

Answers to Referee #3

Minor comments:

Page 2633, Line 16-20: It would be useful to provide a bit more detail on the weights (the text notes this is discussed in SUN12, but a short summary would be appropriate here)

We can add one or a few sentences to explain the role of the weights.

Page 2636, Line 18-20: Likewise, some additional description of the U_R statistic would be welcome here.

Some additional description of U_R is probably better made near lines 7-12 on page 2633, where it was first introduced in this text. We will do so.

Page 2638, Line 9-10 and throughout: For clarity, would it be possible to refer to these $E1$, $E2$ in the rest of the manuscript as high and low solar ensembles? This would make for a more streamlined reading of the results and discussion

Agreed. We will make efforts to follow this suggestion.

Page 2648, Line 25-: The discussion here is too informal, and tries to parse 'closer' and 'significantly closer' in a way that I don't think is helpful. It would be sufficient to note the former ('closer') but to state they are not significantly so. If such a test isn't available, perhaps noting that any differences are minor would be sufficient.

Page 2649, Line 8: As above, I don't think this informal discussion of 'better' aids the clarity of the section here. The authors are welcome to make informal (non-statistical) observations, but parsing these too closely becomes merely confusing.

Page 2649, Line 25: As might be expected for a non-RCS chronology, although I think the authors make clear that it would be difficult to make any grand conclusions from this observation. The position of the GOA reconstruction in, for example Figure 8 is quite interesting.

Collective answer to the last three comments above: Yes, indeed, we can make the discussion in this section (Section 5) being more formally correct and improve its scientific rigour. This is also needed with regards to the comments made by Referee #2 concerning our discussion of Figure 8. Please, see our response to Referee #2.

Page 2651, Line 2: Perhaps draw in as well the recent paper by Schurer et al. 2013 (Small influence of solar variability on climate over the past millennium, Nature Geoscience). As well, how do these findings (and the preceding) compare to Schurer et al. 2013 (Journal of Climate)?

Referee #2 also wanted to see some discussion in light of the new findings by Schurer et al (Nature Geoscience). We will follow this advice when we revise the paper.

Page 2651, Line 8-10: It would be interesting to know how much of this might be due to the inclusion of GHG, since I suspect most of the proxy data show warming since the #1850s concurrent with the rise in GHG. Is there any way to weight the importance of orbital forcing (related to long term cooling seen in the, for example, PAGES2k results as well as the Scandinavian reconstruction by Esper) vs. GHG vs. the (statistical) benefits of the ensemble average?

Please note that our analysis does not include data after 1849, so the recent warming does not contribute to our results. Unfortunately, even if we had used data up to around the year 2000, we could not have addressed this question with help of the simulation ensemble used here – because no simulation was made where only GHG forcing or only orbital forcing was used. But we agree that

the question is important and we could add a comment about this to our discussion, and also say that there is a need for designing ensemble simulation experiments in such a way that this kind of question can be answered. From a practical (and financial) point of view, it is however not possible to produce all kinds of simulations that may be of interest to various potential end-users.

Page 2652, Line 10: But this (Esper et al. 2012) is tied to orbital forcing, correct?

Correct – we can make this clear in our revised text.

Page 2652, Line 19: Perhaps, although this appears to be substantially more pronounced for precipitation proxies.

We can add a comment to clarify this.

Page 2652, Line 21-22: Perhaps also cite D'Arrigo et al. 2013 here, which makes the comparison explicitly.

We can add a reference to D'Arrigo et al 2013. (We assume the referee means "Volcanic cooling signal in tree ring temperature records for the past millennium" in JGR-Atmospheres).

Figure 1: It would be useful to indicate the location of the single-series proxies in plots.

This might help. However, it will not work well for ASIA2K, because more than hundred sites were used. Several individual sites were also used for GOA. We will make some elaboration to see if a good practical solution can be found.

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