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Climate of the Past Discussions

# *Interactive comment on* "Parallelisms between sea surface temperature changes in the western tropical Atlantic (Guiana basin) and high latitude climate signals over the last 140 000 years" *by* O. Rama-Corredor et al.

**O. Rama-Corredor et al.**

joan.grimalt@idaea.csic.es

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General comments

1. In a back of the envelope calculation, the mean temporal resolution of the SST record for the 14C-dated portion of the core is ca. 400 yr. Since most Heinrich Stadials (HSs) that occurred during the last glacial lasted for ca. 1.3 ky (HS1 excluded; Sarnthein et al., 2001. In: The Northern North Atlantic: A Changing Environment), in the best case HSs are characterized by three values. Dansgaard-Oeschger (DO) events



are even shorter than HSs, and thus would be represented by an even smaller number of values. Additionally, the authors used six 14C ages to constrain the age model of the core for the whole 14C-datable portion of the core (ca.50 ka; Reimer et al., 2013. Radiocarbon). The relatively low temporal resolution of the SST record associated to the relatively coarse 14C-based age model render the core appropriate for orbital-scale investigations, but not ideal for the identiïňĄcation of millennial-scale events. In the Abstract, the authors themselves state that (at least for MIS3) it is difiňĄcult to unambiguously identify either DOs or HSs. Still, signiïňĄcant portions of the Introduction, Results and Discussion are devoted to millennial-scale events. I would urge the authors to provide an in-depth evaluation of the ability of their record to investigate millennial-scale events. I have no doubts that, if point 2 mentioned below can be convincingly satisïňĄed, the new SST record presented by the authors is very well suited to assess orbital-scale changes, but this is not the case for millennial-scale changes. By focusing on orbital-scale changes, the conclusions would be substantial and perfectly supported by the results.

Reply - In core MD03-2616 we analyzed 576 samples and the average resolution was 210 yr. The resolution in the radiocarbon age period was 210 yr. Only in certain periods (23.8-29.8 and 35.2-39.6) the resolution was closer to 400 yr. We are attaching Figure 1 showing the SST record in which the number of points included in the section between 5 and 70 ka is indicated. In this Figure the time intervals corresponding to the Younger Dryas and the HSs are marked. Each of these intervals is described by at least 6 measurements. The resolution of the HSs is as average comparable to other tropical cores such as the west Amazonia caves quoted in the study (Figure 3 in the manuscript).

2. SST records based on alkenones may result in inaccurate values for situations of limited growth of open ocean haptophyte algae (e.g., Versteegh et al., 2001. Organic Geochemistry; Harada et al., 2003. Geochimica et Cosmochimica Acta). Typical situations of limited growth of open ocean haptophyte algae include low salinities and

light limitation. Both conditions could be present under the inïňĆuence of the Amazon River plume (Lentz and Limeburner, 1995. Journal of Geophysical Research; DeMaster and Pope, 1996. Continental Shelf Research). During the last glacial, sea level lowstand would have shifted the Amazon River plume offshore potentially affecting site MD032616more intensively than today, also considering potential increases in the discharge of the Amazon River. I would appreciate to see this topic addressed by the authors. This is my main remark regarding the validity of the laboratorial methods applied by the authors.

Reply - In a previous study of the same core, MD03-2616, on calcareous nanoplankton (López-Otálvaro et al., eEarth, 2009, see the full reference in the manuscript) it was established that the species that could be dependent on salinity did not show any systematic correspondence to this parameter. It is therefore unlikely that salinity may have influenced the behavior of hapthopyceae in this core. Furthermore, we have studied and identified in previous studies the alkenone profiles from species that show dependences on salinity (Lopez and Grimalt, J. Am. Soc. Mass Spectrom., 2006; Grimalt and Lopez in Encyclopedia of Quaternary Science. Elsevier. 2007, see full references in the manuscript) and the profiles indicating this influence were not observed in any of the samples of the present study. We are now indicating this aspect in the text.

