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Interactive comment on "Dinocyst assemblage constraints oceanographic and atmospheric processes in the Eastern Equatorial Atlantic over the last 44 ka" *by* William Hardy et al.

William Hardy et al.

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Dear reviewer,

We have corrected the manuscript taking into account the reviewer's suggestions and we have included all modifications in the revised manuscript. Below you will find our detailed responses to each of the reviewer's comments.

COMMENTS :

"Age model: I think it is critical that the authors perform a rigorous error analysis of their age model. I recommend age model uncertainty analysis for every data point using their tie-points and Bayesian statistical error analysis using softwares like "Bacon"

(Blaauw and Christen, 2011) or "B-Chron" (Parnell et al., 2008)"

We have plotted the 2-sigma range error in grayscale envelop around mean calibrated ages. The grey band plotted on the Age - Depth figure (first version) only corresponds to the 14C error (See attached figure 1)

"When discussing the onset or termination of an event, the median age of onset/termination of event and the uncertainty of the median age point should be provided."

We have included in the text the 2-sigma range for climate events, corresponding to the maximal range we calculate from our chronology, itself mainly based on radiocarbon dates and especially for the onset of the Last Deglaciation and the Holocene.

"The authors describe changes in assemblages or species that would suggest an un "atypical" climate changes that includes warm and wet conditions during the LGM and coldest reconstructed temperature of the record during the late Holocene. In indeed, these inferences are in contradiction with several (mostly geochemical) observations. I suggest therefore, a critical discussion about the robustness and weakness of the interpretation of the assemblage changes"

Paleoecological interpretations in our study area are largely based on the modern dinocyst atlas (Zonneveld et al., 2013). In the revised manuscript, the ecology of main species discussed for the LGM atypical signature is highlighted thanks to maps highlighting the present-day distribution of taxa percentages in modern sediments: new Figure 6 inserted in the manuscript. Also, in order to be clearer, we have added a more critical discussion regarding dinocyst species and in particular for the thermophile ones that indeed lacked some present-day ecological information. (See attached Figure 2)

"The authors need also to provide a more nuanced discussion about the mechanisms that control that the Benguela advection over their core location. In Figure 7, it is suggested that the Benguela advection was severely weakened during 4-5 ka and 7-

15 ka BP. How does these interpretations compare with paleclimate records from more southern locations relative to that of the cores described in this study."

In order to discuss the link between Operculodinium centrocarpum abundances and the influence of the Benguela Current over our study area, as mentioned in Zonneveld et al. (2013), a map of the actual geographical distribution of this species has been produced (cf. new Figure 6). Today, this species lives in the Benguela upwelling system and along the Angolan and Congolese margin until the equator (new Figure 6). The presence of O. centrocarpum north of the Angola-Benguela Front has been interpreted in the manuscript as the northward advection of cold waters during the austral winter, migrating westward around 1°S. This is illustrated below with satellite SST data of austral winter (green: 16°C, brown : above 27 °C) and the present-day abundances of O. centrocarpum percentages.

Present-day occurrences of this dinocyst species appear to be consistent with the winter pattern of the Eastern South Subtropical Gyre (Benguela Current, South Atlantic Current and southern South Equatorial Current), but also with the Brazilian margin through the Falkland Current (see attached Figure 3).

This species then appears to be greatly correlated with northward cold currents. We did not find any publications relative to the paleo-intensity of the Benguela Current. Modern surveys exist but are rather based on ENSO or Aguilhas Current monitoring. However, planktonic sediment traps allow discussing the actual relationship between dinocyst assemblages and current sea-surface conditions (Holzwarth et al., 2000; Zonneveld et al., 2001), showing that O. centrocarpum is the dominant species under the Bengula Current influence.

Paleo reconstructions mainly concern latitudinal shifts of the Angola-Benguela Front (Jansen et al., 1996; Uliana et al., 2002). We thus have added the Jansen et al. (1996) reconstructions in new Figure 8.

Concerning dinocyst-based studies in southern locations, there is GeoB 1016 core

published by Dupont and Behling (2006), but the resolution is low regarding our chronological interval. There is finally the GeoB1023 core (Shi et al., 1998), a high resolution study carried out in the Benguela Upwelling System. Shi et al. (1998) did not discuss the Benguela Current activity (neither O. centrocarpum abundances).

We can however extract O. centrocarpum abundances from this study and add this data in new Figure 8 to make regional comparisons.

