

Cp-2022-59 Davis et al Response to editors comments

Point 1 regarding the terms

It is important to have a careful use of the words even if you considered it is only semantic. I ask you to follow the request of the reviewer concerning the use of the term calibration. Please do that before the acceptance of the manuscript. If not, justify in the text the term calibration by add something about that and join the reference in additional data for example. It is essential for the non-specialists of climate reconstruction to know what you have exactly used and to solve this disagreement.

Response: Ok

Action: The word 'calibration' has been removed from the text

Point 2 concerning the sentence pointed in line 121 although just at the beginning of section 2.3

Perhaps the reviewer did not note the good lines but the sentence is in your text and I think it will be better to change in accordance with this remark. So adapt your sentence in accordance please.

Response: Ok

Action: The sentence *"This is a similar approach to that used by Peyron et al. (1998) and Jost et al. (2005) who also applied pollen PFT scores to reconstruct LGM climate from pollen data, but who used an artificial neural network technique (ANN) (Chevalier et al., 2020)."* has been removed and replaced by the sentence requested by the reviewer *"Other methods using PFT scores and artificial neural network techniques have been developed to reconstruct the climate of Europe during the LGM from pollen data (Peyron et al. (1998) and Jost et al (2005)."*

Point 3 the reconstruction and the problem of Pinus

I think that the reviewer point the problem of quantitative reconstruction including Pine when you are working on marine cores. It is not sufficient to just add the reference. I think that more explanation are necessary. The data published by Sanchez Goni team and Salonen used method excluding Pinus from the counts which is so different from your method. Some precisions have to be included in the text to clarify that. Did you use the raw pollen data from the marine sites (complete, those used by Sanchez Goni) or the values from the reconstruction published in these paper? Or do you do another run of reconstruction with pine included in all cases?

now it is not clear for me.

Combourieu-Nebout et al., Fletcher et al. and Sanchez Goni et al. used reconstructions excluded Pinus in any cases.

The responses to these questions are crucial and have to be included in your text in the method and in the discussion. If not we might consider that you compare apples with pears!!

In addition, you're right saying that the vegetation includes Pinus in western Portugal. Nevertheless, keeping this taxon in the reconstructions in marine cores induces a very large bias as at 100 km off the coast the % of pine is over-represented up to 80% in a very big proportion that hides the modification in the other association as the reviewer said to you. For this reason the counts are improved to better represent the vegetation. This fact has been demonstrated since a long, long time by many authors (papers are often referenced in the methods of numerous papers on the pollen records from marine cores).

What do you do with the pollen spectra in some series where some taxa are over-represented due to edaphic conditions or specific inputs? Did you conserve them or not?

This is important to note such things in your paper and more explain it in the methods to close the debate and show that you have done the same on all the records.

When you have 80% of Pinus in marine samples, it did not necessarily reflect that you have a high representation of Pine in the vegetation, it is not the same as in peatbogs or lakes. Reasoning only on the other taxa drives to a best representation of the vegetation in which we can add Pine afterwards and the reconstructions without Pinus (using samples and database without Pinus) are not so bad especially concerning the precipitation, temperature being sometime too cold (see the tests done in Combourieu-Nebout et al 2009 on top-core and surface samples in Mediterranean area).

At the end, for my part, I remain not convinced by the reconstructions when you conserve Pine in all the marine cores as it is not correct to illustrate the vegetation, used for the reconstruction. It did not change a lot your paper if you had presented different runs for the marine and continental records if explaining why by justifying the differences between sediments.

So, please do something about that in your text especially by developing your choices in the methods parts.

Response: I understand that you would like us to clarify more clearly the choices made in the methods section. To try and resolve this problem scientifically, we have now included two additional analyses that investigate the effect of including/excluding Pinaceae on 1) the biomes assignment process and 2) the pollen-climate reconstruction. In the first test we use the modern pollen dataset to investigate the effect on the biome assignment of varying the amount of Pinaceae.

