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Interactive comment on "Assimilation of Pseudo-Tree-Ring-Width observations into an Atmospheric General Circulation Model" *by* Walter Acevedo et al.

Walter Acevedo et al.

bijan.fallah@met.fu-berlin.de

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Answer to reviewer #2

Acevedo et al.,

November 10, 2016

We wish to thank you so much for your positive review and constructive comments. We answer your comments (*italic*) point by point (**Bold**):

One important point which I feel is not treated adequately in this paper is the observation error. The authors use a signal-to-noise ratio of 10. Typical pseudoproxy experiments use ratios of 0.25-1. Although the authors mention in the last part of their paper that their signal-to-noise ratio is optimistic, the reader is left wondering what the effect could be.

This has been also asked by the first reviewer and new Figure 11 is explaining this issue. A block of text also is added to the new version of manuscript explaining this issue.

Furthermore, the error model is not well explained. Why white noise? What would be the effect of a spatial error structure? What would be the effect of system- atic spectral biases in the tree rings? Even more importantly: Was the error assumed to be known perfectly? These questions would be very important for the community and would

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probably deserve a dedicated paper, but to the extent to which they could interfere with some of the results presented, I think some discussion should be added.

The signal to noise ratio (SNR) is expressed as the ratio of the standard deviation of the nature (true) run time-series to that of the additive white noise. The measurements' error is assumed not to be correlated in time (no memory), therefore the white noise is usually used in such studies (for example see Dee et al. (2016) or McShane and Wyner (2011)). Some pieces of text are added to explain the model's error in subsection Observation generation.

A second point concerns the model description, which is rather short. In particular, the boundary conditions are not well discussed (e.g., greenhouse gases, volcanic aerosols, etc.). I am aware that this is a Observation System Simulation Experiment, nevertheless I would be interested in the effects of boundary conditions. What are the climatological maps from ECMF used for? And maps of what quantities? The paper is sufficiently short; some more explanations could be added here.

Done. We added some explanations about the boundary conditions.

The authors use many acronyms (TRW, PLF, DA, SNR, VSL, GCM, TA, EnKF, CFR, OSSE) which may be familiar to some readers but not to others. Again, I don't think that the paper is too long, and some of the acronyms could be spelled out for the sake of better readability.

We agree. We expanded the manuscript from 26 pages to 32 pages and spelled out many of the abbreviations.

The description not only of the methods, but also of the result is rather short.

We added additional text to the discussions as well as methods.

p. 3, l. 6: Or, covariance matrices may be blended from the ensemble and other estimations.

Done.

p. 4, l. 10: Explain t-norms.

It is fully explained now in the new manuscript.

p. 6, l. 28: "a fixed averaging period length of one year": How was that year defined? April to March?

Has been changed to "Given the annual resolution of TRW chronologies, we study the filter performance for yearly averaged values (near surface temperatures)."

p. 7: The reader might get confused with the terms "run" (nature run, free ensemble Discussion paper run) and experiment (PRESCRIBED, SLAB). The table does not help the confusion, but the Appendix does, it is very well written. Please refer at the appropriate places in the manuscript to the Appendix.

Appendix is moved after figure 1 and the OSSE is described there fully.

p. 7, l. 21: The low yearly internal variability in the tropics deserves some further attention. What does this mean in relation to real-world phenomena such as ENSO or PDO? This is particularly interesting as the authors discuss the PRESCRIBED set up and the SLAB but later note that fully coupled systems could/should be used. Would the result be completely different in the tropics?

This issue was raised also by reviewer 1. So we discussed this issue in the new subsection Outlook. Giving more examples of phenomena with larger time-scales than one year.

p. 7, l. 25: Just really minor: "Fig. 3a" is arguably more common than "figure 3.a"
Done.

p. 8, l.16 and elsewhere: Is the emphasis (bold italics) necessary? The authors use the term in the same way as the literature.

Done.

p. 9, l. 18: What do you mean with "any specific year"? Does that mean that the boundary conditions are disregarded? Can 1900 serve as a prior for 1999?

We deleted "any specific year". We used 1900 for 1900. It was meant that we could calculate several years at the same time not in a sequence. making the algorithm even faster.

p. 10, l. 13: "a more consistent"?

Changed to “realistic”

p. 10, l. 30: There is another important difference to traditional CFR techniques (by the way: spell out), namely that data assimilation at least formally does not require calibration and thus is less sensitive to stationarity issues.

Done. We added the comment.

p. 11, l. 1: "full atmosphere-ocean interaction".
Done.

p. 11, l. 25: Not only model errors, also the observation error is an issue.
Given that we know the “true” state, the observation error is known in our OSSE. But in real word application this is true and is discussed in outlook.

References

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