Response to both reviewers

We thank both reviewers for their helpful reviews of the paper, and for pointing us to some recent work that we had missed. Our responses to the specific points raised are given below (response in italic, revised text in blue).

However, there is one point that we need to deal with before responding to specific points. Both of the reviewers commented on the fact that there appeared to be sites missing on the maps and that it was not clear how many sites were actually used for reconstruction. We realised that this was because we omitted to say that the individual site reconstructions were amalgamated in each 5.625°×5.625° grid cell to match the resolution of the LOVECLIM model that we were using as the target for the dynamic time warping. We have revisited this decision recognising that the dynamic time warping could equally well be applied to the individual records and also because this coarse resolution meant that the sites within some grid cells had different signals and amalgamation was leading to a loss of information. Since reviewer 2 was also concerned about the use of interpolated data in the dynamic time warping, so we have tested whether this was necessary and shown that it is sufficient to break the records into segments and perform the dynamic time warping on each segment, so we have now not performed any interpolation. This means that we can identify more individual D-O events but that a somewhat larger percentage of possible D-O events are missed because of the low resolution of the individual records. The broadscale patterns of climate changes are also not affected by the use of individual records, and in fact becomes even clearer. However, the use of individual records (rather than amalgamated records by grid cell) does affect the conclusion about the temperature seasonality in the northern extratropics: changes in winter temperature are now significantly larger than changes in summer temperature (i.e. winters warmed more than summers, so seasonality was reduced). The use of individual records does not affect the conclusions about seasonality in the tropics and southern extratropics: the difference is not significant in the southern extratropics; the changes in MTCO are not correlated with the changes in MTWA in the tropics.

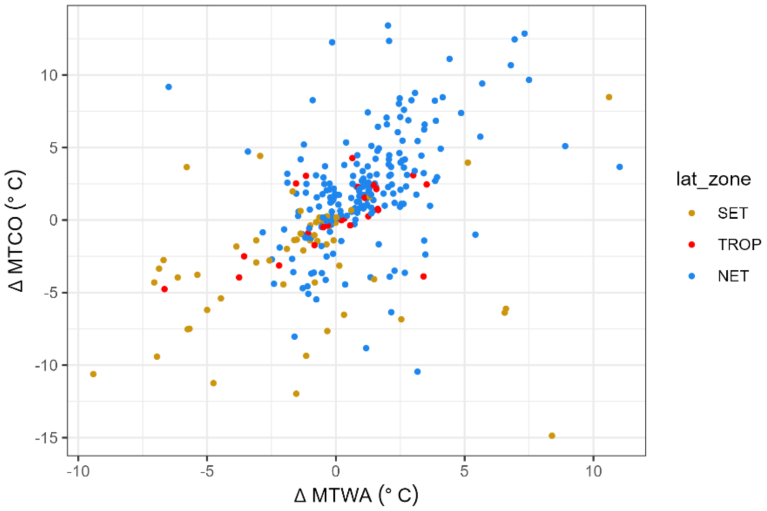
The ratio of ΔMTCO to ΔMTWA based on individual records now is:

Region		Coefficient	Standard error (SE)	Lower 95%	Upper 95%
NET	Slope	2.055	0.257	1.551	2.560
TROP	Slope	0.983	0.551	−0.098	2.064
SET	Slope	1.849	0.772	0.336	3.363

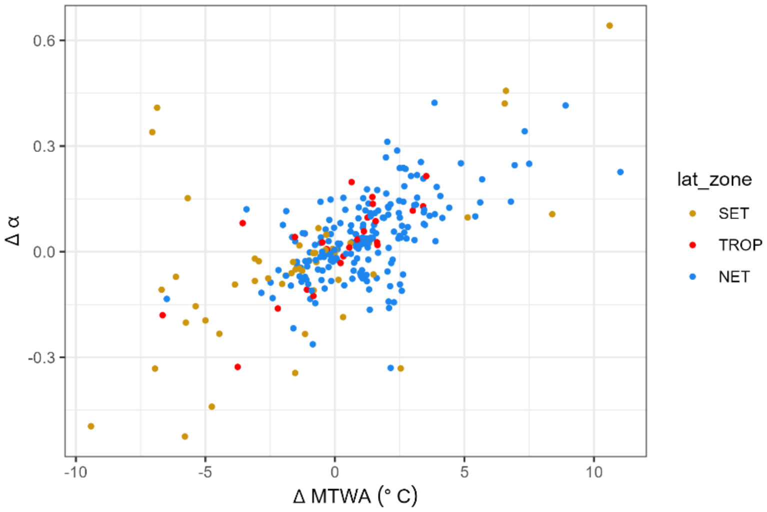
The use of individual records changes the ratio of Δα and ΔMTWA, but does not affect the conclusion that there is a significant positive relationship between these variables in all regions.

Region		Coefficient	Standard error (SE)	Lower 95%	Upper 95%
NET	Slope	0.066	0.009	0.048	0.084
TROP	Slope	0.059	0.020	0.019	0.098
SET	Slope	0.071	0.020	0.032	0.110

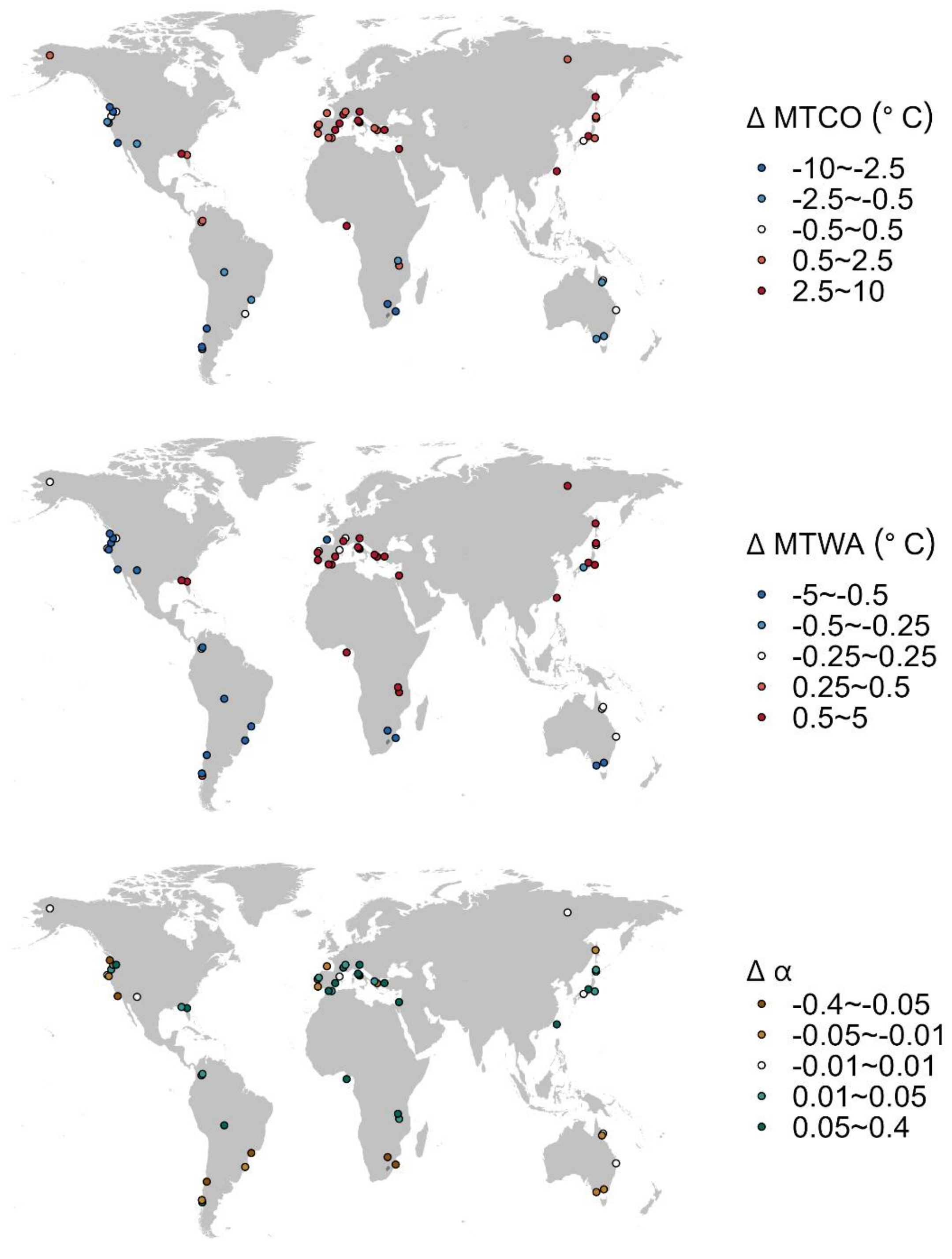
We have redrawn Figure 3 (scatter plot of the change in mean temperature of the coldest month (ΔMTCO) versus the change in mean temperature of the warmest month (ΔMTWA) to reflect the use of individual records.



We have also redrawn Figure 4 (Scatter plot of the change in plant-available moisture (Δα) versus the change in mean temperature of the warmest month (ΔMTWA) to reflect the use of individual records.



New Figure 5: Maps showing the median change of site-based reconstructions for Dansgaard-Oeschger (D-O) events.



We have rewritten the Age Modelling section to reflect the use of individual site reconstructions, as follows:
Although the ACER database provides age models for each pollen record, the resolution of the individual records is variable (mean resolution 474 years) and these models are often imperfectly aligned with the dating of D-O events as recorded in the Greenland ice core, and which have been shown to have a globally synchronous imprint through analysis of speleothem records (Adolphi et al., 2019; Corrick et al., 2020). To create a better alignment, we used dynamic time warping (DTW: Belman and Kalaba, 1959; Burstyn et al., 2021) to adjust the age scale for each individual record (Figure 2). Dynamic time warping optimises the similarity between two sequences by stretching or compressing one sequence in the time dimension to match the other. Here, we use simulated mean annual temperature (MAT) from a transient simulation of the interval 50-30 ka made with the LOVECLIM model (Menviel et al., 2014) as the reference sequence comparing to MAT calculated as the average of MTCO and MTWA from the individual pollen records. We used the mid-point between the start dates of each D-O event (Wolff et al., 2010; converted into AICC2012 timescale) to sub-divide each ACER record into discrete intervals and modify the time scale of the reconstructed mean annual temperature series in each interval to match the reference sequence, having normalised both sequences to remove the influence of differences in absolute values and the amplitude of changes. The adjusted age model for each ACER record was then applied to the reconstructions of MTCO, MTWA, and α for that record for subsequent analyses.

We have rewritten the Results describing the D-O events as follows:
The use of dynamic time-warping made it possible to identify D-O events robustly (Table 1). Thirteen of the 73 sites cover some part of the 50-30 ka periods but do not include D-O events. Across the remaining 60 sites, we identified 278 out of the 348 individual D-O events (80%) that occurred during the intervals covered by the records. In the majority of cases where a D-O event should have been registered but could not be identified in an individual record (60 out of 70 cases), the resolution of that part of the record was extremely poor (≤ 3 samples in the 900-year interval starting 300 years before to 600 years after the official start date of the event).

