

Interactive comment on “Continuous records of the atmospheric greenhouse gases CO₂, CH₄, and N₂O and their radiative forcing since the penultimate glacial maximum” by Peter Köhler et al.

Anonymous Referee #2

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General comments :

The dataset presented here is an important contribution for the paleoclimate community and deserves fast publication. It brings together multiple CO₂, CH₄ and N₂O measurements, and combines them in an intelligent way to produce a continuous history of these greenhouse gas concentrations, and the associated radiative forcing for the past 156ka. This is an essential contribution to the PMIP exercise. The method used (spline fitting) is appropriate, and explained very well. The uncertainties are also detailed clearly.

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Two things are however missing from this dataset : 1. Although the uncertainty in the data are well constrained, they are not propagated to the spline fit, and I believe it would be really useful to provide an envelope of the spline fit, either in the form of a 1 sigma uncertainty, or in the form of an ensemble of solutions, that could then, be used by the modeling community to produce ensembles of response to the forcing.

2. It would be useful in the paper to discuss the perspective to improve greenhouse gas reconstructions in the future : new samples, better replication, better understanding of the core to core offsets, continuous flow, inversion of the firm smoothing, NH reconstructions. . .

Specific comments:

- The core to core offset is an issue. I agree with the authors that this paper is not the place to solve this problem, but it would be useful to quickly state the possible mechanisms. For CO₂, in-situ production is likely the main cause, and we know that it's not a lab or analytical offset, but it's real, in the ice. In situ production can only increase ice core CO₂, and this is why we prefer the lower estimate, rather than take the mean between WDC and EDC. Someone that does not know about ice cores may be surprised by this decision, so I suggest you explain it more clearly.

- For N₂O, I'm not familiar with the possible mechanisms, but since the offset correction is different, I think it should be detailed a bit more: list possible mechanisms, and explain strategy to bring different cores together (page 12, line 10-15).

- Page 10, line 28, add 'A' to 'A hundred year later'

I believe these comments can be addressed quickly, and I am looking forwards to the final publication.

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