Climate of the Past Discussions

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Comment on cp-2021-97

Anonymous Referee #3

Referee comment on "Reorganization of Atlantic Waters at sub-polar latitudes linked to deep-water overflow in both glacial and interglacial climate states" by Dakota E. Holmes et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-97-RC3, 2021

General comments

The study focuses on paleoceanographic changes in the high latitudes of the North Atlantic during the 403-388 ka interval based on the multi-proxy analysis of the DSDP 610B site located on Feni Drift. By comparing existing data for other sites in the North Atlantic subpolar zone, the paper aims to reconstruct the sequence of events on a spatial scale. The quality of the multi-proxy data, which have an excellent temporal resolution, and the new information provided clearly deserve a publication in Climate of the Past. The paper nevertheless presents some structural and conceptual problems that require some modifications before publication.

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 re-worked 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).

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. 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.

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.

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.

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.

Technical corrections

- Summer insolation and astronomical parameter curves should be added in Figure 5

and/or 6.

- The limit of the isotopic substages should be indicated in at least one figure.
- The correction of isotopic values used to present the ODP 980 & 983 and U1308 sites in Figure 4 should be indicated.
- May be great to add in Figure 6 the curve of NPS % from site DSDP 610 with those of ODP Site 983.
- 328: Beginning the results section with a sentence mentioning the similarity to the Holocene does not seem appropriate.
- 404: “Further our results”.
- 473: Values of CO2 and CH4 are given with a too high precision without considering age uncertainties.