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Climate of the Past Discussions

Interactive comment on "Mammal faunal response to the Paleogene hyperthermals ETM2 and H2" *by* A. E. Chew

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I will leave aside commentary on both the stratigraphy and paleo-statistics, since those have already been commented on, and there is no doubt that I am stratigraphically challenged. I would like to comment on aspects that I am very familiar with, i.e. the reconstructed temperatures, their comparison with modern and future values, and their interpreted relationship with physiology and evolutionary patterns. My comments are mostly focused on specific paragraphs in sections 4.2 and 4.3.

Absolute temperature values in the region are probably slightly higher than those cited due to more recent calibrations of LMA (described in detail in Huber and Caballero, 2011 and elsewhere), although the relative temperature change is probably in the range ascribed. The absolute value for pre-hyperthermal conditions is important when

comparing with modern and also because of the thresholded non-linearity in the physiological response to heat stress (reviewed in Sherwood and Huber, 2010 and Buzan et al., 2014 and references cited therein).

The 'best' estimate presented in Huber and Caballero, 2011 (figure 7) and Lunt et al. 2012 (Figure 4) for the modern vs non-hyperthermal early Eocene is ∼12C (the plausible range might be 16C to 8C). This is not so different than what is inferred in the Chew paper. PETM values are likely about 5C warmer than this (again with ill defined error bars).

The global mean temperature associated with regional temperatures this warm is ∼15C warmer than modern (Huber and Caballero, 2011;Lunt et al., 2012; Caballero and Huber, 2013)–this is for non-hyperthermal conditions. The PETM is presumably about 5C warmer still (Dunkley Jones et al., 2013 Caballero and Huber, 2013).

Such immense warming is not found within the 300 year time frame in any study referenced in the paper as far as I am aware. In a low sensitivity model, such as CCSM 3, such a warming only occurs in equilibrium after thousands of years and after a rise of CO2 above 4000 ppm. Obviously, in a more sensitive model, such warming occurs at lower forcing values, but regardless I am not aware of any published study predicting 15-20C warming globally within the next 300 years.

I'll also note that such extreme warming relative to modern values is consistent with the data produced in this study. As described previously (Sherwood and Huber, 2010), it requires >12C global mean warming relative to today to achieve temperatures and humidities capable of widespread heat stress likely to impact mammalian faunas throughout the tropics-to-subtropics (and warmer conditions still to achieve widespread heat stress in midlatitudes). So, I would argue that the various elements of the argument (extreme warmth/high heat stress conditions relative to modern, impact on fauna's and ecosystems) presented in this paper hold up, just not on a time scale or climate change magnitude relevant to the near-future of Earth. The far future, perhaps.

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Interactive comment on Clim. Past Discuss., 11, 1371, 2015.