Dear Referee #2,

Thank you very much for your comments! Please find some replies below.

Comment: The text is mostly well written but lacks an into detail comparison to other records of the region as well as a detailed description of and introduction to the ocean currents around the Strait of Gibraltar and their evolution, which might be of great value related to the topic of the study.
Reply: We agree. A more detailed comparison to key references such as El Refugio Cave as well as an introduction and discussion on the ocean currents has been added.

Comment: I am not convinced of the title, not about the "multi-decadal", nor about "southern Iberia". SST, maybe as well as Alboran sea and Gulf of Cadiz or oceanic variability should somehow be included in the title.
Reply: We think that the temporal resolution of our records is allowing multi-decadal resolution and is one of the key features of this study. Thus, we want to highlight this also in the title. However, Referee #2 is right with his comment that we do not resolve seasonal variations on multi-decadal resolution. "Southern Iberia" is the region the terrestrial plant proxies stem from and as our study is very local also with respect to the oceanic proxies we should keep this phrase. Nonetheless, we agree that the title so far excludes the oceanic regions, so we will include a "atmospheric and oceanic climate variability" in the title.

Comment: Section 1.1, line 5: mentioning of that figure is wrong, a precipitation curve would show the precipitation during winter
Reply: Correct! We have included a precipitation and atmospheric temperature curve in Figure 1.

Comment: e.g. Line 6: would be nice to see the Atlantic regime within the figure. Btw, you use ml in the text and mm as unit for precipitation in the figure, can you adjust that?
Reply: The regimes can be defined by the precipitation amount, therefore in a way it is already shown. Drawing an additional line etc. to our opinion would result in a too busy figure. The units have been adjusted.

Comment: Line 14: you mention again figure one, to my opinion in the wrong sentence.
Reply: Figure 1 has been adjusted so that winter precipitation (October to February) is shown. We think referring to Figure 1 is correct in this sentence.

Comment: Concerning figure 1: (a) the figure shows too much of the Iberian Peninsula, you can easily reduce the area you show and exclude the Ejulve cave. A north arrow or coordinates are missing as well as a scale. The river beds could be shown more clearly. And I would not call the red shaded area the Alboran sea catchment, as a catchment should be related to the input area rather than the endmember of the area affected by the rivers (e.g. you call the other catchment Guadalquivir catchment, not Gulf of Cadiz catchment). I would also not use alphabetic letters for the discussed references, as it is difficult to read and find them within the caption, if you use a, b, c already for the subdivision of figure 1. January should not be written with capital letter in the caption. (b) and (c) could also be completed by coordinates or a north arrow and a scale. What are the white spots within (b) and (c)?
Reply: Thanks a lot to Referee #2 for these helpful comments on Figure 1. Much of these have been adjusted! We think we should not reduce the size of the map by cutting off the northern part, because we want to highlight that the modern true moist Atlantic regime is far to the north while the area under consideration is a much dryer system. North arrow, scale and, coordinates have been added. We also tried to make the river beds more visual by adding a shading to the river bed.

"Alboran Sea catchment" has been renamed to "catchments from various small-scale rivers draining the southern Sierra Nevada". The naming of the catchments was also moved from the Figure into the figure caption. We agreed to differentiate between "shown" and "mentioned" sites because otherwise, we might imply wrong expectations to the reader. For that purpose, we used numbers and small letters for separation. We will keep this because capital letters, for example, would highlight these references too much. Furthermore, the use of small letters for figure subdivision is wanted by the journal. But, we think that in the final manuscript the small letters used for subdivision of the Figure 1 will be shown in bold, so that they should be easier to distinguish. As already said "January" has been replaced by "winter" anyway. The respective months are mentioned in addition. The white spots in subfigures (b) and (c) -now (c) and (d)- are mapping gaps. These are mainly occurring in coastal areas as well as in case of lakes. In order to remove some of the white spots we now show the elevation on land instead of continent in grey.

Comment: Section 2, line 25: resampled on 0,5 cm is not wright, as you mention every second centimetre in line one of page 4. Section 2.2,
Reply: We agreed that the description is difficult to read. We adjusted that in the following way: "*Sediment core ODP-161-976A (36°12.32' N; 4°18.76' W; 1108 m water depth) was retrieved in the Alboran Sea during JOIDES Resolution cruise in 1995 (Comas et al., 1996). To achieve multi-decadal resolution, the section from 100.0 cm to 149.0 cm was continuously sampled at 0.5 cm distances in the IODP Core Repository at MARUM in Bremen (Germany).*" For simplification we do not mention the two different sampling steps, which are the reason for the different temporal resolution of the geochemical and foraminiferal data.

