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Climate of the Past Discussions

Interactive comment on "Temperature seasonality in the North American continental interior during the early Eocene climatic optimum" *by* Ethan G. Hyland et al.

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1) This is an excellent paper comparing seasonality changes in paleoclimate through the Paleocene-Eocene thermal maximum, and finding that the greenhouse spike did not have an equable climate compared with before and afterward, as some have predicted. This is an important qualification for understanding climatic change in a higher CO2 world, in emphasizing seasonality of temperatures rather than averages. This paper is excellent and publishable with minor revision. I am familiar with most of the methods deployed and consider them skillfully applied to the problem. The authors have a high level of technical competence and understanding of limitations of each

method.

We would like to thank Dr. Retallack for his time in reviewing our manuscript, and for the positive evaluation of our work and its importance within the context of research into greenhouse periods.

2) My main reservation is that I do not agree that the difference (ca 4°C) in temperature seasonality of the greenhouse spike compared with the times before and afterward is significant, given standard errors on the various proxies. I consider the temperature seasonality before, during, and afterward statistically indistinguishable. This is not quite the same as the interpretation given, but does make their point that greenhouse spike temperatures were far from equable.

We too were concerned about the significance of the trend across the peak EECO due to the larger error inherent in these measurements, however we believe we have addressed this concern via the combination of 1) averaging larger numbers of replicates (e.g., Fernandez et al., 2017), and 2) applying common statistical tests (e.g., uncertainty of difference). By binning our temperature data into "peak" and "non-peak" periods we allow for larger datasets in calculating a mean value, which leads to lower error in the estimation of those means (Fernandez et al., 2017). Thus, our mean estimates for the two periods has a lower error than any individual estimate from the record. Additionally, we applied an uncertainty of difference test to these two populations, and find that the difference between the two populations is greater than the uncertainty, suggesting that the two populations are statistically distinguishable and not a result of high uncertainty (as described in Section 4.2). We do also agree with Retallack that regardless of whether the peak EECO has a higher MART than the non-peak period, both periods suggest that greenhouse conditions do not lead to "equability" of seasonality, which is our primary conclusion.

3) A minor quibble, is that my understanding of nearest living neighbor and other paleobotanical estimates of paleoclimates rely on an adequate number of species in the

assemblage (usually at least 30 species). The number of taxa in each assemblage should be reported, perhaps most conveniently in the figure.

We agree with Dr. Retallack that the number of taxa is an important consideration for examining the climatic tolerances of assemblages, and will add this information to Figure 3 before final publication of the manuscript. The number (and type) of taxa for each assemblage was previously reported in the supplemental information (Table C1), but should also have been included in the manuscript itself.

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