This shows that removing Pinaceae completely changes the biome in 5860 out of 8213 samples, while increasing the Pinaceae as much as 400% only changes the biome in 2348 samples. This suggests that it is better to include rather than exclude the Pinaceae unless the sample clearly shows signs of over representation (eg 95%+ Pinaceae). In the second test we compare the climate reconstructed from the marine LGM samples when Pinaceae is included/excluded. We find that excluding Pinaceae results in temperatures slightly cooler, and precipitation slightly higher, but the values are a lot smaller than the uncertainties. This suggests that there is little difference between the two approaches, irrespective of which may be more appropriate.

Action: The results of the biome experiment are shown in the new supplementary table S3 and the results of the pollen-climate experiment are shown in the new supplementary table S4. In addition, the following text has been added to the results section:

Line 449+ " The effect of excluding Pinaceae on the biomisation algorithm and MAT climate reconstruction process has not been widely investigated. We therefore decided to evaluate this problem for 1) biomisation, and 2) pollen-climate reconstruction. In table S3 we show the biomisation results for 8213 modern pollen samples taken from the EMPD2 modern pollen database. Using this as the control, we then artificially varied the amount of Pinaceae (Pinus, Abies and Picea) in the assemblage of each pollen sample and compiled the results (Table S3). This shows quite clearly that removing all of the Pinaceae has a much more profound effect on the biomisation process than artificially inflating the amount of Pinaceae (as might be expected in a marine sample where Pinaceae can be over-represented). Even when Pinaceae was artificially inflated by as much as 400% of the original value, the biomes were changed in only 2348 samples, compared to 5860 samples if all the Pinaceae was removed entirely. In terms of the effects on individual biomes, removing the Pinaceae considerably increased the amount of CLDE, STEP and TUND, whilst greatly reducing the amount of XERO, almost eliminating the amount of TAIG, and completely eliminating the COCO biome. In contrast, the effect of inflating the amount of Pinaceae tended to be more evenly distributed between the biomes, with the biggest increase seen in TUND and biggest decrease in STEP. This suggests that even if the over-representation of Pinaceae was quite extreme in marine pollen samples, the effect on biome classification (and by definition, the underlying PFT scores) is less than removing Pinaceae completely from the pollen assemblage.

In a second test, we compared the reconstruction of LGM climate from marine pollen samples when Pinaceae was included, and excluded. The results are shown in table S4 and indicate reconstructed temperatures are generally 1-2C cooler, and precipitation slightly higher when Pinaceae is excluded. The differences between the two methods however are small, and generally less than half of the uncertainties, suggesting that

differences are statistically indistinguishable when considered in the context of the overall uncertainties.

In summary we find that including Pinaceae in the biomisation process is less likely to lead to miss-assignment of the biome than excluding Pinaceae, except in extreme cases of over-representation. Percentages of Pinaceae in the LGM marine samples range on average between 23-88%, suggesting that while Pinaceae was high at some sites, it does not appear to completely overwhelm the assemblage as might be expected if over-representation was to be a significant problem. We also find that including Pinaceae in the pollen assemblage of the LGM marine pollen samples gives pollen-climate reconstructions that are statistically indistinguishable from those obtained by excluding Pinaceae from the assemblage. Including Pinaceae in marine samples also provides compatibility with terrestrial samples, particularly when calculating and plotting pollen taxa percentages. For these reasons we have included Pinaceae in the analysis of all marine pollen samples in this study, although it is important to recognize that Pinaceae in such samples can be subject to over-representation and that the results presented here from marine sites should consequently be viewed with caution. "

Point 4 My last remark concerns the figures: It is not acceptable to propose figures as the series presented in figure 3 a,b,.. What is represented by the large white rectangle with the little cross. This need explanations??? Did crosses represent the presence, the sites? This figures are supposed to show the percentages of the taxa but there is nothing on the figures with percentages, only crosses. Please explain in the captions ; the figures must be read alone without the text.

Response: We are sorry, this appears to be because something went wrong when the pdf version of the word document was created

Action: This has been fixed in the new submission.