Comment: Age model: line 19, 20: can you interpret the sedimentation rates by the use of other studies? Figure 2: why the abrupt steps of the sedimentation rate of ODP and smooth increases and decreases of GEOB? Figure caption is very long, could you include the naming of the record within the figure next to the line?
Reply: Unfortunately, comparable cores (timing, sampling resolution, location) are very scarce (see discussion of the oceanic variability) not allowing the comparison of sedimentation rates. Moreover, the interpretation of sedimentation rates –especially without any reference data- is difficult and beyond the scope of this study. Following a comment from Referee #4, we used Bayesian modelling to create the age models, which also resulted in more smoothed sedimentation rates except for one abrupt change in each sediment core. We re-wrote the figure caption and included the names of the sediment cores into the Figure.

Comment: Line 15: what is the reason for that massive shift? Can you explain that?
Reply: So far, we cannot decide whether the previous dates are "wrong" or "right". A measurement at the same sampling depths would be needed to do so, but this is impossible since these samples do not exist anymore. We assume that the shift is probably a consequence of a sampling of a much larger depth increment for dating by the previous studies.

Comment: Line 16, 17: the exclusions of the ages that you have is not really explained and the reason of lowest analytical error is not enough. Can you explain the "errors" in greater detail, where they might come from etc?
Reply: The errors are the methodological error from the dating itself and the calibration curve of course. Following Referee #4 we modelled the age model using a Bayesian approach (see comment above). Doing so, we kept all double-dated samples. For the new age model, we just excluded two AMS dates at 116.25 and 124.75 cm, because we assume a rather smooth and constant sedimentation rate. This is because there are no evidences for bioturbation etc. resulting in a 10 cm

thick section of similar age. Since the sample at 120.25 cm is also double-dated we just kept this date. This explanation has been added in the revised version.

Comment: Section3, results: you do not include cal after the naming of an age, this is not consistent with the legends of the axes of the figures.
Reply: This is true! We have adjusted that.

Comment: Section 2.3: why abbreviation of methanol MeOH? Looks like a molecular formula, which would be CH4O..
Reply: Correct! We deleted this lab-internal abbreviation since it is not used somewhere else in the text.

Comment: Page 7, Line 2: mentioning of figure 1 is not necessary.
Reply: We deleted the hint to Figure 1 here.

Comment: Page 8: line 7 and 8 is too my opinion exaggerated.
Reply: We have deleted this sentence.

Comment: Page 8, section 4,line 21+22: references are missing and included with more detailed information in line 1,2 and 3 on page 9, which could be included in page 8, line 21.
Reply: This was meant to be an introductory sentence for the following discussion, but we deleted it.

Comment: Line 7 on page 8, rephrase "moreover, a forest ..." as it is unclear.
Reply: We rephrased this sentence to *"Furthermore, a drastic forest opening in SE Iberia is indicated from the Elx pollen sequence at ca. 4.3 cal. ka BP and at Cabo de Gata around 4.4 cal. ka BP (**Fehler! Verweisquelle konnte nicht gefunden werden.**; Burjachs and Expósito, 2015)".*

Comment: Line 15, drought episodes parallel to Norm 33... I don't think so!
Reply: The term "all" is replaced by "most" since we agree that in ODP-161-976A the last two periods of drought at ca. 3.8 and 4.3 ka BP are not accompanied by clear Norm33 peaks.

Comment: Line 23, where can I see that in figure 3?
Reply: We deleted the reference to Figure 3 here.

Comment: Page 11, line 15, why is there no explanation why bond 2 is not visible?
Reply: We agree. A critical and detailed discussion on Bond Event 2 has been added.

Comment: Figure 6: not really discussed within the text.
Reply: We have added a more detailed discussion on the mechanism proposed by Figure 6 and, more general, thriving the oceanic variability in relation to the Bond Events.

Comment: Section 5: the conclusion should be rephrased and maybe restructured too, some bullet points of your study, what is the most important interpretation etc.
Reply: We rephrased the "conlusion" trying to focus more on the most important outcomes of our study.