

## ***Interactive comment on “The early Eocene equable climate problem revisited” by M. Huber and R. Caballero***

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### GENERAL COMMENTS

In this paper the authors provide a comprehensive review of the paleontological proxy data for global warm and seasonally mild terrestrial temperatures in the Eocene and the Early Eocene in particular, and contrast these data with new modelling results. In so doing, as the paper's title states, they revisit a long-standing problem; under what circumstances were frost-free conditions maintained across most continental interiors, and into polar regions? While there are some minor typographic errors, they achieve what they set out to do. Allowing for the uncertainties in both the proxy data and the models, both lines of evidence appear now in agreement as the model with some minor exceptions with winter temperatures, is able to replicate the annual average and

C99

winter temperatures estimated from a variety of proxy evidence. This is a significant outcome. Their analysis also points the way to important gaps in the paleontological proxy record; there is a dearth of terrestrial records from 30°S – 30°N, and for continental areas outside of North America, Europe and Australia, and even then the number of paleontological proxy records of terrestrial temperature are heavily weighted towards North America. This geographically limited terrestrial proxy record limits the value of their model-data comparison as key areas are missing. This is not a criticism of their analysis, just a statement that their study points the way for where future research effort from the paleontological proxy research community should perhaps focus their efforts.

I have a few minor concerns with the paper, mostly focused on the text dealing with the paleontological proxy record, and therefore recommend publication subject to some minor revisions, which I outline here:

p. 247, lines 16-19; perhaps worth citing here also the conclusions by Eberle et al. (2010), cited later in the ms (p. 253, line 24), that these proxies are weighted towards summer temps.

p. 247, line 19; paleoclimates is misspelled.

p. 248, line 18; perhaps also cite Greenwood 2007 here; in that paper I summarize many of these points.

p. 248, line 20; cite Peppe et al. 2010 here for the '2-8°C' error.

p. 249, line 25; perhaps add at the end of this sentence 'and likely represent CO2 minima'.

p. 251, lines 11-12; word missing, perhaps add 'whether'? "... from proxy records and whether ambiguity exists ..."

p. 251, line 24; add comma "... and calibration information, are summarized in Table 1."

p. 252, line 17 and also on p. 253 line 12; here you use 'transfer function', but on p. 256 line 14 you use 'coexistence approach'. Both are correct, but you introduce confusion. Some studies apply this approach to both macro- and microfloras (e.g., Greenwood et al. 2003, 2005). I suggest at first use of 'transfer functions' on p. 252 line 17, you say "... taxon-derived transfer functions (such as the coexistence approach; Utescher et al. 2009) or CLAMP ..."

p. 254, section 3.1.2; elsewhere you cite Greenwood et al. 2003. This paper provides 'coldest quarter temp' estimates for Australian Eocene floras from NLR transfer functions / coexistence approach, which could be substituted for CMM as it would be just 0.5-1°C warmer than the actual CMM value.

p. 265, line 10; 'in the / at the' – choose one.

p. 265, line 17; perhaps also cite Eberle et al. 2010 here.

p. 270, lines 25-26; you state the gap of proxy data for 27°N to 27°S here, but elsewhere you state 30°N – 30°S. Be consistent. Based on Greenwood & Wing 1995, 30°N – 30°S would appear correct.

#### ADDITIONAL REFERENCE:

Greenwood, D.R. 2007. North American Eocene Leaves and Climates: From Wolfe and Dilcher to Burnham and Wilf. In: Jarzen, D., Retallack, G., Jarzen, S. & Manchester, S. (Eds.) *Advances in Mesozoic and Cenozoic Paleobotany: studies in celebration of David L. Dilcher and Jack A. Wolfe*. Courier Forschungsinstitut Senckenberg, 258: 95 – 108.

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