Summary of changes in revision of "Constraining the temperature history of the past millennium using early instrumental observations".

Response to comments by Schmidt:

1) Climate model drift

Schmidt suggested removing the drift remaining from imperfect model spin-up by identifying the trend in the appropriate control run and removing that trend from the millennium run. For the CMIP5 millennium runs this is only possible for the MIROC and GISS models (the others don't have appropriate control runs). There is no standard or entirely satisfactory way of removing the drift, so we have chosen to fit a linear trend to the controls and subtract it from the millennium runs where possible. This is now mentioned in the caption to fig. 1.

2) Uncertainties in volcanic forcing

We have added a sentence to the paper to make explicit the limitations on interpretation resulting from uncertainties in volcanic forcing: "Much of the variation between simulations is a reflection of the uncertain forcing produced by the eruptions (Wagner and Zorita, 2005; Schmidt et al. 2011), so this says little about the accuracy of any GCM".

3) Citation of experiments and simulations

The DOIs for the simulations are still not available, but we have added citations for each model to table 1.

Response to comments by Moberg:

1) Add some statistical testing of a null hypothesis relating to the proxies ability to extrapolate past climates.

As we said in our response to the comment, this is exactly what we are trying to avoid. The point of our analysis is to suggest an alternative to such statistical tests as a way of building confidence in proxies. So we have not added such a test.
We have removed the word 'powerful' - as hyperbole.

2) An analysis over 4 decades can't be used to estimate long-term temperature evolution.

It does give some information over longer time-scales – we have re-written the fourth paragraph of the introduction to make this clearer.

[For some of the minor comments we've just made the suggested change, only the others are mentioned here.]

3) The title is misleading

See 2)

4) ‘All contemporaries’, or ‘All English contemporaries’

‘All contemporaries’ is essentially correct (we think), but details are complicated and irrelevant, so we’ve just deleted the word ‘all’.

5) Mention the target area and season for each reconstruction

This would be an inappropriate level of detail for this analysis – we’re following the IPCC AR4 in using the reconstructions as proxies for large-scale annual change.

6) Mention anomaly baseline period in caption to fig. 1

Proxies follow Jansen et al in being anomalised to 1961-90. The GCM runs don’t cover that period so we can’t do a direct comparison. Instead we’ve chosen an arbitrary normalisation that produces a clear visual representation (normalised to 850-880 mean with an offset). This detail is not important for the points being made in fig. 1 and adding a discussion of it would make the caption unacceptable long, so we haven’t put it in.

7) What kind of spatial and temporal mean is the time-series

Section 4 paragraph 1: “Extracting a set of pseudo-observations by sampling from the model output fields at the date and location of each observation” – so effectively it’s got the coverage shown in fig. 4. In the models, at least, it’s a good approximation to global, annual mean (Fig 9. inset)

8) Add units to the colour bar.

Software details make this difficult, so we’ve put it in the captions instead.

Response to Anonymous Reviewer 2:

1) Give more details on spatial patterns and seasonality

We think this is a follow-up project.

2) Look at Wagner and Zorits 2005

We’ve added a reference to this.

Other changes:

We’ve added 2 more GISS simulations to the GCM ensemble results (they’ve become available since the first draft – we’re using all available simulations).