3. Some portions of the text deserve in-depth restructuration. For instance, in section 3 Methods, the authors describe some results (e.g., the age model), while in section 4 Results the authors discuss some results (e.g., SST trends). The manuscript would proïňĄt from a stricter compartmentalization.

Reply - We have modified the text to follow these indications.

4. In the 14C-dated portion of the core there is an age reversal. The authors only brieïňĆy mention that the 14C result obtained for core depth 176 cm has not been used to produce the age model. Still, the reasons for choosing depth 176 cm as not valid instead of 148 cm, for instance, are not clear. That portion of the age model would



be signiïňĄcantly different if the authors discard the age at 148 cm. I would urge the authors to provide a detailed rationale supporting the elimination of the age obtained at 176 cm core depth.

Reply - We have revised the age model and finally we have decided to change the refused pointer from 176 to 148. The pointer used in the new age-model is 176 cm. This change was made after studying and comparing benthic $\delta$18O isotopes with both pointers to bibliography about termination I (Stern and Lisiecki, 2014). In this paper it was established that in north Atlantic intermediate waters, Termination I started at 16.8-18.3ka. This is in agreement with the use of the pointer “176 cm” from the benthic curves (see Figure 2 in the present report).

5. In order to correlate their SST record to the strength of the Atlantic meridional overturning circulation (AMOC), it would be of great relevance to show a record of AMOC strength spanning the period investigated in this manuscript. Such correlations are performed in different portions of section 5 Discussion (e.g., page 13, lines 16-19; page 16, lines 8-11) but no AMOC record is shown in Figs. 2-5.

Reply - We have now added to the paper a Pa/Th composite record obtained from Bohm et al. (2015) and McManus et al. (2004). This record in compared to the SST data of the present study and other proxies in Figure 2 in the manuscript.

6. In different portions of section 5 Discussion (e.g., Page 12, lines 23-25; page 13, 22-24), the authors refer to changes in salinity in their study area, the western tropical North Atlantic. Still, by only providing a SST curve, any discussion or conclusion on salinity is based on already published records or conceptual models. I would urge the authors to focus the Discussion on SST or to show a salinity record from MD03-2616.

Reply - The experimental information considered in the present paper only concerns SST. Thus, we have deleted any reference to SSS to avoid possible confusions.

7. The large number of speciïňĄc comments and technical corrections listed below

(please consider that Fig. 1 needs in-depth restructuration, see my comments below) makes the reading of the manuscript very demanding. The manuscript would greatly beneïňĄt from a detailed revision.

Reply - We have followed all changes indicated in the specific comments

SpeciïňĄc comments / Technical corrections

Page 2, line 3: Use “37” as subscript, and rewrite the alkenone symbol, since it is not correct.

Reply C37 was changed to C37 and U”37 was changed to Uk’37 throughout the text.

Page 2, lines 8-9: Not clear, please rephrase.

Reply We have modified this sentence: “During the last two interglacial stages (MIS1 and MIS5e) and warm long interstadials (MIS5d-a), the sediments studied record rapid transmission of climate variability from Arctic-to-tropical latitudes.”

Page 2, line 11: Since MD03-2616 was also collected in the NA, this should, in principle, be expected. Thus, please rephrase for more accuracy (i.e., mentioning a speciïňĄc region of the NA).

Reply We have modified this sentence: “records of North Atlantic mid latitude cores (Iberian margin 38°N, Martrat et al., 2007)”

Page 2, line 13: Delete “with SSTs reaching as low as 25.1oC.”

Reply This sentence has been deleted.

Page 2, line 14: If the term “reminder” characterizes signals that are not very clear, delete the sentence. If not, rephrase it for more clarity.

Reply We have modified this sentence: “The events recorded in Guiana parallel”

Page 2, lines 15-17: Why not making a more direct comparison by looking into marine sediment cores (e.g. Nace et al., 2014. Palaeogeography Palaeoclimatology Palaeoe-



cology)?