Changes in both MTCO and MTWA were generally largest in the extratropics and were more muted in the tropics (Figure 3). The change in MTCO was significantly larger in the northern extratropics when considered across all D-O events and sites; the change in MTCO was larger, but not significantly larger, in the southern extratropics; the changes in MTCO are not correlated with the changes in MTWA in the tropics (Table 3). There is a significant positive relationship between the change in α and the change in MTWA in all regions (Figure 4; Table 4).

We have rewritten and expanded the Discussion about seasonality as follows:
There is a significant difference in the warming during winter and summer in the northern extratropics, resulting in an overall reduction in seasonality, but no significant difference in the tropics and southern extratropics. Site-based reconstructions (e.g. Denton et al., 2022; Zander et al., 2023) suggest much larger cooling in winter than summer during cold phases of the last glacial, implying enhanced seasonality compared to warm intervals, which would be consistent with our reconstructions of a reduction in seasonality during warming events in the northern extratropics.

We have also modified the discussion about the modelling targets:
However, most models show larger warming in winter than in summer in the northern hemisphere (e.g. Flückiger et al., 2008; Van Meersbeeck et al., 2011; Izumi et al., 2023), which is also consistent with our reconstructions.

We have also modified the final paragraph to reflect the change in our DTW approach:

Identifying D-O events in pollen records is often problematic, particularly in regions where warming (especially if accompanied by dryer conditions) leads to a reduction (or an hiatus) in sedimentation as reflected in the variable resolution of the available pollen records (e.g. Sinopoli et al., 2019; Wei et al., 2021; Camuera et al., 2022; Pini et al., 2022). The use of shorter periods (Alshehri et al., 2019) goes some way to improving the identification of potential D-O events using dynamic time warping (Alshehri et al., 2019). Nevertheless, we were able to identify D-O events only 80% of the 348 individual D-O events that occurred during the intervals covered by the 60 records available globally. It is also likely that some of the variability in the reconstructed changes between different D-O events reflects imperfect identification of specific events because of the comparatively modest resolution of the records. Several new high-resolution records covering MIS3 have become available since the compilation of the ACER database (e.g. Wei et al., 2021; Camuera et al., 2022; Pini et al., 2022) and including these newer records could help to improve the reliability of the global reconstructions presented here. Nevertheless, this first compilation of quantitative climate reconstructions through multiple D-O events during MIS3 provides an opportunity for evaluation of the transient D-O simulations planned as part of the next phase of the Palaeoclimate Modelling Intercomparison Project (Malmierca-Vallet et al., 2023).

Reviewer 1

1. Changes in seasonality. Lines 18-20 and - The authors say : « The change in winter temperature was not significantly different from the change in summer temperature, and thus there is no evidence that the D-O events were characterised by a change in seasonality. ». Lines 190-192 « There is no indication of a significant difference in the temperature change during winter and summer, and thus no indication of a large shift in seasonality as inferred from some site-based reconstructions (e.g. Zander et al., 2023). »
These sentences are not clear to me. The recent study by Zander et al. (2023, see also Denton et al., 2022) shows that during D-O cooling events, in particular during Heinrich events, there were no substantial changes in summer temperature in Europe, suggesting that abrupt millennial-scale events were defined by colder and longer winters and, consequently, strong seasonality. Reconstructions by Liu et al. show that during D-O warming events winter and summer temperatures change in a similar way. The results of Liu et al. do not necessarily disagree with those of Zander et al. Seasonality may decrease during D-O warming events as both winter and summer temperature increase in parallel, while during D-O cooling events winter temperature decreases strongly compared to summer temperature, leading to an increase in seasonality during D-O cooling compared to D-O warming. Therefore, there could be a substantial change in seasonality during D-O events.

We agree that the idea of increased seasonality during cold phases is not inconsistent with either a lack of no significant difference in seasonality during the warm phases, as we originally proposed. In disaggregating the site data (see comment above) we now show that the warm phases were characterised by significantly larger changes in MTCO than MTWA, implying reduced seasonality compared to cold phases. This is also not inconsistent with the Zander et al (2024) findings. We have not found any other palaeodata based reconstructions of seasonality based on MTCO and MTWA (as opposed to growing degree days, which reflects the length of the summer season and is influenced by both changes in summer and winter) during warming events. We have modified the text appropriately (see above) and also updated the Zander et al reference in the citations, since this is now out.
Zander, P. D., Böhl, D., Sirocko, F., Auderset, A., Haug, G. H., and Martínez-García, A.: Reconstruction of warm-season temperatures in central Europe during the past 60 000 years from lacustrine branched glycerol dialkyl glycerol tetraethers (brGDGTs), Clim. Past, 20, 841–864, https://doi.org/10.5194/cp-20-841-2024, 2024.

2. Lines 35-37 – Something to highlight here is the contribution of this work to document and understand the « regionalisation » of global warming, one of the major challenges of the IPCC.
Thanks for suggesting this. We do touch upon the spatial patterns of change as a target for modelling in the Discussion but agree that it would be worthwhile to mention this in the Introduction, especially as this is a crucial issue for predicting the societal impacts of future climate change. We will modify the text to read:
Thus, the D-O events offer a parallel in terms of speed to projected future warming, although both the baseline state and the mechanism inducing this warming differ from anticipated 21st century climate changes. D-O events could therefore provide an opportunity to determine how well climate models that are used for future projections can simulate rapid climate changes (Malmierca-Vallet et al., 2023), particularly regional patterns of warming (and cooling) that are regarded as a challenge for modelling (Doblas-Reyes et al., 2021; Lee et al., 2021) and are highly important in assessing the vulnerability of human societies to future climate changes (IPCC 2022).

Doblas-Reyes, F.J., A.A. Sörensson, M. Almazroui, A. Dosio, W.J. Gutowski, R. Haarsma, R. Hamdi, B. Hewitson, W.-T. Kwon, B.L. Lamptey, D. Maraun, T.S. Stephenson, I. Takayabu, L. Terray, A. Turner, and Z. Zuo, 2021: Linking Global to Regional Climate Change. In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1363–1512, doi:10.1017/9781009157896.012.

Lee, J.-Y., J. Marotzke, G. Bala, L. Cao, S. Corti, J.P. Dunne, F. Engelbrecht, E. Fischer, J.C. Fyfe, C. Jones, A. Maycock, J. Mutemi, O. Ndiaye, S. Panickal, and T. Zhou, 2021: Future Global Climate: Scenario-Based Projections and Near- Term Information. In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 553–672, doi:10.1017/9781009157896.006.

IPCC, 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

3. Lines 45-51 – One of the first quantitative climate reconstructions of well identified D-O cycles from two deep-sea pollen records based on the Modern Analogue Technique was published by Sanchez Goñi et al. in 2002. Please add this reference.

We apologise for not citing this paper and showing our terrestrial record bias. We will modify the sentence to read:

There are quantitative climate reconstructions based on terrestrial pollen records from La Grande Pile (Guiot et al., 1993), Lago Grande di Monticchio (Huntley et al., 1999), Padul (Camuera et al., 2022), El Cañizar de Villarquemado (Wei et al., 2021; Camuera et al., 2022) and Lake Ohrid (Sinopoli et al., 2019), marine cores in the western Mediterranean and offshore from Portugal (Sánchez-Goñi et al., 2002), diatom assemblages at Les Echets, France (Ampel et al., 2010), bacterial membrane lipid records from the Eifel region (Zander et al.,2023), isotopic measurements of earthworm calcite from the Rhine Valley (Prud'homme et al., 2022) and clumped isotope measurements on snails in Hungary (Újvári et al., 2021).

4. Lines 77-79 – Merging Quercus deciduous with Q. evergreen in a unique Quercus morphotype may have had strong implication for reconstructing the seasonality of precipitation in the Mediterranean region. Please add some discussion on that.

We agree that it is not ideal to amalgamate deciduous and evergreen morphotypes of Quercus. We were forced to do this because many of the records simply refer to Quercus. While we could try and disaggregate this for the modern data by using modern species distribution maps and thus inferring the likelihood of the pollen taxon being evergreen or deciduous, but this is obviously not satisfactory in places where both types are present. The problem is even greater for the palaeo-records, where we would have to guess which type was most likely to be present. It is true that the distinction between deciduous and evergreen oaks could have implications for reconstructing moisture seasonality - although we are not reconstructing precipitation but rather plant-available moisture during the growing season here. However, a key point here is that there are several other taxa present in the records that are sensitive to moisture and temperature seasonality and this adds to our confidence in the reconstructions. We will add a comment about this as follows:

Counts for *Quercus*, *Quercus* (deciduous) and *Quercus* (evergreen) were combined because of inconsistent differentiation of *Quercus* pollen in different regional records. Deciduous and evergreen oaks occupy different areas of climate space, particularly in terms of seasonal moisture; specifically, evergreen oaks are typically found in areas characterised by winter rainfall such as the Mediterranean. Nevertheless, since there are other plant taxa that are similarly diagnostic of such regimes, the amalgamation of *Quercus* (deciduous) and *Quercus* (evergreen) should not have a major effect on the robustness of our climate reconstructions.

5. Line 79 – What does it mean « <10 occurrences » ? Less than 10% ? If this is the case, this threshold seems to me too high. For instance, Olea that it is an important climatic indicator hardly reaches 10%.
We apologise for not being clearer about what we meant here. We excluded any taxon from the training data set that did not occur in more than 10 individual samples in the SMPDS data set (which has 24649 samples in total), regardless of their abundance in an individual sample, on the grounds that this number of samples would provide an inadequate sampling of the climate space. These may have been genuinely extremely rare taxa or taxa that might not have been identified by most individual palynologists. Since there are 591 taxa that are represented at ≥ 10 samples, this filtering will not affect the reliability of the reconstructions. However, we will make rewrite the text to clarify this point as follows:
Taxa that occurred in less than 10 samples in the training data set were not used to make reconstructions because it is unlikely that the available samples provided a reasonable estimate of the climate space occupied by these rare taxa (Liu et al., 2020). After filtering, the data set contains information on 591 individual pollen taxa from 17547 sites (Figure 1).

6. Lines 91-92 – Please replace « continental-shelf marine sites » with « deep-sea sites ». No one of the marine records included in ACER is located in the continental-shelf area as the sedimentation in this area only preserves the Holocene period.
We will delete the "continental-shelf" in the revised version.

7. Lines 123-124 – Maybe it is worth to say here that this alignment is supported by the global synchroneity of D-O warming events shown by the well-dated speleothem records (Corrick et al., 2020).
We do refer to the global synchroneity of the D-O events in the Introduction (lines 42-43) but agree that it is worthwhile to make this point again when talking about the age modelling approach. We have modified the text as follows:
Although the ACER database provides age models for each pollen record, the resolution of the individual records is variable (mean resolution 474 years) and these models are often imperfectly aligned with the dating of D-O events as recorded in the Greenland ice core, and which have been shown to have a globally synchronous imprint through analysis of speleothem records (Adolphi et al., 2019; Corrick et al., 2020). To create a better alignment, we used dynamic time warping .....

