Climate of the Past Discussions

Clim. Past Discuss., referee comment RC2
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# Comment on cp-2021-185

Anonymous Referee #2

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Referee comment on "The use of paleoclimatic simulations to refine the environmental and chronological context of archaeological/paleontological sites" by Léa Terray et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-185-RC2, 2022

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Summary
The authors use a suite of climate simulations to discern between two alternative chronologies of paleoclimate levels in a record covering most of the last glacial cycle from North Africa. The simulations seem to favour the isotope-derived timeseries.

Main comments:

The authors address an important issue in paleoclimate and make seemingly innovative steps in combining climate modelling with uncertain paleoclimate chronologies. That said it is not clear that this method would in general produce robust results. Although, this paper demonstrates one example, it does not take account of uncertainties or biases in the climate model simulations or in the records (other than treating the two as equally likely). Something more formalised based on for example Bayesian methods would seem to be more robust, though it may not exist yet. The present method also does not address the underlying causes of interpretational issues with the paleoclimate data. For example, would it not be possible that the improved correlation between climate and isotopes could be because the more biologically-derived proxies are a more complex function of physical drivers than the water isotope signal? It is not clear how the combining (and perhaps weighting) across different climate model variables does or could give a different outcome. Overall, this is a difficult problem to tackle, but it seems that here a clearer demonstration that this method can deal effectively with these issues is needed.

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Minor comments:

For the description of the climate simulations it would make more sense to re-write this with a focus on the new simulations that you have performed rather than on the older ones on which you based the SST fields. Then, whilst I appreciate the effort in evaluating

the biases in the different model versions, I would recommend that the discussion of this, along with figures 2-4 are placed in an appendix. To me this would improve the readability of the paper.

The wording used to describe DH1 and 2 is sometimes confusing. DH1/2 are first introduced as two alternative chronologies from the paleoclimate recrods, but later in the text they are used to describe a chronology of the simulations (e.g. line 367). Please could you go through and ensure that it is clear in each instance which is meant?

Abstract: 1st sentence isn't clear. How about something like? : "Reconstructing the paleoenvironmental and chronological context of archaeological/paleontological sites is a key step for understanding the evolutionary history of organisms."

In the abstract please define "US-ESR" and "OSL", or you could just say two different dating methods?

Line 11: Please elaborate what you mean typically by "drastic discrepancies".

Line 28: "whose microvertebrate assemblages have been extensively studied" - please provide a few example references here.

Figure 1: not clear how the dates in panel F relate to the other variables.

Figures 5/6: can you add the times in kyr BP to the grey boxes/legend to match the text (e.g. at line 257).

Lines 297-303: It's not clear to me how the principal component analysis is calculated e.g. from which variables and times? Please could you add a paragraph here to explain this?

It's not clear that the approach for MIS5d in DH2 (L5-8). Have you replicated the climate simulation for 115k in each of these? Is this reasonable given the variations in curves B-E of Figure 1?

Line 366: do you mean overestimated as in too old, or that the uncertainties are over/under-estimated?

Line 425: "interglacial"->"interstadial"? There was no interglacial in MIS3?

Discussion:

Since your results come down in favour of the isotope-based record, it would be worth discussing how the inclusion of water and/or carbon isotopes in the climate model could better refine future work?

I also wonder if you might speculate on how applicable this approach is going to be? It require lots of climate simulations, and is presumably only applicable where the chronological/interpretational uncertainties are large.

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Technical corrections;

Abstract sentence 2: Commonly used method .. -> Methods commonly used ...
Line 3: Reconstruct->Reconstructing
Line 5: method -> methods
line 29: describe->described
line 71 and throughout: precipitations -> precipitation

Table 1 lig155k -> lig115K
Table 1 and throughout : Gaz-> Gas

Line 148: forced-> prescribed
Line 169: "In global the model reach equilibrium ...". Do you mean "The globally averaged quantitites show the model has reached equilibrium by eight years"?

Line 422: "goes until 11 ka on L8", do you mean "is as large as 11 ka for L8"?

Line 445: "reasonnalbe"->"reasonable"

Overall, the language could do with further proof-reading/editing for English.