Reply At this stage of the manuscript our intention was comparing SSTs to Sajama ice core record to remark the similar structures related to HE1-Bolling-Allerod-YD. The core of Guiana SSTs is compared to that from Nace et al. in (Figure S2 supplementary information).

Page 2, line 25: Which hemisphere of “polar variability”.

Reply Polar has been substituted by “northern hemisphere”.

Page 3, line 1: The Introduction is completely focused on millennial-scale events. Change the focus to orbital-scale modiïňĄcations in climate if the millennial-scale information in the core is not conclusive and the more conclusive signals relate to orbital scale changes.

Reply An in-depth restructuration concerning the millennial scale events has been incorporated to the manuscript. Now the D-O and HE in Guiana SSTs are indicated in the figures and compared with the events from the other cores.

Page 3, lines 13-14: Consider including Barker et al. (2015).

Reply We are now including this reference in the manuscript. When our paper was submitted the paper from Barker et al (2015) was not published.

Page 4, lines 10-11: In general terms, many studies assessed this issue. State a speciïňĄc area if you still want to keep this sentence.

Reply We have eliminated the reference.

Page 4, line 17: Add “and” before “(iii)”.

Reply Done. We have reorganized the whole paragraph.

Page 4, lines 24-25: Delete “a tropical region conïňĄned between Arctic and Antarctic oceanographic inïňĆuence”.

Reply This sentence has been deleted as suggested by the reviewer.

Page 5, line 19: Substitute “was formed by” by “is composed of”.

Reply Done.

Page 5, line 21: Section 2.1 is too short. Please provide some more details (e.g., mechanism controlling the position of the Intertropical Convergence Zone).

Reply This section has been reorganized: “The Guiana Basin (Fig. 1 in the manuscript) is directly influenced by the latitudinal migration of the ITCZ between 10°N and 5°S (Muller-Karger et al., 1989). Seasonal movements of the ITCZ generate two rainy periods (boreal late spring - early summer and winter) and two periods with less rain (boreal late summer - early autumn and early spring). This spatial and seasonal variability in the ascending branch of the Hadley cell has an impact on the vegetation and hydrology of the area. Trade winds change their direction depending on the ITCZ position (Fig. 1 in the manuscript). South-east trade winds prevail when the ITCZ is in its northern position (drier continental climate; short rainfalls in Guiana). Conversely there is an opposite flow of north-east trade winds when the ITCZ is in its southern position (wetter oceanic climate; long rainfalls in Guiana).”

Page 6, lines 1-5: Move run-off related issues to section 2.3.

Reply Done

Page 6, line 10: Section 2.1 is too short. Please provide some more details (e.g., seasonal SST, annual and seasonal sea surface salinity (SSS)).

Reply We have modified this section (2.2). Among other aspects, information on annual SST and annual SSS from Levitus database are now included in the text: “, the present average annual SST at the MD03-2616 location is 27.6°C and 33.6 psu“

Page 6, line 11: Are the authors referring to SST? Additionally, provide SSS annual, summer and winter means (either here or in section 2.3) (also in Fig. 1). The proximity



of the Amazon River mouth may generate extremely low SSS that hamper appropriate growth of open ocean alkenone producing algae. Also, consider that past periods of enhanced Amazon precipitation and Amazon River discharge (e.g., Mosblech et al., 2012. Nature Geoscience; Govin et al., 2014. Climate of the Past) coupled with lower sea-level may have resulted in signiïňĄcantly lower SSS at site MD03-2616, affecting the growth of alkenone producing algae (see y comment above).