8. Line 212 – Replace « …this in necessary… » with «…this is necessary ».
We will correct this typo.

9. Lines 220-221 – In contrast with author statement, there is a recent pollen record documenting the Indian monsoon D-O climatic variability by Zorzi et al. (2022). It would be interesting to apply

the same methodology to this record that qualitatively show the increase of the Indian monsoon during the D-O warming events.

Thanks for pointing us to this paper, which we had missed. It would indeed be interesting to apply our methodology to reconstruct moisture and temperature changes at this site, but we note that although the pollen data are available from Pangaea, the dating information - which we would need to apply the dynamic time-warping - is not. We will add the record to the list of post-ACER records that have become available (as suggested in the comment below) in the hope that we can make more extensive reconstructions at a later date. We realise that our discussion of the results of changes in α was somewhat biased towards the extratropics. As a result of our disaggregation of the reconstructions (see above), and the expansion of reference series from land only to global, we are now able to identify changes in the monsoon region and will modify the discussion as follows and include the appropriate references

The reconstructions also indicate an increase in α across much of the tropics, including northern South America, West Africa and southern China and Japan. Although α is not a direct reflection of summer precipitation, these changes are consistent with enhanced northern hemisphere monsoons during warming events, as shown by speleothem records from the Caribbean (Warken et al, 2019) and speleothem and pollen records from Asia (Wang et al., 2001; Zorzi et al., 2022; Fohlmeister et al., 2023). Although there is some consistency in the broadscale patterns of changes in temperature and moisture across D-O events, the magnitude of the changes as well as the spatial patterning varies between events.

Additional references

Warken, S.F., Scholz, D., Spötl, C., Jochum, K.P., Pajón, J.M., Bahr, A., Mangini, A. (2019) Caribbean hydroclimate and vegetation history across the last glacial period. Quaternary Science Reviews, 218, 75-90, https://doi.org/10.1016/j.quascirev.2019.06.019.

Wang, Y.J., Cheng, H., Edwards, R.L., An, Z.S., Wu, J.Y., Shen, C-C., Dorale, J.A.(2001). A High-Resolution Absolute-Dated Late Pleistocene Monsoon Record from Hulu Cave, China. Science,294, 2345-2348, 10.1126/science.1064618.

Fohlmeister J, Sekhon N, Columbu A, Vettoretti G, Weitzel N, Rehfeld K, Veiga-Pires C, Ben-Yami M, Marwan N, Boers N. Global reorganization of atmospheric circulation during Dansgaard-Oeschger cycles. Proc Natl Acad Sci U S A. 2023 Sep 5;120(36):e2302283120. doi: 10.1073/pnas.2302283120. Epub 2023 Aug 28. PMID: 37639590; PMCID: PMC10483664.

Zorzi, C., Desprat, S., Clément, C., Thirumalai, K., Oliviera, D., Anupama, K., et al. (2022). When eastern India oscillated between desert versus savannah-dominated vegetation. *Geophysical Research Letters*, 49, e2022GL099417. https://doi.org/10.1029/2022GL099417

We will also modify the discussion of modelling targets as follows:

Models generally show an intensification of the northern hemisphere monsoons during D-O events (e.g. Menviel et al., 2020; Izumi et al, 2023), but there is less consistency about changes in plant-available moisture in the extratropics. Our reconstructions of α suggest an intensification of the northern hemisphere monsoons, consistent with the simulations, and provide an opportunity to evaluate spatial patterns of moisture changes over the extratropics.

10. Line 233 – Please add the above one (Zorzi et al., 2022).

We will add this reference. We have also taken the opportunity to add in the new records from Girraween Lagoon and Lake Baikal. Is it time for ACER version 2?

Bird, M.I., Brand, M., Comley, R., Fu, X., Haddeen, X. Jacobs Z., Rowe, C., Wurster C.M., Zwart, C., Bradshaw, C.J.A., 2024. Late Pleistocene emergence of an anthropogenic fire regime in Australia's tropical savannahs. Nature Geoscience 17: 233-240.

Rowe, C, Brand, M., Wurster C.M., Bird, M.I., 2024. Vegetation changes through stadial and interstadial stages of MIS 4 and MIS 3 based on a palynological analysis of the Girraween Lagoon sediments of Darwin, Australia. Palaeogeography, Palaeoclimatology, Palaeoecology 642 (2024) 112150

Shichi, K., Goebel, T., Izuho, M., Kashiwaya, K., 2023. Climate amelioration, abrupt vegetation recovery, and the dispersal of *Homo sapiens* in Baikal Siberia. Science Advances 9, eadi0189.

11. In the figures, I do not see the results (circles) of the quantitative climate reconstruction of the MD95-2042 and MD99-2331 cores. Both cores have a high mean temporal resolution of 300 and 250 years for the studied interval, respectively. Could you explain why?
We did use these two cores for reconstructions, but they were not included on the figures which only showed the amalgamated grid cell values. Please see explanation and new figures above.

12. Line 413 – Add a space between « (a) » and « from ».
We will correct this.

Reviewer 2

1. All the DO results discussed in the paper are derived from data that needs to be explicitly presented. I need to see the raw data used to generate this article's main conclusions. Pollen-based climate reconstructions can be pretty noisy when not off-target if improperly controlled. I am confident the authors did all the necessary checks, but I still want to see the data. Note: Yes, they are available in that GitHub repository, but the paper should be convincing by itself. And it is short enough to take on a few more details.

We will add a supplementary table as below:
Supplementary Table: Climate change for individual sites and D-O events, where k indicates the D-O event; ΔMTCO, ΔMTWA and Δα are the change in mean temperature of the coldest month, mean temperature of the warmest month and plant-available moisture, respectively, identified individually for each climate variable, each site and each event; $\sigma_{\Delta\mathrm{MTCO}}$, $\sigma_{\Delta\mathrm{MTWA}}$ and $\sigma_{\Delta\alpha}$ are the corresponding standard errors; zone is the latitude zone of the site, where NET means northern extratropics, TROP means the tropics and SET means the southern extratropics.

site name	k	ΔMTCO	ΔMTWA	Δα	$\sigma_{\Delta\mathrm{MTCO}}$	$\sigma_{\Delta\mathrm{MTWA}}$	$\sigma_{\Delta\alpha}$	zone
Abric Romaní	11	10.68	6.79	0.142	1.11	1.31	0.032	NET
Abric Romaní	12	9.18	−6.49	−0.134	1.90	2.18	0.032	NET
Azzano Decimo	5	0.00	0.00	0.000	1.34	1.48	0.019	NET
Azzano Decimo	6	0.02	0.76	0.023	2.34	1.72	0.029	NET
Azzano Decimo	7	5.75	5.61	0.140	2.50	2.53	0.032	NET
Azzano Decimo	8	12.45	6.94	0.246	1.48	2.17	0.024	NET
Azzano Decimo	11	0.00	0.00	0.000	0.90	1.39	0.022	NET
Azzano Decimo	12	8.26	−0.90	−0.111	1.79	1.44	0.023	NET
Caledonia Fen	5	−3.96	−6.14	−0.071	1.38	1.53	0.026	SET
Caledonia Fen	6	0.26	−0.34	−0.002	1.13	1.43	0.025	SET
Caledonia Fen	7	−1.45	−0.72	−0.030	1.08	1.28	0.018	SET
Caledonia Fen	8	−1.04	−0.83	−0.004	1.18	1.56	0.024	SET
Caledonia Fen	9	3.96	5.12	0.097	1.32	2.19	0.104	SET
Caledonia Fen	10	0.00	0.00	0.000	1.35	1.27	0.023	SET
Caledonia Fen	11	0.00	0.00	0.000	1.38	1.24	0.021	SET
Caledonia Fen	12	−4.08	1.48	−0.065	0.98	1.22	0.022	SET
Cambara do Sul	5	−0.22	−0.53	−0.012	3.00	1.76	0.046	SET
Cambara do Sul	6	−1.40	−1.00	−0.025	2.74	1.65	0.052	SET
Cambara do Sul	7	0.63	−1.37	0.018	2.42	1.75	0.049	SET
Cambara do Sul	8	1.97	−1.68	−0.061	2.43	1.58	0.041	SET
Cambara do Sul	9	−1.68	−0.36	0.005	2.77	1.69	0.061	SET
Cambara do Sul	10	−0.37	−0.99	−0.027	2.59	1.66	0.049	SET
Cambara do Sul	11	−0.94	−1.37	−0.048	2.61	1.69	0.046	SET
Camel Lake	6	0.00	0.00	0.000	1.96	0.94	0.006	NET
Camel Lake	7	8.02	2.45	0.038	2.11	0.93	0.019	NET
Carp Lake	5	0.81	0.91	0.038	0.95	1.53	0.020	NET
Carp Lake	6	−0.47	−0.56	0.142	1.08	1.15	0.019	NET
Carp Lake	7	−0.31	−0.17	0.148	1.00	1.22	0.018	NET
Carp Lake	8	−1.23	−1.15	−0.072	1.39	1.13	0.021	NET

Carp Lake	9	1.56	−0.22	0.090	1.16	1.22	0.021	NET
Carp Lake	10	2.17	0.92	0.126	0.98	1.29	0.020	NET
Carp Lake	11	−0.57	−1.03	−0.092	1.04	1.63	0.021	NET
Carp Lake	12	0.00	0.00	0.000	0.97	1.19	0.017	NET
Colônia	5	0.00	0.00	0.000	1.56	1.81	0.078	SET
Colônia	7	−1.38	−1.61	−0.029	1.61	1.53	0.061	SET
Colônia	8	0.00	0.00	0.000	1.54	1.73	0.035	SET
Colônia	9	0.00	0.00	0.000	1.36	1.41	0.042	SET
Colônia	10	−2.09	−1.26	−0.054	1.51	1.50	0.080	SET
Colônia	11	0.00	0.00	0.000	1.49	2.26	0.076	SET
Colônia	12	−1.82	−3.86	−0.093	1.29	1.63	0.048	SET
Fargher Lake	5	0.00	0.00	0.000	1.33	1.18	0.019	NET
Fargher Lake	6	−4.44	0.36	−0.095	1.65	1.36	0.021	NET
Fargher Lake	7	−8.04	−1.60	−0.217	1.60	1.10	0.025	NET
Fargher Lake	8	−3.66	−0.54	0.041	2.41	1.15	0.028	NET
Fargher Lake	9	−2.51	−0.36	−0.007	1.82	0.97	0.024	NET
Fargher Lake	10	−1.45	0.21	0.081	1.74	0.98	0.023	NET
Fargher Lake	11	−5.08	−1.07	−0.042	1.97	1.13	0.028	NET
Fargher Lake	12	−4.57	−1.10	−0.079	1.69	1.46	0.023	NET
Fundo Nueva	6	−3.77	−5.38	−0.155	3.42	2.23	0.057	SET
Fundo Nueva	7	−7.49	−5.68	0.152	5.08	2.36	0.096	SET
Fundo Nueva	8	−7.65	−0.33	0.048	3.27	2.34	0.031	SET
Fundo Nueva	9	4.42	−2.94	−0.027	4.94	2.50	0.038	SET
Fundo Nueva	10	−4.30	−0.82	−0.110	4.44	2.63	0.041	SET
Fundo Nueva	11	0.00	0.00	0.000	3.34	2.43	0.060	SET
Fuquene	5	0.00	0.00	0.000	1.87	1.40	0.042	TROP
Fuquene	6	−3.13	−2.20	−0.161	1.57	1.38	0.040	TROP
Fuquene	7	3.05	−1.16	0.051	1.41	1.22	0.052	TROP
Fuquene	8	1.54	1.12	0.058	1.37	1.28	0.032	TROP
Fuquene	9	0.00	0.00	0.000	1.30	1.34	0.024	TROP
Fuquene	10	2.52	−1.54	0.041	1.00	1.13	0.025	TROP
Fuquene	11	−0.37	0.56	0.012	1.17	1.23	0.028	TROP
Hay Lake	5	0.00	0.00	0.000	1.24	0.87	0.023	NET
Hay Lake	6	0.00	0.00	0.000	1.56	1.00	0.021	NET
Hay Lake	7	−1.24	−0.97	−0.002	1.20	0.99	0.025	NET
Hay Lake	8	0.00	0.00	0.000	1.31	0.97	0.024	NET
Hay Lake	9	0.00	0.00	0.000	1.31	1.13	0.021	NET
Ioannina	5	1.83	1.85	0.097	0.66	0.94	0.012	NET
Ioannina	6	0.00	0.00	0.000	0.57	0.82	0.013	NET
Ioannina	7	3.05	2.07	0.011	0.72	0.94	0.013	NET
Ioannina	8	2.17	−0.08	−0.028	0.74	0.91	0.014	NET
Ioannina	9	1.12	2.63	−0.065	0.77	0.99	0.014	NET
Ioannina	10	3.13	2.13	−0.098	0.61	0.86	0.014	NET
Ioannina	11	1.76	1.37	0.109	0.71	0.90	0.014	NET
Ioannina	12	4.62	2.47	0.110	0.60	0.80	0.015	NET
Joe Lake	5	1.73	0.12	0.023	1.86	1.70	0.020	NET

