

Interactive comment on “Millennial-scale climatic variability between 340 000 and 270 000 years ago in SW Europe: evidence from a NW Iberian margin pollen sequence” by S. Desprat et al.

Anonymous Referee #1

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General comment

This paper presents the details of a new pollen data set from a deep sea core obtained off the NW Iberian margin. The pollen data are of good quality and have the potential to show some interesting patterns at both orbital and millennial timescales, with the benefit of combining marine and terrestrial proxies in the same sediment sequence. However, many comparisons are also made with another sediment sequence and, since the correlation relies on an isotopic record of relatively low resolution, the land-sea comparisons lack the temporal precision that comparisons within a single sequence can provide. This is acknowledged in the text and is not a huge problem. More

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problematic is that much of the discussion is extremely confusing. To make this into a really good paper, the discussion needs to be written more clearly. I suggest that it be structured more strongly (perhaps with more subheadings) and that you draw out key points and implications after (or before?) each comparison is made. Some additional figures might also help, for example, there is one place where the argument seems to be that larger tree populations persisted through stadials in SW Iberia than in NW Iberia, but this is not clear from the current figures. There are some suggestions below about how to improve the clarity of this paper, plus some specific corrections to grammatical errors and a few stylistic improvements. In summary, this paper will be appropriate for publication in *Climates of the Past*, once the clarity of the argument has been improved. (References is made to the text by giving first the page number, then the line number, followed y the comment).

Specific comments

382, 20 to 23: Some definitions are needed here. I do not think that all the warm substages of MIS 9 are interglacial in the strict sense. How do you define the temperate forest periods? What is a humid forest and how is it different from a temperate forest? What does [forest] imply here about the vegetation structure, are we talking closed canopy here?

383, 7: [Climatic optimum] has commonly been used to refer to the warmest and wettest period of the Holocene in northern Europe (a pronounced expansion of *Corylus* around 6 ka). In light of this earlier usage, it seems an inappropriate term for the time of maximum expansion of deciduous *Quercus* and taxa tolerant of summer drought (evergreen *Quercus*, *Olea* and *Pistacia*) and if you do decide to use it, you will need to clearly redefine the expression in climatic terms.

383, 13: [Latecomer trees] is a bit colloquial. Could you change this to something more precise, e.g. late successional? The suggestion that arrival of the late-succession trees indicates cooling, needs some discussion as it is not necessarily true. Soil develop-

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ment, migration time, competition all contribute to the pattern of succession, making it difficult to infer cooling on land unambiguously.

385, 15 to 22: This description seems unnecessarily complex. One of the reasons it is confusing is that earlier on (383, 7) you describe the occurrence of a [climatic optimum] within the Pontevedra forest period, while here you refer to Pontevedra in its entirety as representing the climatic optimum of the whole of MIS 9.

385, 25 to 387, 4: This section needs some work. It presents comparisons between numerous different records and observations of similarity and difference. It is confusing to read, and difficult to identify the thread of the argument. There are some important points here and they would come across more clearly with re-arrangement and re-wording.

388, 26: Expansion of Poaceae could indicate drier as well as colder conditions.

389, 13 to 390, 7: This section is rather confusing and needs to be re-written. One source of confusion is that in addition to the [weak oscillations] you identify in the pollen record during ice volume minima, there are equally weak oscillations during times of higher ice volume (MIS 9d and 9b). Another confusing element is the comparison of the relative amplitudes of peaks; everything is compared relative to everything else, making the argument difficult to follow. Also, I am not sure that the term [Mediterranean forest] depicts the vegetation of SW Iberia accurately; are you saying that in the SW, temperate forests (plus Mediterranean elements) remained more extensive during the cold intervals? The figure (4) does not show this clearly.

Another point about figure 4: The MD01-2443 pollen data look rather different to the curves published in Tzedakis et al. (2004) and Roucoux et al. (2006). I do not know why this looks so odd, but if it is scanned, it would be better to get hold of the original data and use this instead.

390, 13 to 15: The trouble with arguing that suborbital climate oscillations are [damped]

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during periods of low ice volume, is that one must still account for the pronounced (i.e. not damped) decline in tree populations recorded in MD01-2443 during MIS 9e. It is not clear that millennial scale oscillations are [somehow scarcer] during times of low ice volume.

389, 1: In fact, there is a decrease in AP% in MD01-2443 which, given the uncertainty in the alignment of the cores, could be related to the drop you observe in MD03-2697 at 315 ka.

391, 17 to 392, 4: Begin new paragraph with [Tzedakis et al.]. In this section there are several distinct ideas about mechanisms, which either need to be split into separate paragraphs, or linked more clearly to make the argument more coherent.

392, 18: Indeed, alkenone SST estimates do suggest stability during the warm intervals of MIS 7, but the pollen record of MD01-2443 for this period does not, and the pollen record of Desprat et al. 2006 does not seem sufficiently detailed to enable secure identification of stability.

