

Interactive comment on “Solar cycle in current reanalyses: (non)linear attribution study” by A. Kuchar et al.

Anonymous Referee #2

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Summary

This paper deals exclusively with the 11-year solar cycle variability in the stratosphere and lower mesosphere. The author's look at a range of different diagnostics included well-documented ones (e.g. T, u and O₃) and less well-documented ones (e.g. the TEM diagnostics). Three most recent reanalyses are used, and the differences between them are well documented. The authors also use three different techniques to 'extract' the 11-year solar cycle signal, which comprise of both linear and non-linear methods.

The novelty of this paper lies in the comparison of the linear (multiple linear regression) and non-linear methods (e.g. MLP). The authors conclude that the two methods give

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similar results for this type of analysis. I think this is an important result for the field, and probably should be made apparent in the author's paper. i.e. it should be the first point made in the conclusions, rather than a paragraph lost amongst other paragraphs.

While I think the science is robust, and applied rigorously, I feel that the study does lack proper credit of other relevant studies. I have therefore included many additional studies which I feel should be cited. I expand more in my comments below. When the literature has been reviewed more thoroughly, and relevant comparisons made with the authors work, I recommend publication.

Comments

Overall comments 1. I feel that the paper needs to cite more appropriately. I notable paper which is recently published (this is probably why it was missed), is Mitchell et al, 2014a. In this paper many different reanalysis data sets are studied, and MLR are used on them. Also, different MLR techniques are considered. Clearly there are many crossovers with Kuchar et al, and as such this paper should be talked about in the introduction, and compared throughout.

2. More discussion is needed over how the TEM diagnostics are calculated in the reanalyses, as there are issues with this (see minor comments on this).

3. The English needs to be improved.

Specific comments

1. The title does not really make sense. Consider changing to “The solar cycle in current reanalyses: linear versus non-linear attribution approaches” or something similar.

2. L41: insert 'most of' between 'where' and 'the ozone'.

3. L66 missing citation, perhaps include Austin et al, 2008 here.

4. L72 include Matthes et al, 2004 and Matthes et al, 2010 here.

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5. L72-84 some discussion of the Kren et al, 2014 paper should be made here, as there look at this relationship in models and conclude that it could be chance.
6. L97 Next to (or instead of) Gray et al, please include Kuroda and Kodera, 2001.
7. L108-109 Please include Gerber et al, 2009 in this list. Also, Mitchell et al, 2013 should be cited in place of (or as well as) the Baldwin and Dunkerton paper, as this was an update that dealt with timescales explicitly.
8. L122-135. Here reference should be made to the recent Chiodo papers (Chiodo et al, 2012; 2014).
9. L129: Include Scaife et al, 2013 here.
10. L136-152 I think more needs to be made of the different types of MLR (see overall comment 1).
11. L175 My overall comment 1 is linked the Fujiwara et al, 2012.
12. L178 (and elsewhere) Consider changing 'on the last generation' to 'to the most recent generation at the time of writing'
13. L202-215 See my overall point 2 here. But you should discuss papers that have calculated TEM diagnostics in reanalysis, as well as explaining any issues you may have had in doing so. For instance, Seviour et al, 2013 show how to do it for ERA-I, as well as issues that are faced. Mitchell et al, 2014b do the same for MERRA.
14. L232-235 This is not very clear until later in the analysis section. Rewrite so it is clear right away.
15. L296-299 Many studies just use AR1 for this, do the authors think that AR2 is better for some reason? Could they explain this.
16. Section 4.1 see overall comment 1.
17. L410-415: Expand on what is meant by 'using the model with EESC... ' (see

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comment 14. Also, use 'regression model' rather than 'model' otherwise readers may get confused with GCM models.

18. L476-578: I do not really follow this argument, and it is rather important because all your figures use it. Could you expand on this. Also, explain clearly how columns 2-4 should be interpreted from now on (e.g. on figures 1-3).

19. Figure 3: I do not see the O3 response.

20. L525 I think the PJO needs to be discussed here. Please also cite the Kuroda and Kodera, 2001 paper.

21. L556-562 Again, not the PJO here.

22. L628 This paragraph is a little confusing. What the authors say is only true in November, not really true for all of early winter. For instance, in December the vortex is weaker, and more easterly (between 80-90N).

23. L669 – Insert 'probably' between 'This' and 'results'.

24. L752 Missing reference, I would add Austin et al, 2008 here.

25. L788-802 To me this is the key conclusion of the paper. I think it should be right at the front of the conclusions.

Figures

Figure 3 has missing O3 response (but is listed in the caption). Figures 1-5 consider not using the rainbow color scale, and this is much harder to interpret than a red-blue color scale (for instance).

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