Climate of the Past Discussions

Clim. Past Discuss., referee comment RC2
https://doi.org/10.5194/cp-2021-18-RC2, 2021

R2 Comment on cp-2021-18

Anonymous Referee #2

Referee comment on "Maastrichtian-Rupelian paleoclimates in the southwest Pacific – a critical evaluation of biomarker paleothermometry and dinoflagellate cyst paleoecology at Ocean Drilling Program Site 1172" by Peter K. Bijl et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-18-RC2, 2021

General comment

The manuscript presents new paleoclimatic data from high southern latitudes that is consistent with previous interpretations for the region. A strength of the manuscript is that it also evaluates the strengths and weaknesses of proxies for sea surface temperature (SST) including isoGDGTs and mean annual air temperature (MAAT) including soil-derived branched GDGTs. The authors conclude that MAAT is consistently lower than SST during the early Eocene, independent of the calibration chosen and moreover, that the proxies fail to document a rise in MAAT during the PETM and MECO. The factors contributing to this discrepancy (i.e., a change in GDGT source) are discussed, however the incorporation of mixing models may help demonstrate this now that new data (see Lauretano et al. 2021, Nature Geoscience, accepted) is available for the peat/coal of interest.

Specific comments

The authors discuss the potential contribution of terrestrial material from Australia throughout the manuscript. As such, reference pollen-based vegetation reconstructions from southeastern Australia should be included in lines 94-96.

In lines 172-175 the authors detail the incorporation of “substantial terrestrial input”. Could you please clarify whether the source of the terrestrial input is deemed contemporaneous or reworked or both?

Could the authors please elaborate on why smaller Eocene hypothermal events do not stand out clearly at Site 1172. Is it for the same reasons as the PETM and MECO or other factors?

Can you please elaborate on possible mechanisms facilitating the warm bias for TEX86-based SSTs in the sw Pacific?

The inability to document a MAAT rise during the PETM and MECO is attributed to a switch in brGDGT sources, namely from soils and peaty lakes, that dampened the proxy-response. Here you cite Holdgate et al. 2009 and say the source could be peats in SE Australia. However, earlier in the manuscript you mention that "rivers flowing from southeast Australia drained into the Gippsland and Bass Basins, and that terrigenous material is unlikely to have reached the ETP." Can you please clarify whether or not you think material from SE Australia could have reached site 1172? In addition, have you considered incorporating new brGDGT data (see Lauretano et al. 2021, Eocene to Oligocene terrestrial Southern Hemisphere cooling caused by declining pCO2, Nature Geoscience) derived from co-eval peats and deriving a mixing model (see Baczynsk et al. 2016 or Lyons et al. 2020 for mixing model examples)? This way you could test whether shifting sources of brGDGTs could be contributing to the absence of MAAT responses to the PETM and MECO.

You mention that diversity and TEX86 have a modest correlation for long-term trends and short-term trends (PETM), but not the MECO. Can you please elaborate on why this trend doesn't hold true for the MECO?

You regularly refer to "Australian hinterland" and "hinterland catchment". Can this please be illustrated on one of your maps?

How do the authors know the site drifted out of the zone of intense precipitation? Is there fossil or geochemical evidence for this? Latitudinal zones have shifted through time so there is no guarantee the northward movement of the Australian plate would have shifted the site into a new latitudinal/precipitation zone.

Technical corrections

Line 186 – please add 'in' after brGMGTs

Line 942 – please change 'bothe' to 'both'

Line 1249 – please change 'prodcution" to "production"