Joe Lake	6	0.22	−0.14	0.001	1.61	1.54	0.019	NET
Joe Lake	7	0.00	0.00	0.000	2.08	1.74	0.022	NET
Joe Lake	8	0.00	0.00	0.000	1.87	1.72	0.023	NET
Joe Lake	9	1.06	0.10	0.007	2.08	1.68	0.021	NET
Joe Lake	10	0.00	0.00	0.000	1.98	1.71	0.021	NET
Joe Lake	11	1.27	−0.16	−0.024	1.90	1.58	0.020	NET
Kalaloch	5	0.00	0.00	0.000	2.67	2.07	0.029	NET
Kalaloch	6	−3.49	2.28	−0.144	3.86	2.83	0.038	NET
Kalaloch	7	0.00	0.00	0.000	2.60	2.08	0.035	NET
Kalaloch	8	−2.72	−2.48	−0.087	2.71	1.86	0.037	NET
Kalaloch	9	−3.63	2.68	0.054	2.48	1.72	0.034	NET
Kalaloch	10	−2.68	−1.70	−0.096	2.16	1.99	0.025	NET
Kalaloch	11	−0.85	−2.84	−0.117	2.54	1.81	0.038	NET
Kalaloch	12	−4.39	−2.40	−0.132	3.26	1.77	0.040	NET
Kamiyoshi Basin (KY01)	12	0.18	−0.50	0.000	0.76	0.89	0.040	NET
Kashiru Bog	8	0.00	0.00	0.000	2.28	1.47	0.065	TROP
Kashiru Bog	11	0.00	0.00	0.000	1.53	1.23	0.054	TROP
Kenbuchi Basin	5	1.64	0.91	0.038	1.61	0.95	0.018	NET
Kenbuchi Basin	6	2.30	1.05	0.026	1.50	0.92	0.018	NET
Kenbuchi Basin	7	2.30	0.80	0.050	1.40	0.88	0.018	NET
Khoe	5	0.00	0.00	0.000	1.26	0.76	0.020	NET
Khoe	6	2.94	−0.48	−0.054	1.04	0.91	0.017	NET
Khoe	7	2.22	0.86	−0.019	1.04	0.56	0.017	NET
Khoe	8	1.66	0.97	−0.061	0.89	0.53	0.015	NET
Khoe	9	5.11	1.38	0.101	1.36	0.61	0.024	NET
Khoe	10	4.47	0.84	0.021	1.35	0.71	0.024	NET
KW31	5	4.27	0.64	0.198	2.16	2.50	0.056	TROP
KW31	6	2.14	1.57	0.087	1.52	2.11	0.051	TROP
La Laguna	5	0.66	1.45	0.155	1.45	2.30	0.097	TROP
La Laguna	6	−0.91	−1.08	−0.108	1.38	2.25	0.078	TROP
Lac du Bouchet	5	8.26	2.94	0.215	1.25	1.43	0.018	NET
Lac du Bouchet	6	12.86	7.33	0.342	1.25	1.50	0.018	NET
Lac du Bouchet	7	8.76	3.07	0.033	1.25	1.49	0.021	NET
Lac du Bouchet	8	2.32	2.73	0.235	1.23	1.56	0.019	NET
Lac du Bouchet	9	6.88	2.81	0.070	1.43	0.98	0.017	NET
Lac du Bouchet	10	3.62	2.64	0.142	1.17	1.74	0.020	NET
Lac du Bouchet	11	7.38	4.86	0.251	1.43	1.40	0.018	NET
Lac du Bouchet	12	−1.41	3.43	0.079	1.54	1.63	0.019	NET
Lagaccione	5	3.80	0.33	0.153	0.87	1.17	0.017	NET
Lagaccione	6	2.20	1.30	0.137	0.77	1.06	0.017	NET
Lagaccione	7	0.00	0.00	0.000	0.81	1.21	0.019	NET
Lagaccione	8	2.00	0.91	0.095	0.80	1.53	0.019	NET
Lagaccione	10	0.00	0.00	0.000	0.86	0.93	0.017	NET
Lagaccione	11	3.11	2.76	0.037	1.03	0.88	0.016	NET
Lagaccione	12	8.23	3.84	0.423	0.84	1.71	0.020	NET
Laguna Bella Vista	11	0.00	0.00	0.000	1.03	1.23	0.077	TROP

Laguna Bella Vista	12	−2.50	−3.56	0.081	1.66	2.53	0.056	TROP
Laguna Chaplin	8	0.00	0.00	0.000	1.58	2.15	0.199	TROP
Lake Billyakh	5	2.28	1.56	0.086	2.37	1.65	0.033	NET
Lake Billyakh	6	−3.94	1.34	−0.165	2.10	1.72	0.033	NET
Lake Billyakh	8	3.71	−0.42	−0.015	2.22	1.50	0.032	NET
Lake Billyakh	12	2.58	1.27	0.021	2.54	1.59	0.036	NET
Lake Consuelo (CON1)	7	0.00	0.00	0.000	1.11	1.72	0.025	TROP
Lake Malawi	5	0.00	0.00	0.000	1.14	1.82	0.037	TROP
Lake Malawi	6	0.00	0.00	0.000	1.48	2.18	0.037	TROP
Lake Malawi	7	0.00	0.00	0.000	1.17	1.62	0.031	TROP
Lake Malawi	8	0.69	1.64	0.019	0.83	1.83	0.041	TROP
Lake Malawi	9	3.09	3.01	0.117	1.11	1.68	0.036	TROP
Lake Malawi	10	2.28	0.87	0.034	3.13	3.11	0.046	TROP
Lake Masoko	5	−3.89	3.40	0.129	2.09	2.21	0.078	TROP
Lake Masoko	6	2.42	1.46	0.136	1.85	2.19	0.070	TROP
Lake Nojiri	5	6.84	3.88	0.030	1.64	0.95	0.046	NET
Lake Nojiri	6	3.23	3.41	0.208	1.30	0.94	0.038	NET
Lake Nojiri	7	4.92	4.07	0.158	1.69	0.91	0.060	NET
Lake Nojiri	8	9.66	7.50	0.250	1.01	0.92	0.054	NET
Lake Nojiri	9	4.10	2.58	−0.111	1.32	0.95	0.039	NET
Lake Nojiri	10	8.46	4.15	0.096	1.22	0.89	0.049	NET
Lake Nojiri	11	9.41	5.68	0.205	1.47	0.83	0.037	NET
Lake Nojiri	12	3.67	11.02	0.226	1.33	1.19	0.035	NET
Lake Tulane	5	−1.01	5.42	0.100	1.46	1.14	0.032	NET
Lake Tulane	6	1.26	0.82	0.014	0.80	0.69	0.029	NET
Lake Tulane	7	5.10	8.90	0.415	1.82	1.28	0.042	NET
Lake Tulane	8	2.95	3.93	0.184	1.40	1.49	0.039	NET
Lake Tulane	9	0.00	0.00	0.000	0.70	0.60	0.039	NET
Lake Tulane	10	6.58	3.45	0.119	1.64	0.96	0.028	NET
Lake Tulane	11	0.85	1.38	0.034	0.93	1.16	0.038	NET
Lake Tulane	12	−1.90	−2.18	−0.052	2.07	1.17	0.076	NET
Lake Wangoom LW87 core	5	−1.40	−3.09	−0.020	0.93	1.14	0.033	SET
Lake Wangoom LW87 core	6	−1.40	−0.09	0.008	1.16	1.47	0.033	SET
Lake Wangoom LW87 core	7	−1.35	−1.52	−0.050	1.05	1.29	0.035	SET
Lake Wangoom LW87 core	8	−2.92	−3.09	−0.083	0.99	1.24	0.039	SET
Lake Wangoom LW87 core	9	−0.15	−0.77	−0.004	1.11	1.33	0.022	SET
Lake Wangoom LW87 core	11	0.00	0.00	0.000	1.22	1.50	0.050	SET
Lake Wangoom LW87 core	12	−2.76	−6.69	−0.108	1.04	2.82	0.100	SET
Lake Xinias	5	0.00	0.00	0.000	1.50	1.28	0.024	NET
Lake Xinias	6	0.00	0.00	0.000	1.53	1.34	0.028	NET
Lake Xinias	7	5.47	2.59	0.073	1.31	1.19	0.026	NET
Lake Xinias	8	2.45	2.17	−0.032	1.24	1.19	0.026	NET
Lake Xinias	9	0.00	0.00	0.000	1.09	1.17	0.022	NET
Lake Xinias	10	1.25	0.90	0.009	1.20	1.37	0.025	NET
Lake Xinias	11	1.94	1.29	−0.023	1.19	1.24	0.022	NET
Lake Xinias	12	1.83	2.23	−0.023	1.02	1.07	0.021	NET

