Response to Reviewers

Please find below our response to the latest round of reviews. We'd like to thank the reviewer for their constructive feedback (and patience) in reviewing this manuscript. We hope the following changes addresses their comments sufficiently.

Lines 26-28: It is good that the effect of burial of organic matter is now mentioned in the introduction. However, Sproson et al. (2022) is a very specific paper which is not relevant in this context. I am also not happy about overemphasizing the uncertainty here; the same could be said about degassing and weathering...

The reference to Sproson et al. (2022) has been removed and after discussion with co-authors we have replaced it with Hilton and West (2020), which should hopefully be more appropriate. I recognise that we are not dwelling on the uncertainty much here, but as it's not the focus of this study I would prefer not to dedicate too much time to a discussion of it. Hopefully the revised version will strike a balance between brevity and acknowledging that there are uncertainties involved in this study.

Line 40: "Mg\Ca" -> "Mg/Ca"

This has been corrected.

Lines 49-50, "The large quantities of GCM-derived climate outputs have been incorporated into global geochemical models over the last 10-15 years...": The quantities are not really relevant, are they? It is the information that counts...

This is true – the sentence in question is intended to show that there have been substantial efforts to model climates and that the field continues to develop. As for the quality, we are referring to peer-reviewed data here so one would hope we can have confidence in it...

Lines 134-135, "Should CO2 concentrations in GEOCLIM fall outside of the specified range, it will be unable to interpolate climate conditions.": What does GEOCLIM do in this case? And more importantly: Is this really relevant for this study?

It's true that this is not relevant here but it is prudent to mention what would occur in such an event – the text has been updated accordingly to provide a brief description of how GEOCLIM responds.

Line 180, "This process was devised and evaluated in Hayes (2019) and found to be robust.": Thanks for adding the information on interpolation and extrapolation to the main text of the paper. Could you elaborate on how the robustness was assessed, please? Maybe I missed it in Hayes (2019) but I could not find anything which goes beyond what is shown in the manuscript. In any case, I think the more important point is the one which you make in your response: CO2 concentrations do not go much beyond the 560-1120 ppm range, so this should indeed not be a big issue. This is definitely worth mentioning.

While the outcome of the assessment is unchanged between Hayes (2019) and this study, the key point is that the impact of the interpolation process is tiny (a few ppm), less than the implementation of factors such as changing resolution and far less than changing the GCM inputs. An analysis of the precipitation and temperature fields after interpolation confirmed there were no artifacts from the process.

As suggested, we have now emphasised in this part of the text that our results are essentially all within this range so it is largely irrelevant for the study.

Lines 185-187: Higher resolution helps, of course, but in the end you will be limited by the uncertainties in reconstructing paleo-relief…

This is true, although I would argue that assessing the uncertainties in palaeo-relief reconstructions would be quite a task (and beyond the scope of the study here). The point of the sentence here was to emphasise that, while not without uncertainty, the higher resolution data should provide a much better reconstruction than those used in the FOAM inputs. I've added some extra text which hopefully makes this clearer.

Figure 6: As noted by Reviewer 1 on Figure 1 of the original version, "Pg" is not correct…

Thank you for spotting this. While making the correction, I also noticed that the same error exists on Figures 2 and 4. These should now be corrected to "P". As the figures are too small to include Palaeocene (and there does not appear to be a widely accepted abbreviation) the abbreviation is explained in the caption text.