"A significant part of the Congo Basin is located north of the equator and, therefore, it is a part of the West African monsoon system. I highly encourage the authors to graphically compare their time-series of thermophile and low salinity assemblage/species with the highly resolved runoff and SST records from the Gulf of Guinea (Weldeab et al, 2007a-b, Weldeab et al., 2012a, Weldeab et al., 2012b). It is important that C2 BGD Interactive comment Printer-friendly version Discussion paper the authors' micropaleontolagical approach is compared with and tested against the geochemical proxy records from the same region (see above reference)"

We totally agree and we have added the Ba/Ca signal in Figure 6 (now named Figure 7)

There are several references cited in the main text but no listed in the reference list. It mismatch can avoided by using one of the several citation software and a careful checking.

We fixed it.

Wordings: there are several wordings (admitted, thanks to, climateuring, mitigation, tierce) that the authors need to replace with more appropriated words/phrases. Please change: "Weldeab et al" instead "Syee Weldeab et al.. "biogenic opal" instead "Biogenic Silica (BiSiO2)"

We fixed it.

Sincerely yours,

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Forke, S., Grøsfjeld, K., Henry, M., Holzwarth, U., Kielt, J.-F., Kim, S.-Y., Ladouceur, S., Ledu, D., Chen, L., Limoges, A., Londeix, L., Lu, S.-H., Mahmoud, M. S., Marino, G., Matsouka, K., Matthiessen, J., Mildenhal, D. C., Mudie, P., Neil, H. L., Pospelova, V., Qi, Y., Radi, T., Richerol, T., Rochon, A., Sangiorgi, F., Solignac, S., Turon, J.-L., Verleye, T., Wang, Y., Wang, Z. and Young, M.: Atlas of modern dinoflagellate cyst distribution based on 2405 data points, Review of Palaeobotany and Palynology, 191, 1–197, doi:10.1016/j.revpalbo.2012.08.003, 2013.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2016-148/bg-2016-148-AC2-supplement.pdf

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-148, 2016.

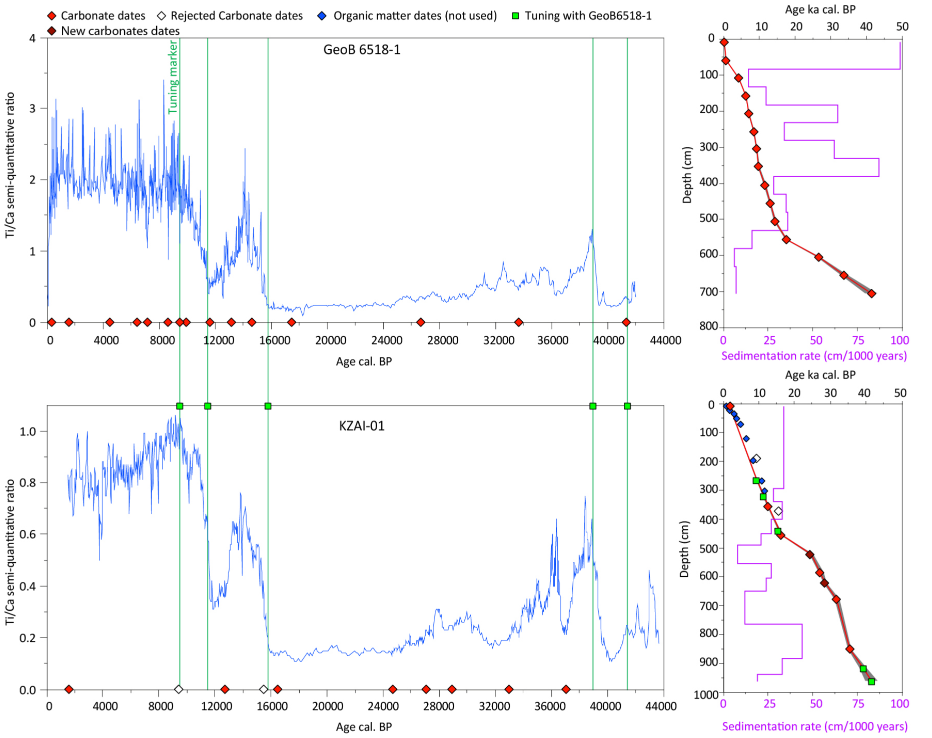

Fig. 1. Figure 1 : fixed Figure 2 of the submitted paper. The grey band correspond now to the 2-sigma range error.

