Dear Referee #3,

Thank you very much for your inspiring and helpful comments. Please find some replies below.

Comment: The introduction seems to focus mainly on the 4.2ka event where the data set and the remainder of the paper is much broader than that one event. I would like to see an extension of the introduction to cover more of the mid-late Holocene "events" in detail. The introduction could also include more background on the major forcing mechanisms in play here and discussed later in the paper. The NAO bit is in the study area section, but there is no info on the Bond events, and how these may influence ocean circulation and SST's in this region.
Reply: A true point. We restructured the introduction also explaining the NAO and the Bond Events in general. Nonetheless the focus on the 4.2 ka event as an example remained since we also followed the suggestion of Referee #1 and concentrate more on the 4.2 ka event in the discussion.

Comment: Figure 1 needs improvement. A scale, north arrow and labelling of the different oceans, countries etc is needed for a non local expert reader.
Reply: We have implemented a scale as well as a north arrow. Labelling of the Atlantic Ocean and Mediterranean Sea as well as the sub-basins such as the Gulf of Cadiz and the Alboran Sea is now included. We won't label countries for political reasons. Also the journal encourages us not to do so.

Comment: It would be nice to see the sedimentation rates through time plotted in your figures (Figure 3 for example) this would help get a feeling of how the different cores were deposited over time and will help inform the reader with regards to sample density vs time and therefore resolution of the data set. This is critical when interpreting changes at the multi-decadal level.
Reply: A very good point! We moved the sedimentation rates from Figure 2 to Figure 3.

Comment: You state that two dates were removed (page 4 line 17) as they gave the same value as another date at 120cm. Can you explain why they were removed? Does this not just suggest a rapid accumulation rate over this period of the core and that all dates are valid?
Reply: We extended the discussion on the age model and explain the removal of particular dates in more detail. Considering these two dates as evidence for an extraordinary high accumulation interval is ruled out, because in the sediment core itself there is no evidence by any lithological feature, grain-size or other properties for such anomaly. In the meantime, we also followed the suggestion of Referee #4 and modelled the age models using a Bayesian approach, that allows to better consider the reliability of these dates.

Comment: I have some concerns about the use of the n-alkane data as the primary proxy for wetter or dryer conditions; I fear this proxy has been over extended in the interpretation. The areas I would like clarification are: a) it would be nice to see a couple of example chromatograms from the n-alkane work, especially during the extreme wet and dry periods (supplementary info is appropriate). This would help clarify if the material is originating from the same/similar source locations throughout the record. My concern is that over such a large catchment and long time period, changes in rainfall may be geographically heterogeneous, leading to the removal of organic matter from different parts of the catchment at different rates over time.
Reply: We included example chromatograms in the supplement and additionally collected information on the vegetation of the catchment areas in order to assess this point.

Comment: b) Linked to this, more explanation of the physical mechanism of n-alkane removal by runoff is required (at least in your response to these comments). I'm concerned that under dry conditions, C3 dominated environments (forests for example) are less susceptible to water and sediment loss than C4 dominated environments, due to the physical make-up and bonding of their soils by root systems. If this is the case then the co-variation between n-alkane concentration

reduction and “C4 proxy increase” is actually not showing an increase in C4 vegetation abundance within the catchment, but a change in the relative loss of n-alkanes from each environment within the catchment. c) I would also direct the authors to the following paper, which suggests that identifying between C3 and C4 vegetation using n-alkanes is not straightforward, this needs consideration and clarification. Bush and McInerney (2013) Leaf wax n-alkane distributions in and across modern plants: Implications for paleoecology and chemotaxonomy. Geochimica et Cosmochimica Acta 117 (2013) 161–179.
Reply: We added a few sentences on the physical mechanisms in the discussion. Moreover, according to Short Report #1 the interpretation concerning the vegetation shifts will be less strong in the revised version. A large scale shift from C3 to C4 vegetation is not considered anymore, which would also reduce the concern expressed by Referee #3.

Comment: d) How can you be sure that reductions in the n-alkaline concentration in the core are not just a dilution effect from marine sediment deposition? Showing sediment accumulation rate on the same graph would clarify this (see comment above).
Reply: The sedimentation rate is plotted in Figure 3 to allow comparison (see reply above). Also we added a small discussion on whether the sedimentation rate affected the used proxies or not.

Comment: There are a few places in the text where you suggest this are “well correlated” or that events are well replicated in both cores (page 7 line11, page 8 line 11, page 10 line 7). I think the paper would benefit greatly from some stats to back up these statements, which are currently based on a visual assessment of the data. Being able to demonstrate a relationship between the cores will greatly enhance the robustness of the conclusions drawn.
Reply: We fully agree. We now calculated Pearson’s correlation coefficients for compared data. A detailed description of how this has been done has been added to the supplement.

Comment: I would also suggest that you investigate the periodicity of the wet-dry events shown in the record. NAO and bond events have well documented “frequencies”, if you can demonstrate that these events in your record have a similar frequency this would again add weight to the argument that these major climate modes maybe the dominant mechanism controlling changes
seen in your record.
Reply: We tried to apply spectral analysis to the proxy records. Unfortunately, the analysed time period is too short for producing robust results, at least for the ca. 1500-year Bond cycle. Therefore, we refrain from applying this approach and have to limit the discussion on visual correlation.

Comment: If you are confident that the Norm33 does represent changes in C3-C4 vegetation distribution within the catchment (see comments above), I direct you to page 9 where you suggest that changes in vegetation community composition may change on very rapid time scales and that this can be accurately recorded within the ocean records. Under modern conditions, is there evidence of changes between C3 and C4 vegetation makeup over the time scales you see in the sediments? And, could you use these proxies to quantify the extent of vegetation change that would have been seen to get such a change in Norm33. What I’m asking I guess is, does the extent of Norm33 change seen in the record make sense, in terms of both rate of change from C3-C4 and the extent (%) of vegetation cover that would have to have changed, if contextualised by our understanding of the catchment under modern conditions?
Reply: As stated above the interpretation concerning C3-C4 vegetation change has been discarded.

Comment: The SST data resolved from alkenone data is interesting but it must be clear within the text (when interpreting) and within the figures when this data falls within the 1◦C error that you state in the methods (I suggest adding error bands in the figures). For example, in Figure 3 most of the peaks and troughs in your seasonal SST data are within error. This data is best interpreted in terms of differences between season temperatures (which you do well). Don't over interpret unless the max/min temps fall outside your (+/-?) 1◦C error.
Reply: We added a statement on the SST error in the discussion chapter and in order to visualize the error in the figures we plotted a single error bar displaying the mean analytical and/or methodological error. Unfortunately, the plotting of error bands, as suggested by Referee #3 would results in too busy figures, which would hamper the visual correlation.

Comment: I think that more detail on the significance of not seeing Bond event 2 should be added. You suggest this is the first time higher seasonality in SST in relation to mid Holocene Bond events is described this far south. More mechanistic detail of how this N Atlantic process effects the Gulf of Cadiz would be helpful in understanding why there are difference between the mid and late Holocene Bond events and how it shows up at your sites.
Reply: We agree. We extended the discussion on the Bond Events and associated mechanisms.

Comment: Page 3 line 14, "during winter" repeated.
Reply: This has been adjusted.

Comment: Page 6 line 1, "cm" not "ccm"
Reply: It has been changed to "cm^3" since we meant cubic centimetres.

Comment: Page 7 lines 1 and 2, use "in high resolution" not "on high resolution".
Reply: This has been changed.

Comment: Page 10 line 8, Figure 6 is introduced into the text before Figure 5, re-order figures.
Reply: Figures 5 and 6 have been completely re-structured.