**Climate
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Discussions

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Interactive comment on "The Eocene-Oligocene transition: a review of marine and terrestrial proxy data, models and model-data comparisons" *by* David K. Hutchinson et al.

Anonymous Referee #1

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General Comments

This manuscript, entitled "The Eocene-Oligocene transition: a review of marine and terrestrial proxy data, models and model-data comparisons" by Hutchinson et al., is an outstanding review paper worthy of publication in Climate of the Past. This paper makes large strides and provides a comprehensive update to Eocene-Oligocene research as much has been done since the 2007 review of Coxall and Pearson. The authors take a methodical approach, first addressing terminology and a framework for the Eocene-Oligocene, then boundary conditions such as paleogeographic reconstructions, paleoceanography, and constraints on glaciation. Next, the authors move

to a comprehensive review of marine and terrestrial paleoclimate and pCO2 reconstructions, mechanistic modeling studies of paleogeographic, CO2 and temperature changes. Finally, and most importantly, the authors end the paper with a metaanalysis of the factors affecting paleoenvironmental changes during the E-O transition and conclude that CO2 decrease likely served as the primary driver of cooling and Antarctic glaciation. As this manuscript is very well written, I do not have large structural comments. Instead, I include my few specific comments along with line-by-line technical corrections below.

Specific Comments and Technical Corrections

Lines 111 and 125: This is just one example of "Fig." vs "Figure." Be consistent throughout.

Lines 111 and 123: Again, just an example. . .I think it may help to structure these paragraphs in a way that really highlights these key terms such as EOGM and EOIS. This reorganization could help readers not as familiar with key E-O events as this is a review intended for a broad audience.

Figure 1. Along with the comment above, perhaps it would help to differentiate old/existing terms with your new preferred framework. Possibly a different colored font for existing terms e.g. Step 1 vs your new proposed terms e.g. EOIS.

Line 199. Isotope

Lines 202 to 205. Possibly one more sentence to explain the mammalian phenomenon

Figure 3 caption. UK37 formatting.

Line 527. Possibly one additional sentence to discuss the d18Osw ice volume assumption and its robustness

Line 645: Revise "multiple evidence"

Line 657: UK37 formatting

Section 5.2. Possibly a short discussion of challenges with leaf proxies (e.g. preservation bias, sampling bias) would supplement the existing discussion of challenges with chronology in terrestrial records in general.

Line 920: The CCD was introduced on line 421 and should be abbreviated there.

Lines 927-930: This sentence is very jargony and should be revised (and probably split into 3 or so sentences). At the very least, "glacio-eustatic sea level-led shelf-to-basin fractionation" and "C12-enriched carbon capacitors" should be explained.

Line 929: "C12-enriched" formatting

Line 930: clathrates

Lines 931-935: These mechanisms require additional explanation and reduced jargon. Explain "labile and refractory components"

Line 955: This description of GENIE is very similar to line 932

Line 968: Define SAT here and not in line 971.

Figure 7. This figure is perhaps the most important in the paper and possibly the hardest to interpret. At the very least, when finally published, these three panels should be much larger. Many of the other figures can be smaller. I found 7a particularly hard to interpret, but the coastlines and proxy-model comparisons in all three panels are a bit challenging to see.

Line 1082: For UVic,

Line 1085: For FOAM,

Table 2 caption: This caption requires the statement as in Table 3 about the meaning of green highlighted cells

Line 1164: This is the first of several instances where "CO2 forcing alone" is cited as the best fit. Perhaps I'm not understanding the skill score analysis, but in Table 3 it

appears that the ensemble mean skill score of 0.326 is achieved with coefficients of 0.7, 0.06 and 0.26 for alpha, beta and gamma respectively. Wouldn't this mean that CO2 is the primary driver but that ice and paleogeography make modest contributions as well? If this is the case, the authors should clarify modify their interpretation to include these additional factors. If this is not the case, a quick mention of why this result indicates CO2 is the sole driver would be helpful.

Figure 8 caption: 910 ppm, not 900 right?

Line 1217: Here,

Line 1229: There is therefore a . . . . . .