

Review: Efficient Reconstructions of Common Era Climate via Integrated Nested Laplace Approximations

The authors have presented a thorough revision and have greatly focused the scope and presentation of the paper. They explore different models for reducing dimension of the proxy dataset and explore the impact of different inference algorithms and the use of forcings to inform the reconstruction. I appreciate the authors' effort in fitting the different models with the full and reduced proxy datasets which suggest there is only a small difference in predictive skill between the screened and unscreened data - I will always disagree whether this is an ideal way to proceed, but I recognize compromises need to be made to analyze the data. I also applaud the authors for the inclusion of code to reproduce the models presented. The ideas in the revised manuscript are more focused and organized and the thesis of the paper is more clear.

I still have some issues with the methodology and conclusions - primarily the evaluation of the reconstruction relative to another reconstruction - does this lead to group-think? I am also concerned with the difference in mean between the INLA and MCMC model in Figure (7) - are you running into issues of identifiability? Would a restricted regression model resolve this issue (Hanks et. al. (2015), Hughes and Haran (2013)) or is this due to the INLA model being a different model than the MCMC model (e.g. B14). Figure 6b shows that the suite of models have a hard time identifying the mean response relative to the comparison reconstruction. Is this consistent across all of the models or only an issue for the 4 you presented. If this is a consistent issue, it raises questions about the real-world implications on the discussion of climate change if small changes in model assumptions can produce different predictions (see Schofield et. al. 2016). The paper would be improved with one or two sentences along the lines of "Assumptions about the model choice have implications in the exact version of the prediction produced, resulting in different reconstructions. However; regardless of assumptions made in model choice, the rate of temperature increase in the last century relative to the past 2000 has been unprecedented."

There are some copy-editing issues that need resolution that are listed below:

- line 17 page 1 - state-of-the-art proxy
- page 3, line 14 Section vs. section
- page 7 lines 31-33
- page 11, eq (4), what is $m- = 1$ in $\sum_{m=1}$?
- page 12 line 56 - is precision the word you mean here, or is it better described as accuracy?

References

- Hanks, E. M., Schliep, E. M., Hooten, M. B., & Hoeting, J. A. (2015). Restricted spatial regression in practice: geostatistical models, confounding, and robustness under model misspecification. *Environmetrics*, 26(4), 243-254.
- Hughes, J., & Haran, M. (2013). Dimension reduction and alleviation of confounding for spatial generalized linear mixed models. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 75(1), 139-159.
- Schofield, M. R., Barker, R. J., Gelman, A., Cook, E. R., & Briffa, K. R. (2016). A model-based approach to climate reconstruction using tree-ring data. *Journal of the American Statistical Association*, 111(513), 93-106.