394, 1 to 8: The contrast between minor continental ice accumulation, minor offshore cooling, and major forest contraction (suggesting major cooling/drying on land) requires a clearer explanation. Why is the offshore SST change so minor in comparison with the extent of forest collapse?

394, 15: Bottom water temperatures could indeed affect benthic $\delta^{18}\text{O}$ at the Iberian margin, but the ice volume component remains an important part of the signal. It is mainly the timing of changes (especially at deglaciations) that are affected by deep water temperature changes.

392, 28: When you say that MIS 9 shows variability of particularly high amplitude, which other interval(s) are you comparing it to, and which parameters show this pattern?

394, 26&27: Two points here are not clear, [when ice sheets were reorganising] and [reached a significant size]. What does re-organising mean, in terms of ice sheets?

What size is significant – are you able to put a number on that (e.g. 3.5 per mil)?

395, 5 and onwards: It would help the argument here to include justification for the comparison of MIS 3 and 9b.

Technical, grammatical and stylistic comments

376, 5: Change to: [This study enables the documentation of vegetation changes]

376, 10: [appears] should be [appear] as it is plural in this case (also in line 15).

376, 16: replace [likely] with [probably]

376, 19: Cut [regardless of glacial state] because the lines 10 to 13 above explain that the amplitude of millennial scale oscillations seems to be related to ice volume, so this sounds ambiguous.

377, 8: Insert [have] to read, [few studies have focused]

377, 10: Replace [lately] with [recently]

377, 28: [one and a half precession cycles] should be plural

377, 29: [a particular general trend] this is an oxymoron, i.e. contradictory terms to refer to one trend.

378, 2: Cut [somehow].

378, 5: [baseline climatic states] needs some explanation.

378, 7: This sentence needs rewording to make it clearer.

378, 10: Change [ill-documented] as this is too strong, and it is not clear whether you mean that there are records, but not very good ones, or that there are none, or that there are not enough. Perhaps just explain that there are still very few high resolution records of this interval.

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378, 15: Cut [to perform a]

378, 16 to 21: Change [the previous and more recent climatic cycles] to [previous climatic cycles] OR [the current and previous climatic cycles.]

379, 16: Check the convention for millimetres per year. Is it not mm yr⁻¹, or mm a⁻¹?

379, 24: Replace [is constituted] to [consists]

379, 25: Cut [an]

380, 1: Change [achieved] to [carried out], and insert [the] to read [sediments from the MIS 9 interval]

380, 3: Change [counting] to [counts]

382, 5: Change [Antarctica] to [Antarctic]

382, 9: Change [impeded us to develop the age model of] to [prevented development of an age model for]

382, 14: Change [tied up] to [aligned]

382, 15: Replace [allowing] with [producing]; also, instead of calling the curves [tuned] and [target], give them core names to make it clearer which is which (since neither is strictly speaking tuned).

383, 4: Replace [outlines] with [characterizes]

383, 21: Replace [couple of thousand years] with some thing more precise.

384, 25: [hardly expand] singular.

385, 6: [This change can reflect] not clear. Do you mean [could] or [might], for example?

388, 7: Replace [kept reducing] with [continued declining]

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388, 7 to 8: A more realistic description might read, [such a pronounced event is not present in the southern and northwestern Iberian margin SST records]

388, 15: Cut [particular] and [decrease]

388, 17 & 18: Change to read [the marine proxies prevents us from identifying] and [However, almost every reduction]

388, 21 (and other occurrences): It would be clearer if you used the same description for the cores each time, i.e. either [NW Iberian] or [SW Iberian], rather than sometimes using [Portuguese margin] or Galician margin].

389, 8: Insert [alkenone measurements] to read, [not detected by alkenone measurements in MD01-2443]

391, 5 to 9: From [Although the drier cooler nature] to [SST optimum.] This sentence is confused and needs re-writing.

391, 14 & 15: Change [High sensitive sites] to [Sites which are highly sensitive]

391, 2: Add MIS 7e to the list of warm intervals that are cut short, since you have just mentioned it above.

392, 15: Replace [previous] with [other] or something similar. [Previous] does not make sense in this context, as you have just talked about MIS 5 and 11.

392, 26: Does this mean [the most severe cooling episodes in NW Iberia during MIS 9 occur during intervals of both high and low summer insolation]?

393, 4: AABW and NADW - define at first use.

393, 9: Change to read, [reveal a minor weakening]

393, 11: Replace [drops] with [declines] or [decreases]

393, 14: Replace [likely] with [probably]

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393, 16: [.is likely to be linked]

393, 18: [MOC changes, whether caused by]

393, 28: [A similar]

394, 23: Which part of MIS 3 is referred to here?

394, 24: Replace [put forward] with [infer]

395, 3: [Vostok ice core]

395, 10: [Kawamura]

395, 11: [warming events]

395, 18&21: Which Tzedakis et al. 2004 papers are cited here, a or b?

Interactive comment on Clim. Past Discuss., 4, 375, 2008.

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