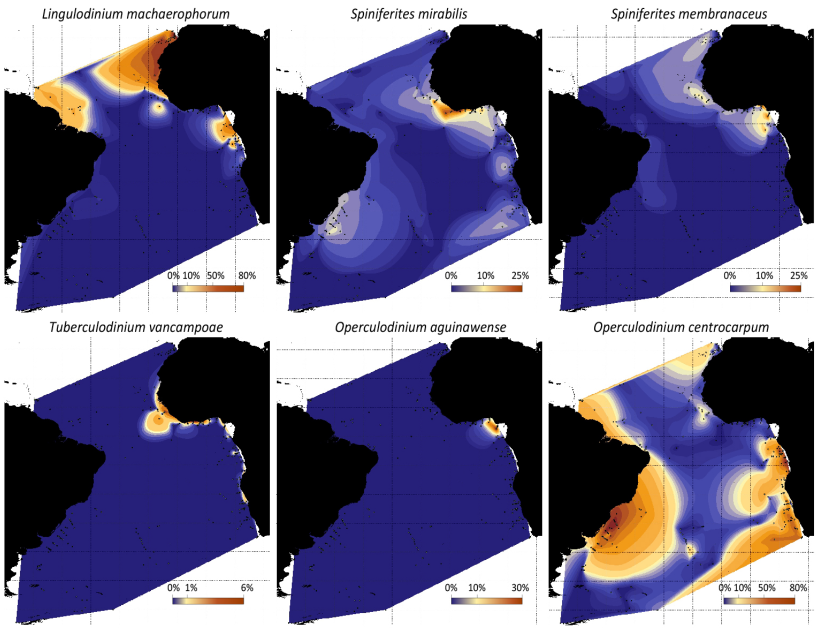

Fig. 2. Figure 2 : Modern-day dinocyst location according modern Atlas (Zonneveld et al., 2013)

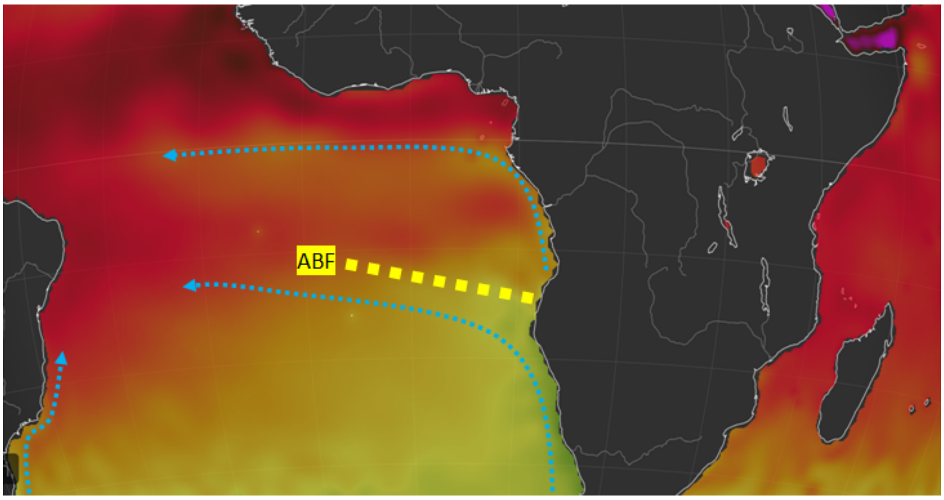

Fig. 3. Figure 3 : Map of mean July SST in South Atlantic Ocean. Blue arrows display the major northward cold currents and yellow dashed line represents the Angola-Benguela Front. Green : 16°C, brown : 27°C

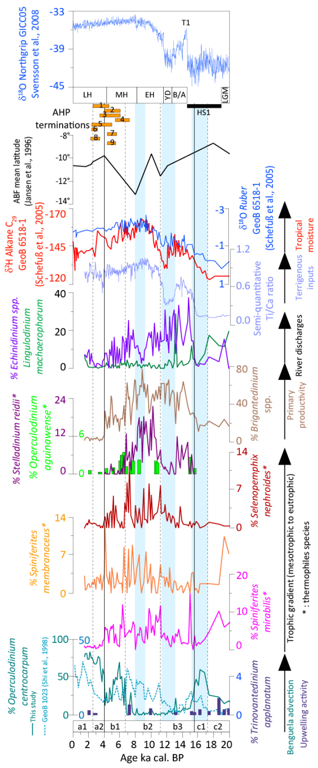

Fig. 4. Figure 4 : Fixed Figure 8 according reviewer comments.

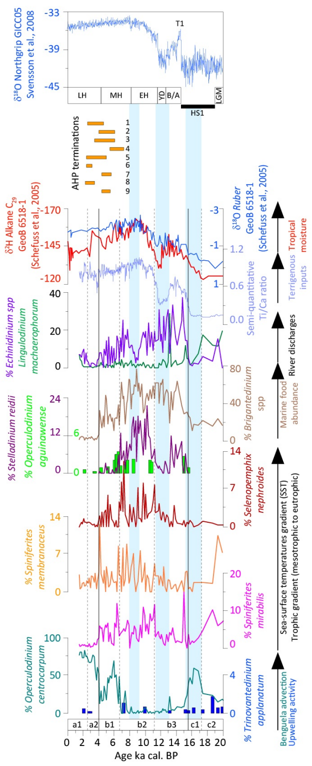

Fig. 5. Figure 5 : Firstly submitted version of Figure 8