should be 'degrees-minutes-seconds'

1666, 17: annually-resolved (double-l)

Table 1. It might be useful to denote what the target area and season is for each reconstruction, and also comment on the importance of any differences in these choices.

Fig. 1. The anomaly baseline period should be indicated in the caption.

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Fig. 5. The caption should include a statement that the temperature data nor not bias-corrected, to avoid any mis-interpretation (by people who don't read the text) that the early temperatures were warmer than in 1961-90.

Figs. 5, 6, 8. I lack some information on how the time series was calculated from the raw data. What kind of spatial and temporal mean is it actually?

Figs. 4, 5, 6, 8. All three figures could have the unit (# obs, degC, hPa, m/s) specified at the colour bar.

Fig. 7. The grey dots are a bit too dark to be easily distinguished from the black (problems both on my printout and my computer screen). Use lighter grey, or two different colours.

Fig. 9. In the lower part, I would advice to put some error-bar onto the black curve. In this case, the ships' observations are used as a proxy for NH mean temperatures. For sure there is some uncertainty in this relationship, as evidenced by the inset graph from the models in the upper part. Could the authors consider using the residuals from this regression line as an estimate of the error variance when using the ships-area coverage as a NH proxy, and then use this to define an approximate 95% prediction interval to be plotted along with the black curve? Such a prediction interval (error-bar) would be helpful for interpretation of the comparison with the proxy-based NH temperatures.

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