

Interactive comment on “Technical Note: Probabilistically constraining proxy age–depth models within a Bayesian hierarchical reconstruction model” by J. P. Werner and M. P. Tingley

Anonymous Referee #2

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Summary

In this article, the authors define a framework to explicitly include time-uncertain proxies within Bayesian hierarchical climate reconstruction models. While they formalize the Age-Depth Model for layer counted proxies to improve on the existing BARCAST algorithm (Tingley and Huybers, 2010a, b), this notation is applicable to any Bayesian hierarchical climate reconstruction model with potentially other types of chronologies, which makes their method very attractive. With this approach, the authors are able to propagate the age-errors throughout the climate reconstructions, and constrain the

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uncertainty space via the Bayesian framework.

General comments

This research paper builds an essentially theoretical yet very useful framework for climate reconstructions within Bayesian hierarchical models using time-uncertain proxies. The mathematical notations are clearly exposed and the algorithm performance is well illustrated via a set of experiments. The chosen scenarios are justified within the frame of model validation. Moreover, improvements on the basic algorithm are provided by the authors to explore the uncertainty space more efficiently. However, the adeptness of the algorithm on realistic spatial domains remains to be proven. For instance, I wonder if the exponential decay driving the spatial covariance of the climate field in eq. 1a, even though it is widely used, is an accurate descriptor of real climate covariance structure?

Specific comments and typos

- The various quantities used to evaluate the reconstructions (Sec. 4) need to be explained a little bit more, perhaps by giving the adequate range of values as well as their mathematical definition. Additionally, looking Fig. 7, some of those coefficients seem redundant?
- BARCAST: what does the acronym means?
- Eq 1b: ϵ_t should be e_t
- Page 4510, line 22: “A final technical issue concerns the convergence . . .”
- P4512, l23: “saved”

C2326

- P4513, I6: "ADMs"
- P4513, I16: "from the true ADM"
- P4515, I7 "covariance structure of the climate field"

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