Les Echets G	5	2.49	−1.14	−0.027	2.33	1.82	0.014	NET
Les Echets G	6	6.06	2.40	0.287	1.30	1.52	0.016	NET
Les Echets G	7	1.21	−0.21	−0.003	1.55	1.73	0.021	NET
Les Echets G	8	3.04	0.67	−0.077	0.91	0.71	0.013	NET
Les Echets G	9	0.63	0.17	0.021	0.95	0.74	0.014	NET
Les Echets G	10	0.35	0.20	0.023	0.97	0.83	0.015	NET
Les Echets G	11	1.69	−0.01	0.005	1.58	1.23	0.016	NET
Les Echets G	12	0.46	1.38	0.039	1.85	1.75	0.018	NET
Little Lake	5	3.15	1.59	0.052	1.58	1.01	0.017	NET
Little Lake	6	0.28	−1.46	−0.029	1.75	1.11	0.017	NET
Little Lake	7	−3.59	−1.65	0.041	1.81	1.04	0.021	NET
Little Lake	8	−0.44	−0.56	0.025	2.06	1.17	0.025	NET
Little Lake	9	−8.83	1.18	0.117	2.01	1.31	0.030	NET
Lynchs Crater	5	0.00	0.00	0.000	1.19	1.64	0.047	TROP
Lynchs Crater	6	0.26	1.26	0.097	1.16	1.74	0.048	TROP
Lynchs Crater	7	0.00	0.00	0.000	1.11	1.59	0.040	TROP
Lynchs Crater	8	−3.96	−3.75	−0.327	1.35	1.77	0.062	TROP
Lynchs Crater	9	0.77	1.63	0.027	1.23	1.24	0.081	TROP
Lynchs Crater	10	2.45	3.52	0.215	1.20	1.55	0.075	TROP
Lynchs Crater	11	−4.76	−6.65	−0.180	1.12	1.33	0.079	TROP
Lynchs Crater	12	−1.73	−0.83	−0.126	1.44	1.45	0.136	TROP
MD01-2421	5	2.09	2.51	0.097	1.54	0.92	0.037	NET
MD01-2421	6	0.66	1.46	0.039	1.17	0.86	0.037	NET
MD01-2421	7	−0.96	−1.32	−0.046	1.23	0.87	0.041	NET
MD01-2421	8	0.00	0.00	0.000	1.19	0.90	0.042	NET
MD01-2421	9	2.70	3.86	0.106	1.59	0.90	0.044	NET
MD01-2421	10	0.00	0.00	0.000	1.50	0.91	0.037	NET
MD01-2421	11	3.97	2.51	−0.093	1.42	0.99	0.041	NET
MD04-2845	5	0.58	−1.45	−0.041	1.85	1.11	0.017	NET
MD04-2845	6	4.19	−1.37	−0.070	1.66	1.18	0.021	NET
MD04-2845	7	1.18	2.28	0.057	2.05	1.20	0.021	NET
MD04-2845	8	3.19	−1.88	−0.068	1.41	0.98	0.020	NET
MD04-2845	9	0.00	0.00	0.000	1.25	0.91	0.030	NET
MD04-2845	10	0.30	0.43	−0.006	1.67	1.12	0.021	NET
MD04-2845	11	0.93	−0.65	−0.051	1.89	1.22	0.023	NET
MD04-2845	12	0.00	0.00	0.000	1.87	1.21	0.023	NET
MD84-629	5	4.18	2.68	0.186	0.93	1.30	0.018	NET
MD84-629	6	0.98	3.66	0.102	0.73	1.19	0.018	NET
MD84-629	7	1.73	1.09	0.077	0.74	1.00	0.019	NET
MD84-629	8	2.58	−1.88	0.115	0.94	1.13	0.019	NET
MD84-629	9	0.00	0.00	0.000	1.30	2.99	0.020	NET
MD84-629	10	−0.28	0.72	−0.054	0.84	1.31	0.021	NET
MD84-629	11	7.60	2.64	0.238	0.96	1.53	0.019	NET
MD84-629	12	2.51	−0.24	−0.044	0.88	1.38	0.020	NET
MD95-2039	5	3.70	1.23	−0.084	1.72	1.05	0.027	NET
MD95-2039	6	1.00	1.21	0.038	1.67	1.13	0.027	NET

MD95-2039	7	1.07	1.22	−0.066	1.86	1.14	0.027	NET
MD95-2039	8	4.77	1.61	−0.075	1.45	1.09	0.026	NET
MD95-2039	9	1.56	−0.74	−0.024	1.75	1.05	0.024	NET
MD95-2039	10	−1.67	1.67	−0.003	1.56	1.04	0.026	NET
MD95-2039	11	2.28	2.03	−0.056	1.59	1.04	0.025	NET
MD95-2039	12	2.59	1.07	−0.074	1.69	1.05	0.029	NET
MD95-2042	5	2.86	1.07	−0.076	2.05	1.27	0.035	NET
MD95-2042	6	2.70	1.01	−0.069	1.86	1.18	0.033	NET
MD95-2042	7	0.64	0.63	0.075	1.98	1.20	0.030	NET
MD95-2042	8	3.05	1.32	−0.107	1.87	1.15	0.035	NET
MD95-2042	9	0.13	0.09	−0.023	1.88	1.17	0.034	NET
MD95-2042	10	2.04	1.27	0.012	1.86	1.18	0.033	NET
MD95-2042	11	0.81	1.07	0.040	1.58	0.92	0.027	NET
MD95-2042	12	4.47	2.07	−0.142	2.02	1.00	0.031	NET
MD95-2043	5	2.52	1.51	0.076	1.57	1.35	0.027	NET
MD95-2043	6	0.57	0.62	−0.006	1.46	1.48	0.029	NET
MD95-2043	7	1.46	1.19	0.022	1.37	1.27	0.027	NET
MD95-2043	8	0.82	0.74	−0.031	1.57	1.20	0.028	NET
MD95-2043	9	0.51	0.83	0.026	1.31	1.35	0.028	NET
MD95-2043	10	0.18	0.06	−0.018	1.40	1.37	0.028	NET
MD95-2043	11	0.94	0.99	0.020	1.38	1.47	0.029	NET
MD95-2043	12	2.40	1.09	0.152	1.46	1.36	0.029	NET
MD99-2331	5	1.83	−1.53	0.029	2.03	1.39	0.021	NET
MD99-2331	6	2.50	0.65	0.027	1.94	1.19	0.025	NET
MD99-2331	7	3.37	1.04	−0.053	1.95	1.21	0.027	NET
MD99-2331	8	2.05	−0.36	0.063	1.62	1.10	0.042	NET
MD99-2331	9	0.00	0.00	0.000	1.95	1.19	0.023	NET
MD99-2331	10	1.78	−0.52	−0.081	1.92	1.25	0.028	NET
MD99-2331	11	2.10	−0.24	0.030	2.16	1.31	0.028	NET
MD99-2331	12	−2.38	3.48	0.076	1.95	1.28	0.033	NET
Megali Limni	5	6.24	3.43	0.112	1.26	1.44	0.024	NET
Megali Limni	6	3.66	2.15	0.135	0.90	1.40	0.018	NET
Megali Limni	7	6.59	1.98	0.165	1.00	1.35	0.017	NET
Megali Limni	8	6.43	1.63	0.175	1.27	1.94	0.027	NET
Megali Limni	9	5.44	3.18	0.153	1.05	1.36	0.018	NET
Megali Limni	10	0.00	0.00	0.000	1.11	1.27	0.014	NET
Mfabeni Peatland	5	−3.14	0.14	−0.080	2.80	1.79	0.059	SET
Mfabeni Peatland	7	−9.36	−1.15	−0.234	2.78	1.82	0.061	SET
Mfabeni Peatland	8	−11.97	−1.54	−0.344	2.84	1.91	0.068	SET
Mfabeni Peatland	9	−6.84	2.54	−0.332	2.02	2.07	0.052	SET
Mfabeni Peatland	10	0.00	0.00	0.000	2.73	1.86	0.061	SET
Nakafurano	5	1.41	−0.10	0.004	1.51	0.92	0.021	NET
Nakafurano	7	1.52	0.60	0.058	1.52	0.85	0.022	NET
Native Companion Lagoon	5	0.00	0.00	0.000	1.16	1.34	0.056	SET
Native Companion Lagoon	6	−0.39	−0.24	−0.007	1.26	1.46	0.051	SET
Native Companion Lagoon	7	−0.18	−0.01	−0.004	1.01	1.26	0.033	SET

Native Companion Lagoon	8	0.18	−0.64	0.067	1.14	1.31	0.053	SET
Native Companion Lagoon	9	0.69	0.60	0.025	1.02	1.25	0.039	SET
Native Companion Lagoon	10	0.19	0.02	0.005	1.05	1.22	0.034	SET
Navarrés	5	11.11	4.41	0.125	0.78	1.32	0.016	NET
Navarrés	6	8.39	2.48	0.145	1.02	1.41	0.017	NET
Navarrés	7	0.00	0.00	0.000	2.71	1.83	0.032	NET
ODP 820	5	0.00	0.00	0.000	1.43	1.30	0.066	TROP
ODP 820	6	0.10	0.33	−0.013	1.55	1.46	0.066	TROP
ODP 820	7	0.00	0.00	0.000	1.59	1.50	0.063	TROP
ODP 820	8	−0.39	−0.32	0.007	1.98	1.72	0.084	TROP
ODP 820	9	−0.01	0.22	−0.032	1.73	1.60	0.063	TROP
ODP 820	11	0.00	0.00	0.000	1.89	1.63	0.082	TROP
ODP 820	12	−0.50	−0.49	0.026	1.44	1.42	0.060	TROP
ODP site 976	5	0.99	1.90	0.096	0.64	0.85	0.023	NET
ODP site 976	6	0.58	−0.16	0.050	0.60	0.99	0.026	NET
ODP site 976	7	1.38	1.46	0.059	0.78	1.03	0.028	NET
ODP site 976	8	1.11	2.54	0.040	0.70	0.90	0.027	NET
ODP site 976	9	0.00	0.00	0.000	0.93	1.27	0.029	NET
ODP site 976	10	0.92	2.49	0.045	0.73	0.95	0.026	NET
ODP site 976	11	1.75	3.13	0.134	0.65	1.14	0.027	NET
ODP site 976	12	4.44	3.32	0.254	0.93	1.12	0.032	NET
ODP1019	5	2.49	−0.45	−0.009	3.59	1.58	0.031	NET
ODP1019	6	0.00	0.00	0.000	4.92	2.00	0.044	NET
ODP1019	7	−3.91	2.09	−0.160	2.45	1.57	0.059	NET
ODP1019	8	−4.70	−1.29	−0.085	6.58	2.22	0.056	NET
ODP1019	9	3.39	3.06	0.132	5.66	1.82	0.063	NET
ODP1019	10	1.89	−1.16	0.052	4.59	1.67	0.027	NET
ODP1019	11	0.00	0.00	0.000	1.96	1.18	0.018	NET
ODP1019	12	0.73	−1.01	−0.026	3.41	1.33	0.024	NET
ODP893A	5	−10.45	3.17	0.217	1.40	0.88	0.028	NET
ODP893A	6	−6.35	2.15	−0.330	0.70	0.97	0.025	NET
ODP893A	7	−4.12	−0.40	−0.104	1.06	1.10	0.032	NET
ODP893A	8	−5.47	−0.76	−0.146	1.17	1.19	0.031	NET
ODP893A	9	−0.64	−2.01	0.076	1.08	1.02	0.030	NET
ODP893A	10	−1.21	−1.18	−0.074	1.19	1.00	0.027	NET
ODP893A	11	−3.69	−0.95	−0.134	0.84	1.01	0.036	NET
ODP893A	12	−3.62	−0.85	−0.263	1.16	1.08	0.027	NET
Potato Lake	5	0.00	0.00	0.000	1.05	0.68	0.027	NET
Potato Lake	6	0.00	0.00	0.000	1.34	0.76	0.027	NET
Potato Lake	7	0.00	0.00	0.000	1.22	0.75	0.035	NET
Potato Lake	8	0.00	0.00	0.000	1.33	0.93	0.028	NET
Siberia	5	0.00	0.00	0.000	1.31	1.21	0.012	TROP
Stracciacappa	5	3.84	2.05	0.128	1.01	2.03	0.021	NET
Stracciacappa	6	1.80	−0.03	0.068	1.04	2.33	0.030	NET
Stracciacappa	7	4.22	1.54	0.109	0.94	1.51	0.020	NET
Stracciacappa	8	0.98	1.08	0.068	1.24	2.46	0.028	NET

