

Authors' response

September 2025

Editor:

"Dear authors,

After reading the manuscript, I am satisfied that the revisions have addressed the concerns and suggestions of the reviewers. I only recommend a few minor changes prior to publication:

We thank the editor for careful reading of our revised manuscript and for confirming that the reviewers' concerns have been addressed. We have implemented the suggested minor changes as follows:

L197+: 'auccorrelation occurs when current values correlate with past values, which is common in paleoclimate data due to long-term persistence in climate dynamics.' Here it should be added that taphonomic processes such as bioturbation also add to this auccorrelation in the proxy record.

We have added this clarification.

L304+: 'a few paleoclimate studies use information criteria for model selection, for example Valler et al 2024 show we can be beneficial'. This statement seems gratuitous as Valler et al 2024 were far from the first to use an IC in paleoclimatology. I recommend removing it altogether.

We agree with the editor and have removed this sentence.

L318-319: 'six and 12' and 'seven and 14'. Please use either numeric or textual representations, but do not mix and match.

We have chosen to use numeric representations and have made them consistent throughout.

L374-376: This argument is circular; you cannot use the Bai-Perron framework to validate the recurrence network analysis of Westerhold et al (2020), and use Westerhold et al (2020) to validate the Bai-Perron framework. Given that this framework is actually rooted in statistical theory and econometric practice, it seems like it would help buttress the results of Westerhold et al (2020). The intersection with the tipping points identified by Rousseau et al (2023) is also relevant here.

We have revised this part of the discussion accordingly to avoid circular reasoning and to highlight the relevance of Rousseau et al. (2023).

L387: ‘Five of these breakpoints closely match the five major transitions identified by Westerhold et al (2020).’ Please clearly mark those transitions on Fig 7.

The transitions identified by Westerhold et al. (2020) were marked in the plot with dashed lines in the original manuscript. We have made these lines thicker and hopefully they are now presented more clearly in Fig 7.

L430: ‘which Clark et al (2006) describe as a gradual transition occurring between 1.25 and .7 Ma’ → See also James et al (2024, 10.1029/2023PA004700) for a dynamical argument about a gradual transition.”

We have added this reference.

References

- Rousseau, D.-D., Bagniewski, W., and Lucarini, V. (2023). A Punctuated Equilibrium Analysis of the Climate Evolution of Cenozoic Exhibits a Hierarchy of Abrupt Transitions. *Scientific Reports*, 13:11290.
- Westerhold, T., Marwan, N., Drury, A. J., Liebrand, D., Agnini, C., Anagnostou, E., Barnet, J. S. K., Bohaty, S. M., Vleeschouwer, D. D., Florindo, F., Frederichs, T., Hodell, D. A., Holbourn, A. E., Kroon, D., Lauretano, V., Littler, K., Lourens, L. J., Lyle, M., Pälike, H., Röhl, U., Tian, J., Wilkens, R. H., Wilson, P. A., and Zachos, J. C. (2020). An astronomically dated record of Earth’s climate and its predictability over the last 66 million years. *Science*, 369(6509):1383–1387.