Point by point response to Reviewer 3

We would like to thank Reviewer 3 for helpful comments on our manuscript. Here we have addressed each of the comments and questions in the following format: Each question or comment is re-stated as in the original review of the manuscript in black 'Calibri font'. Our response to each comment/question is indented and written in blue 'Calibri font'.

Specific comments

The focus of the paper on the concept of interglacial climate stability is somewhat disturbing because the period in which the authors show circulation changes and the presence of IRD does not correspond to the interglacial period of MIS 11 but rather to the glacial inception. The episode starting at 397 ka is associated with the very end of the MIS 11 interglacial period or even marks the beginning of MIS 11b. The paper should be reworked to aim to study the reorganization of the circulation in the high latitudes of the North Atlantic during the glacial inception and not to test the stability of warm climates since the detected circulation changes are not occurring during the course of the interglacial period (even if we remain in an interglacial isotopic stage).

We edited the abstract, introduction, and conclusions to reflect our findings more clearly – see also the responses to reviewers 1 and 2.

Nevertheless, I agree with the authors that even if the ice volume increases, it is still low during the first NDW reduction interval. If we follow the theory put forward by McManus in 1999, the threshold isotopic value of 3.5 per mil is not exceeded during this interval (it will only be exceeded during the 390 ka episode) which indeed suggests that the ice volume would still be too small to drive millennial events related to ocean-ice feedback mechanisms, leading to changes in the strength of the MOC and changes in interhemispheric heat transport. High latitude circulation changes are apparently happening despite the still low ice volume, but the manuscript does not highlight that the episode between 397 and 392 ka corresponds to a typical millennial-scale event, i.e., an event widely recorded in the North Atlantic SST (from high latitudes to subtropics) and characterized by bipolar see-saw.

We acknowledge this point made by the reviewer and will include this point in the revised version of the manuscript including relevant references.

The authors may also want to discuss the possibility that the circulation conditions during these 5000 years (that is quite long duration for a millennial event) may reflect orbital variability or processes associated with the glacial inception during the obliquity minimum.

This is an interesting point, especially since the first reduction of the AMOC at 397ka occurs at a summer insolation minimum (both forced by precession and obliquity), while the second event at 390ka occurs when precession is in the opposite phase, but obliquity is still low.

Related to this topic, Yin et al. 2021 most recently hypothesize that abrupt weakening of the AMOC at the end of interglacial periods (but before glacial boundary conditions are established) is triggered by a combination of a high precession with June solstice occurring at aphelion and, at the same time, a relatively low obliquity (inducing low total summer irradiation). They, propose a sea-ice feedback mechanism to explain the sharp decline in overturning terminating interglacial warmth. Similarly, Zhang et al. 2021 propose a direct astronomical influence on abrupt AMOC variability that is most pronounced during intermediate ice boundary conditions. They propose that either an enhanced boreal seasonality due to a decrease in precession or an increased latitudinal insolation gradient associated with a lowered obliquity can generate a glacial climate background state under which the AMOC oscillates spontaneously. These observations are supportive of our proxy observations at 397ka when precession is high and obliquity low (entering minima), e.g., Yin et al. 2021. The event at 390ka occurs when precession is low, and obliquity is low (exiting minima), which is consistent with Zhang et al 2021 who propose that AMOC variability can be triggered by either precession or obliquity during intermediate cryosphere climate background. The combination of low obliquity and low precession would have led to a strong LTG but also to intense summer heating of the emergent GIS, which would have led to a warm Nordic Seas and set the stage for the meltwater event at 390ka.

We will include the possibility of orbital forcing for the events in the revised version of our manuscript and thereby contribute to the emerging discussion surrounding this thematic.

The authors cited the paper of Oliveira et al. (2016) mentioning that SST does not record millennial cooling during the 397-397 ka interval but it would have been interesting to note that centennial events are detected in southwestern Europe by the pollen record of the same site (IODP Site U1385, same paper). 3 rapid climatic events showing forest reduction occured at 396 and 393.5 ka without associated SST changes on the Iberian margin and one at 390 associated SST change. It was noted that the first 2 episodes are of lower amplitudes than the 390 ka event, during which the ice volume is larger and for which the other ODP 980 and 983 sites record iceberg discharge episodes. The correspondence is striking enough to be cited, potentially suggesting that the discharge events detected by DSDP site 610B are potentially coupled to atmospheric changes affecting mid-latitude climate.

We agree with the reviewer that the pollen record will make an interesting contribution to the revised version of the manuscript.

Structure: Almost all the figures are called in the method section even though they show results or even a comparison with data from the literature. It would seem more appropriate to me to call these figures in the result section. In my opinion, the paragraph between lines 228 and 235 corresponds to results.

We will revise the manuscript so that most of the figures will be called in the results section.

Chronology: Did you keep the original age models from core ODP 983 and U1308? It is difficult to justify that it is better to correlate with a record from the same region (whose age model is based on Martinson (1987) benthic isotope stack) instead of LR04 and then compare with the benthic records from those sites, one of which based on EDC 3 age model and the other on LR04 and later, mention that there is a good correlation between the records. This procedure is lacking of consistency.

For ODP 983 we used the age model published in Barker 2015 and 2019 – see also comment for reviewer 1, and for U1308 we used the age model published by Hodell et al. 2008 (based on LR04)

Technical corrections

Summer insolation and astronomical parameter curves should be added in Figure 5 and/or 6.

This is now added to Figures 5 and 6

The limit of the isotopic substages should be indicated in at least one figure.

We have added the isotopic substages (as defined in (Railsback et al., 2015) in Figure 6

The correction of isotopic values used to present the ODP 980 & 983 and U1308 sites in Figure 4 should be indicated.

The correction of 0.63 is now added to the figure caption of Figure 4

May be great to add in Figure 6 the curve of NPS % from site DSDP 610 with those of ODP Site 983.

This is now added to Figure 6

328: Beginning the results section with a sentence mentioning the similarity to the Holocene does not seem appropriate.

We have removed this sentence also as part of revisions requested by Reviewer 2

404: “Further our results”.

This has been changed

473: Values of CO2 and

This has been revised

END of Reviewer 3

References used:

Railsback, L. B., Gibbard, P. L., Head, M. J., Voarintsoa, N. R. G., and Toucanne, S.: An optimized scheme of lettered marine isotope substages for the last 1.0 million years, and the climatostratigraphic nature of isotope stages and substages, Quaternary Science Reviews, 111, 94-106, 2015.