Stracciacappa	9	0.00	0.00	0.000	1.05	1.81	0.021	NET
Tagua Tagua	5	0.00	0.00	0.000	3.83	3.53	0.029	SET
Tagua Tagua	6	−1.99	−1.90	−0.068	5.72	5.18	0.042	SET
Tagua Tagua	7	−7.53	−5.75	−0.201	5.31	4.21	0.046	SET
Tagua Tagua	8	−6.20	−5.00	−0.195	6.47	5.07	0.045	SET
Tagua Tagua	9	−2.79	−2.58	−0.076	5.03	4.94	0.040	SET
Tagua Tagua	10	1.60	1.31	0.024	4.42	4.34	0.047	SET
Taiquemo	5	3.65	−5.79	−0.525	5.82	4.27	0.273	SET
Taiquemo	6	−6.39	6.56	0.421	3.79	4.53	0.326	SET
Taiquemo	7	−4.30	−7.05	0.340	4.16	4.94	0.296	SET
Taiquemo	8	−3.35	−6.86	0.409	7.98	2.89	0.102	SET
Taiquemo	9	−6.11	6.60	0.457	7.08	3.94	0.233	SET
Taiquemo	10	−10.62	−9.41	−0.496	3.48	4.13	0.236	SET
Taiquemo	11	8.48	10.61	0.642	4.56	4.80	0.234	SET
Taiquemo	12	−14.86	8.39	0.106	3.56	2.71	0.078	SET
Toushe Basin	5	7.42	1.24	0.177	2.44	1.15	0.087	NET
Toushe Basin	6	4.18	2.06	0.105	2.26	1.28	0.086	NET
Toushe Basin	7	12.26	−0.14	−0.083	3.08	1.72	0.108	NET
Toushe Basin	8	3.87	0.81	0.049	2.16	1.34	0.025	NET
Toushe Basin	9	12.35	2.07	0.125	2.80	2.23	0.074	NET
Toushe Basin	10	5.20	−1.24	0.053	2.54	1.81	0.041	NET
Toushe Basin	11	13.41	2.02	0.312	4.33	1.41	0.117	NET
Toushe Basin	12	5.35	0.40	0.119	2.68	1.58	0.080	NET
Tswaing Crater	6	0.00	0.00	0.000	2.21	1.77	0.045	SET
Tswaing Crater	7	−9.41	−6.94	−0.332	4.49	2.14	0.062	SET
Tswaing Crater	8	−4.44	−2.04	−0.092	2.33	1.69	0.115	SET
Tswaing Crater	10	−5.40	−4.46	−0.233	1.79	1.82	0.035	SET
Tswaing Crater	11	−6.53	0.32	−0.186	2.15	2.09	0.045	SET
Tswaing Crater	12	−11.24	−4.75	−0.440	3.08	1.86	0.057	SET
Valle di Castiglione	5	4.72	−3.41	0.120	1.39	1.86	0.020	NET
Valle di Castiglione	6	0.00	0.00	0.000	1.46	1.97	0.020	NET
Valle di Castiglione	7	4.94	1.67	0.116	1.17	1.99	0.020	NET
Valle di Castiglione	8	7.06	1.97	0.268	1.03	1.85	0.025	NET
Valle di Castiglione	9	0.00	0.00	0.000	0.87	1.52	0.020	NET
Valle di Castiglione	11	3.08	−0.77	0.019	1.56	2.24	0.025	NET
Valle di Castiglione	12	7.10	2.50	0.237	0.94	1.42	0.018	NET
W8709-13 PC	5	0.00	0.00	0.000	2.39	1.12	0.015	NET
W8709-13 PC	6	−0.81	−0.23	−0.006	2.40	1.22	0.016	NET
W8709-13 PC	7	0.00	0.00	0.000	2.86	1.28	0.015	NET
W8709-13 PC	8	−0.08	−0.18	−0.009	1.65	1.06	0.019	NET
W8709-13 PC	9	−0.06	−0.36	−0.002	2.21	1.12	0.015	NET
W8709-13 PC	11	−1.79	−0.56	−0.015	2.44	1.14	0.016	NET
W8709-13 PC	12	−2.33	−0.11	−0.020	2.43	1.14	0.018	NET

2. I also wonder what the impact of amalgamating all the pollen data at the genus level is. I am thinking here about some of the euro-Mediterranean taxa, such as Quercus, which would have a broadleaf and an evergreen version. Amalgamating these two will undoubtedly impact seasonality reconstructions. Have you considered refined the classification of some key taxa that may have a direct impact on the reconstructed seasonality?
Please see response to the same question (question 4) by reviewer 1.

3. I find Fig.1 misleading. Like the two South African sites, many sites are included here, even if they are not used subsequently. It almost looks like a way to beef up the study's numbers: “based on 73 sites” instead of my roughly estimated “based on 25-30 sites.”
Please see explanation of this above and the changes made as a result of now presenting the individual sites reconstructions instead of aggregated results.

4. Pollen records documenting DO events are rare, and that’s okay. Once this list is reduced according to the study, it would also be more ethical to cite the original reference of all the datasets used. ACER is an excellent archive/repository but can only exist because other colleagues have generated the data. ACER contains information about these original publications. Please use it.
We have added references to the individual sites in Table 1.

Table 1: Details of the sites from the Abrupt Climate Changes and Environmental Responses (ACER) database (Sánchez Goñi et al., 2017) covering the interval between 50 ka and 30 ka used for the climate reconstructions. n_{due} is the number of D-O events that should be found based on the time interval covered by the record. n_{miss} is the number of D-O events that were not identified. n_{low} is the number of D-O events missed because of low resolution of part of the record. Some of the 73 sites (indicated by / in n_{due}, n_{miss} and n_{low}) provide records for parts of the 50-30ka interval but not for the intervals of the D-O events. Reconstructions based on samples where the D-O signal was not identified were not used in subsequent analyses. The full citations for each site are given in Supplementary Information.

Site name	Latitude	Longitude	Elevation (m)	Site type	Reference(s)	n_{due}	n_{miss}	n_{low}
Abric Romanì	41.53	1.68	350	TERR	Burjachs & Ramon (1994)	2	0	0
Azzano Decimo	45.8833	12.7165	10	TERR	Pini et al. (2009)	6	2	2
Caledonia Fen	–37.3333	146.7333	1280	TERR	Kershaw et al. (2007b)	8	2	2
Cambara do Sul	–29.05	–50.1	1040	TERR	Behling et al. (2004)	7	0	0
Camel Lake	30.26	–85.01	20	TERR	Watts et al. (1992)	2	1	1
Carp Lake	45.91	–120.88	720	TERR	Whitlock and Bartlein (1997); Whitlock et al. (2000)	8	1	1
Colônia	-23.87	-46.71	900	TERR	Ledru et al. (2009)	7	4	4
Core Trident 163 31B	–3.61	–83.96	–3210	MARI	Heusser and Shackleton (1994)	/	/	/
Fargher Lake	45.88	–122.58	200	TERR	Grigg and Whitlock (2002)	8	1	1
Fundo Nueva	–41.28	–73.83	66	TERR	Heusser et al. (2000)	6	1	0
Fuquene	5.45	–73.46	2540	TERR	van Geel and van der Hammen (1973); Mommersteeg (1998)	7	2	2
Füramoos	47.98	9.88	662	TERR	Müller et al. (2003)	/	/	/

GeoB3104	–3.67	–37.72	–767	MARI	Behling et al. (2000)	/	/	/
Hay Lake	34	–109.425	2780	TERR	Jacobs (1985)	5	4	4
Ioannina	39.75	20.85	470	TERR	Tzedakis et al. (2002); Tzedakis et al. (2004)	8	1	0
Joe Lake	66.76667	–157.217	183	TERR	Anderson (1988); Anderson et al. (1994)	7	3	3
Kalaloch	47.6053	–124.371	19	TERR	Heusser (1972)	8	2	0
Kamiyoshi Basin (KY01)	35.102	135.586	335	TERR	Takahara et al. (2000);; Takahara et al. (2007); Hayashi et al. (2009)	1	0	0
Kashiru Bog	–3.47	29.57	2240	TERR	Bonnefille & Riollet (1988); Bonnefille et al. (1992)	2	2	2
Kenbuchi Basin	44.05	142.383	135	TERR	Igarashi et al. (1993); Igarashi (1996)	3	0	0
Khoe	51.341	142.14	15	TERR	Igarashi et al. (2002)	6	1	1
Kohuora	–36.95	174.8667	5	TERR	Newnham et al. (2007)	/	/	/
Kurota Lowland	35.517	135.879	20	TERR	Takahara & Kitagawa (2000)	/	/	/
KW31	3.52	5.57	–1181	MARI	Lézine & Cazet (2005); Lézine et al. (2005)	2	0	0
La Laguna	4.92	–74.03	2900	TERR	Helmens et al., 1(996)	2	0	0
Lac du Bouchet	44.83	3.82	1200	TERR	Reille and de Beaulieu (1990)	8	0	0
Lagaccione	42.57	11.8	355	TERR	Magri (1999); Magri (2008)	7	2	2
Laguna Bella Vista	–13.6167	–61.55	600	TERR	Burbridge et al. (2004)	2	1	1
Laguna Chaplin	–14.4667	–61.0667	600	TERR	Burbridge et al. (2004)	1	1	1
Lake Billyakh	65.2833	126.7833	340	TERR	Müller et al. (2010)	4	0	0
Lake Biwa (BIW95-4)	35.245	136.054	84	TERR	Takemura et al. (2000); Hayashida et al. (2007); Hayashi et al. (2010)	/	/	/
Lake Consuelo (CON1)	–13.95	–68.991	1360	TERR	Urrego et al. (2005); Urrego et al. (2010)	1	1	1
Lake Malawi	–11.22	34.42	470	TERR	DeBusk (1998)	6	3	3
Lake Masoko	–9.33	33.75	840	TERR	Vincens et al. (2007)	2	0	0
Lake Nojiri	36.831	138.216	657	TERR	Kumon et al. (2009)	8	0	0
Lake Tulane	29.83	–81.95	36	TERR	Grimm et al. (1993); Grimm et al. (2006)	8	1	1
Lake Wangoom LW87 core	–38.35	142.6	100	TERR	Harle et al. (2002)	7	1	1
Lake Xinias	39.05	22.27	500	TERR	Bottema (1979)	8	3	3
Les Echets G	45.9	4.93	267	TERR	de Beaulieu & Reille (1984)	8	0	0
Little Lake	44.16	–123.58	217	TERR	Grigg et al. (2001)	5	0	0
Lynchs Crater	–17.3667	145.7	760	TERR	Kershaw et al. (2007a)	8	2	2
MD01-2421	36.02	141.77	–2224	MARI	Igarashi & Oba (2006); Oba et al. (2006); Aoki et al. (2008)	7	2	0
MD03-2622 Cariaco Basin	10.7061	–65.1691	–877	MARI	González et al. (2008); González and Dupont (2009)	/	/	/
MD04-2845	45.35	–5.22	–4100	MARI	Sánchez Goñi et al. (2008); Daniau et al. (2009)	8	2	2

MD84-629	32.07	34.35	–745	MARI	Cheddadi & Rossignol-Strick (1995)	8	1	1
MD95-2039	40.58	–10.35	–3381	MARI	Roucoux et al. (2001); Roucoux et al. (2005)	8	0	0
MD95-2042	37.8	–10.17	–3148	MARI	Sánchez Goñi et al. (1999); Sánchez Goñi et al. (2000); Daniau et al. (2007); Sánchez Goñi et al. (2008); (Sánchez Goñi et al. (2009)	8	0	0
MD95-2043	36.14	–2.621	–1841	MARI	Sánchez Goñi et al. (2002); Fletcher and Sánchez Goñi (2008)	8	0	0
MD99-2331	41.15	–9.68	–2110	MARI	Sánchez Goñi et al. (2005); Naughton et al. (2007); Sánchez Goñi et al. (2008); Naughton et al. (2009)	8	1	1
Megali Limni	39.1025	26.3208	323	TERR	Margari et al. (2007); Margari et al. (2009)	6	1	0
Mfabeni Peatland	–28.1487	32.51867	11	TERR	Finch & Hill (2008)	5	1	1
Nakafurano	43.367	142.433	173	TERR	Igarashi et al. (1993)	2	0	0
Native Companion Lagoon	–27.68	153.41	20	TERR	Petherick et al. (2008a); Petherick et al. (2008b)	6	1	1
Navarrés	39.1	-0.68	225	TERR	Carrión & van Geel (1999)	3	1	0
ODP 1233 C	–41	–74.45	–838	MARI	Lamy et al. (2004); Heusser et al. (2006)	/	/	/
ODP 820	–16.63	146.3	–280	MARI	Moss & Kershaw (2000); Moss & Kershaw (2007)	7	3	3
ODP site 976	36.2	–4.3	–1108	MARI	Nebout et al. (2002); Masson-Delmotte et al. (2005)	8	1	0
ODP1019	41.66	–124.91	989	MARI	Mix et al. (1999); Pisias et al. (2001)	8	2	2
ODP1078C	–11.92	13.4	–426	MARI	Dupont & Behling (2006); Dupont et al. (2008)	/	/	/
ODP893A	34.28	–120.03	–577	MARI	Heusser (1998); Heusser (2000)	8	0	0
Potato Lake	34.45	–111.33	2222	TERR	Anderson (1993)	4	4	4
Rice Lake (Rice Lake 81)	40.3	–123.22	1100	TERR	L. Heusser, unpublished data	/	/	/
Siberia	–17.09	–64.72	2920	TERR	Mourguiart & Ledru (2003)	1	1	1
Stracciacappa	42.13	12.32	220	TERR	Giardini (2007)	5	1	1
Tagua Tagua	–34.5	–71.16	200	TERR	Heusser (1990)	6	1	0
Taiquemo	–42.17	–73.6	170	TERR	Heusser et al. (1999); Heusser and Heusser (2006)	8	0	0
Toushe Basin	23.82	120.88	650	TERR	Liew et al. (2006)	8	0	0
Tswaing Crater	–25.4	28.08	1100	TERR	Partridge et al. (1997); Scott et al. (2008); L. Scott, unpublished data;	6	1	1
Tyrrendara Swamp	–38.1986	141.7626	13	TERR	Builth et al. (2008)	/	/	/
Valle di Castiglione	41.9	12.76	44	TERR	Alessio et al. (1986); Follieri et al. (1988);	7	2	2

					Follieri et al. (1989); Narcisi et al. (1992): Narcisi (1999); Magri & Tzedakis (2000); Magri (2008)			
W8709-13 PC	42.11	–125.75	–2712	MARI	Pisias et al. (2001)	7	2	2
W8709-8 PC	42.26	–127.68	–3111	MARI	Heusser (1998); Lyle et al. (1992)	/	/	/
Walker Lake	35.38	–111.71	2500	TERR	Berry et al. (1982); Adam et al. (1985); Hevly (1985)	/	/	/

5. I want more details about the calculation of the anomalies. This problem is not trivial and fundamental to this study since the DO results are presented as climate anomalies. Anomalies to what? How were they calculated? A particular emphasis on how these were calculated for marine records is warranted if any of these are kept in the final 25-30 records.

We do not use the term anomaly. We are, in fact, estimating the change in climate at each site over the period corresponding to the D-O warming phase as registered in Greenland. This was explained in Section 2.4. However, since this was apparently insufficiently clear, we will modify the Introduction to be clearer what we are aiming to do as follows:

In the paper, we provide reconstructions of seasonal temperature changes and changes in plant-available moisture during the intervals corresponding to D-O warming events in Greenland during Marine Isotope Stage 3 based on available pollen records globally.

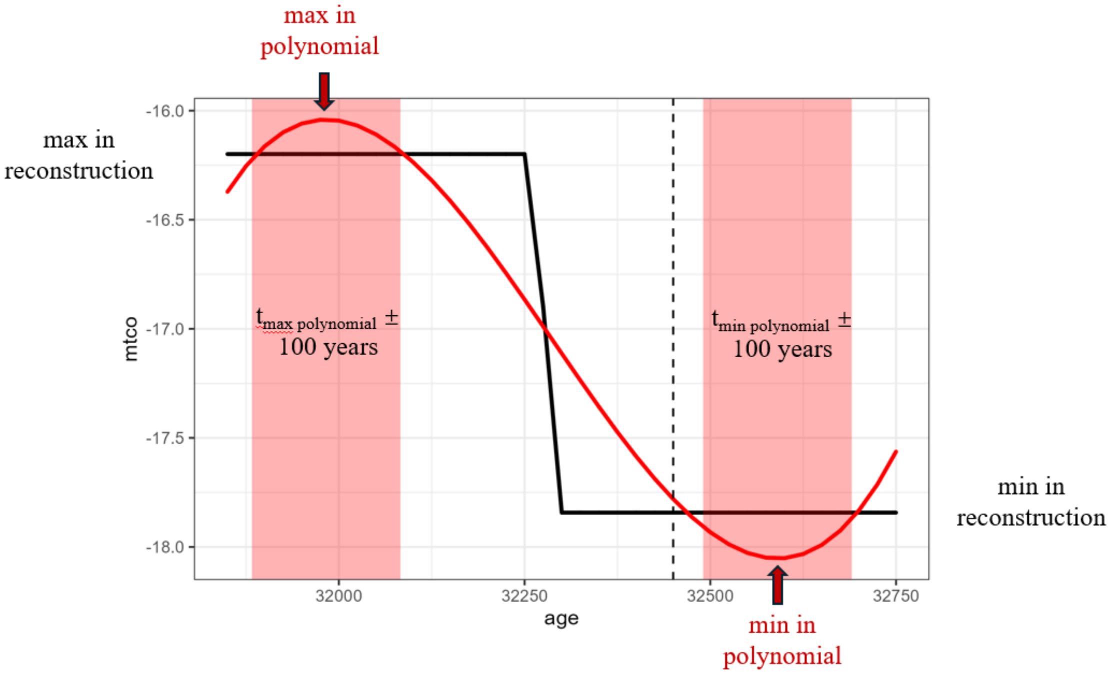
We will change to title of Section 2.4 as follows:

2.4. Assessment of regional climate changes during Greenland D-O warming events

We will also modify the first paragraph of section 2.4 and add a supplementary figure to make the method clearer:

The magnitude of climate change during the interval corresponding to each D-O warming event as registered in Greenland is calculated individually for each climate variable at each site. To avoid making an assumption about the sign of the climate change at a site, we used a third-order polynomial to fit the reconstructions during the interval from 300 years before to 600 years after the official start date of each event (Wolff et al., 2010; converted into AICC2012 timescale) to determine whether the change was positive or negative. We used the ages corresponding to the minimum and maximum in the fitted polynomial ($t_{\text{min polynomial}}$, $t_{\text{max polynomial}}$). However, since the smoothed polynomial may underestimate or overestimate the amplitude of change, we used the reconstructed minimum or maximum value within the period $t_{\text{min polynomial}}$ ± 100 years or $t_{\text{max polynomial}}$ ± 100 years respectively (see Supplementary Figure X).

Supplementary Figure X: Illustration of using a polynomial fit to find the change in climate for each D-O event at each site. The black line is the reconstruction, the red line is the third-order polynomial, the red shaded areas are the periods $t_{\text{min polynomial}}$ ± 100 years and $t_{\text{max polynomial}}$ ± 100 years. The plot shows an example of a positive change in the climate since $t_{\text{min polynomial}}$ occurs before $t_{\text{max polynomial}}$.



6. Unfortunately, I have major concerns about the reconstructions themselves, although I am sure these doubts will be lifted when more details are provided. At the moment, I understand that the authors did not regionalise their calibration dataset and used the same transfer function based on all their modern samples to analyse data from Australia, Asia, Africa, North America, and Europe. This methodological choice needs to be more challenged in the paper, and the authors should justify why they think this is not a problem (it most likely isn't!). Using as much calibration data as possible is not standard with regression techniques, even if all the novelties added to the standard WA-PLS should give it more flexibility. Based on this global mixing of samples and taxa amalgamation, I am not overly surprised that seasonal differences do not appear in the results. These specific points make me seriously question the main findings.

As pointed out above, the failure to identify seasonal differences was because we amalgamated the individual records rather than considering them separately. It is not related to the use of a global calibration data set. It is true that some people have used regional calibration data sets and this can result in apparently better fits. However, this makes it difficult to reconstruct climate outside the limited range of the calibration data set. As shown by Turner et al. (2020), using WA-PLS, using a larger calibration data set provides a better sampling of climate space. Turner et al. (2020) showed that using a larger data set led to smaller reconstruction errors (Figure 2 in Turner et al., 2020) and reduced the standard deviation of the bootstrapped taxon coefficients (Figure 3 in Turner et al., 2020) thus providing more accurate taxon coefficients. The use of a global calibration data set relies on the assumption of phylogenetic niche conservatism, which is widely supported from ecological studies both at species and higher levels (see e.g. Wiens & Graham, 2005; Wiens et al., 2010; Crisp and Cook, 2012; Yin et al., 2021; Jiang et al., 2023). Given that we are largely using genera for woody species and sub-families or families for non-woody species, our use of a global data set seems justified and ensures that we can make reconstructions of glacial climates that may be outside the range of climates seen in any specific region today. We will add a paragraph (after the first paragraph) in the Discussion about the use of a global calibration data set, as follows:

We have used a global pollen data set for calibration of the pollen-climate relationships, SMPDsv2 (Villegas-Diaz and Harrison, 2022). The use of a global data set, rather than region-specific training data, relies on the principle of phylogenetic niche conservatism (Harvey and Pagel, 1991), which states that traits tend to remain constant over time. This also applies to the climate niche (Wiens and Graham, 2005; Wiens et al., 2010; Peterson, 2011; Crisp and Cook, 2012; Jiang et al., 2023) as evidenced by disjunct distributions of taxa across different continents (Yin et al., 2021). Niche conservatism underpins the fact that the modern distribution of specific genera can be predicted using climate-pollen relationships developed from other regions (e.g. Huntley et al., 1989). The use of a global data set for calibration makes it possible to sample a large range of climates, and thus makes it more likely that the reconstructions of glacial climates are realistic and not confined to the limited climate range sampled in any one region (Turner et al., 2020). Indeed, Turner et al. (2020) have shown that increasing the size of the calibration data set tends to lead to smaller reconstructions errors and more accurate estimates of taxon coefficients. Pragmatically, the use of a global data set also facilitates making reconstructions for sites from regions where there is limited modern pollen data.

We will add the appropriate references:

Harvey, P.H. & Pagel, M.R. (1991). The comparative method in evolutionary biology. Oxford University Press.

Wiens, J.J., Graham, C.H., 2005. Niche conservatism: Integrating evolution, ecology, and conservation biology. Annu. Rev. Ecol. Evol. Syst. 2005. 36:519–39 doi: 10.1146/annurev.ecolsys.36.102803.095431

Wiens JJ, Ackerly DD, Allen AP, Anacker BL, Buckley LB et al. 2010. Niche conservatism as an emerging principle in ecology and conservation biology. *Ecol. Lett.* 13:1310–1324.

Peterson, A.T., 2011. Ecological niche conservatism: a time-structured review of evidence. Journal of Biogeography 38, 817–827

Crisp, M.D. and Cook, L.G. (2012), Phylogenetic niche conservatism: what are the underlying evolutionary and ecological causes?. New Phytol, 196: 681-694. https://doi.org/10.1111/j.1469-8137.2012.04298.x

Jiang, K., Wang, Q., Dimitrov, D., Luo, A., Xu, X., Su, X., Liu, Y., Li, Y., Li, Y., & Wang, Z. (2023). Evolutionary history and global angiosperm species richness–climate relationships. *Global Ecology and Biogeography*, 32, 1059–1072. https://doi.org/10.1111/geb.13687

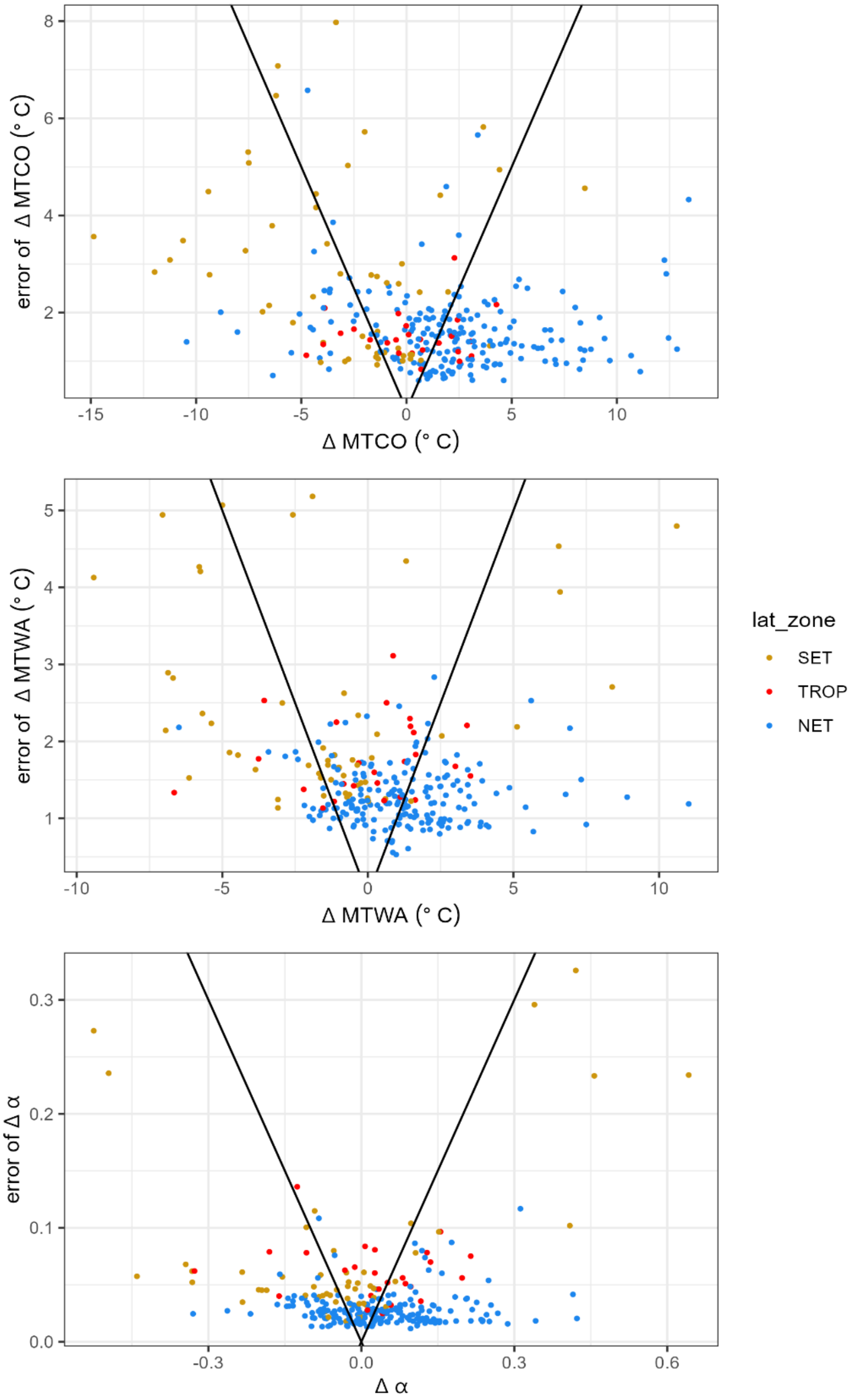
Yin, X., Jarvie S., Guo W.-Y., Deng T., Mao L., Zhang M., Chu C., Qian H., Svenning J.-C., & He F. (2021). Niche overlap and divergence times support niche conservatism in eastern Asia–eastern North America disjunct plants. *Global Ecology and Biogeography*, 30, 1990–2003. https://doi.org/10.1111/geb.13360

Huntley, B., P.J. Bartlein and I.C. Prentice (1989) Climatic control of the distribution and abundance of beech (*Fagus* L.) in Europe and North America. *Journal of Biogeography* **16**: 551-560.

Turner MG, Wei D, Prentice IC, Harrison SP. The impact of methodological decisions on climate reconstructions using WA-PLS. Quaternary Research. 2021;99:341-356. doi:10.1017/qua.2020.44

7. I am also worried about the RMSEs presented in Table 2. They are enormous, with a mean error of 6.5°C and 3.7°C for winter and summer temperatures, respectively. An R2 has little meaning when dealing with so much data, so I wouldn't give this too much importance. Regionalising the pollen data will undoubtedly shrink these to more adequate values. But this is not just a game of optimising errors. These errors are of the order of, if not larger than, the signal reconstructed (Fig. 3). This is highly problematic because your key results may be background noise. You need to demonstrate how that's not the case.

*We can demonstrate that the results are robust by comparing the error_change and change (see new Supplementary Table above). There are **278** rows with signal detected. Most of them have the absolute value of error_change smaller than the absolute value of change, that is 182 in MTCO, 146 in MTWA and 213 in α. The figures below show the relationship in different latitude zones. Each point is an event at a site. The black lines are lines with intercept of 0 and slope of ±1. Points between the two black lines are those with |error_change| > |change|, points outside the two black lines are those with |error_change| < |change|. Although there are fewer points for the tropics and southern extratropics, there does not seem to be any systematic difference in the number of points where the error_change is larger than the change.*



8. L19: Here and elsewhere, Europe is part of Eurasia. So, it is either Eurasia or Europe and Asia.
We will replace "Europe and Eurasia" with "Eurasia" in all the places it appears in this manuscript.

9. L21-22: "broadscale features of temperature change" is too vague. Please specify which features you have in mind here
We will modify the abstract to be more explicit:
These reconstructions show that the largest warming occurred in northern extratropics, especially Eurasia, while western North America and the southern extratropics were characterised by cooling.

The change in winter temperature was significantly larger than the change in summer temperature in the northern extratropics, indicating that the D-O warming events were characterised by reduced seasonality, but there is no significant difference between the summer and winter temperature changes in the southern extratropics. The antiphasing between northern and southern extratropical changes, and the west-east pattern of cooling and warming in North America are consistent across the eight D-O events examined, although the signal at individual sites may vary between events.

10. L108-109: Clarify how you define two sites as "geographically and climatically similar". What thresholds do you use?
We are using the thresholds we defined in the Liu et al. (2020) fxTWAPLS paper. We should have specified this and will modify the sentence to:
…where one site at a time was randomly selected as a test site and sites that are both geographically close (within 50 km horizontal distance from the site) and climatically close (within 2% of the full range of each climate variable in the dataset) were removed from the training set along with this test site, to prevent redundancy in the climate information from inflating the cross-validation goodness of fit, following Liu et al. (2020).

11. L115-116: You mention some sample-specific errors. The method is appropriate, but these errors are not used in any of the subsequent analyses. There is potential to do better on that front.
We did use the sample-specific errors when estimating the ratio of ΔMTCO to ΔMTWA, and Δα to ΔMTWA. We will add a paragraph at the end of section 2.4 to make it clearer:
We calculated sample-specific errors for the minimum and maximum reconstructed values. Assuming that the minimum and maximum values are independent, we used error propagation to obtain the error of the change:

$$\sigma_{change} = \sqrt{\sigma_{min}^2 + \sigma_{max}^2}$$

Following Liu et al. (2022), we used a maximum likelihood method to estimate the ratio of ΔMTCO to ΔMTWA (and ratio of Δα to ΔMTWA) to take account of the errors on both variables.

12. L136: Interpolating all records at 25 years is a bit ambitious. I do not think any of the selected records match this resolution. This artificial high-resolution may bias statistical tests performed on the data since the errors behave in ~1/n, n being the number of points. Please adjust to using an interval more consistent with the studied data.
Please see response above about the dynamic time warping and the revised text for the Age Modelling section.