Reply We were referring to SST. As stated in section 4.2, SSS changes are not affecting the measurements of SST with the alkenones: “The alkenones found in all the samples of the present study correspond to distributions containing C37 methyl ketones, C38 methyl and ethyl ketones, C39 methyl and ethyl ketones and C40 ethyl ketones. This distribution named as Type A in previous studies (Lopez and Grimalt, 2006; Grimalt and Lopez, 2007) is widely found in marine sediments and waters and the correspondence between SST and U_37ˆk’ has not been observed to depend from salinity changes. The other distribution, Type B, is characterized by well-defined relationships between carbonyl position and chain parity, that is, methyl and ethyl ketones for the odd and even carbon number homologs, respectively. This second distribution is found in sedimentary environments of salinities lower than seawater (Lopez and Grimalt, 2006; Grimalt and Lopez, 2007) and it was not found in any of the samples of the present study. The lack of influence of salinity changes in the SST alkenone record is also consistent with a previous study performed in the same core on calcareous nanoplankton (López-Otálvaro et al., 2009) in which it was found that the species that could be dependent on salinity did not show any systematic correspondence to this parameter.”

Page 6, line 14: Delete “main”.

Reply This word has been deleted.

Page 6, line 20: Add “retroïňĆection” after “NBC”.

Reply Done.

Page6, lines25-27: Provide the mean depth of the boundary between these two water masses. This is a relevant information to be considered together with the core depth.

Reply Done.

Page 6, lines 26-27: uNADW is placed beneath AAIW! Lankhorst et al. (2009. DSR), for instance, assigned the pressure range of 600-1050 dbar for AAIW, and 1200-2050 dbar for uNADW. Please rephrase.

Reply We have corrected this mistake. The sentence has been rephrased: "The Antarctic intermediate waters (AAIW) originate from subpolar latitudes around Antarctica and flows at 400-1000 m depth with a pressure range of 600-1050 dbarIt is identified in the tropical region by a salinity minimum, which contrasts with the upper North Atlantic deep-water that flows at a deeper depth 1200-4000 m and has assigned a higher pressure 1200-2050 dbar"

Page 7, lines 7-9: Seems not to be relevant for this manuscript. If this is indeed the case, delete it.

Reply The sentence: "These mud banks are associated with salinity variations and have an effect on the development of coastal ecosystems such as mangroves (Lambs et al., 2007)" has been deleted.

Page 8, line 19: Add the error of your SST reconstruction.

Reply The error has been added: "$\pm$0.5°C (Grimalt et al., 2001)".

Page 8, line 20: It is important to state in this section (and not only in the caption of Table 1) that (i) the authors performed a linear interpolation between age pointers, (ii) if any DR was used, and (iii) which software was used to calibrate the raw 14C ages.

Reply Now this information has been added to the manuscript: "The age-model is based in a linear interpolation (using the AnalySeries software) between 18 age pointers. From 5.9 to 34.5 ka, the MD03-2616 age-model is based on 6 AMS14C-dates



measured in tests of planktonic foraminifera Globigerinoides sacculifer, calibrated using Calib 7.0 software and Marine13 curve (Reimer et al., 2013). The assigned reservoir age was 284 y and Delta R = -15$\pm$37. Both of them were obtained from the Marine reservoir correction database (http://calib.qub.ac.uk/marine/) as a mean of closest points in the area.".

Page 8, lines 21-22: Delete this sentence.

Reply Done.

Page 8, line 24: Substitute "shelves" by "shells".

Reply It has been substituted by "tests".

Page 8, line 25: Delete "Table 1".

Reply "Table1" was deleted from the sentence.

Page 8, lines 26-27: "...identifying the biozone with the Y interval of Pulleniatina obliquiloculata disappearance..." reads awkward. Please rephrase.

Reply The sentence has been rephrased as "The other pointer used (40 ka) was the last occurrence of Pulleniatina obliquiloculata (Ericson and Wollin, 1956; Kennett and Huddlestun, 1972; Prell and Damuth, 1978; Vicalvi et al., 1999; Peterson et al., 2000; López-Otálvaro et al,. 2009) known as biozone Y transition (Table 1).".

Page 9, line 2: Delete "Fig. 2e". "Fig.2e" was deleted from the sentence

Reply

Page 9, line 3: Delete "Fig. 2d; Table 1".

Reply Fig.2d and table 1 were deleted from the sentence.

Page 9, lines 6-15: Move this whole paragraph to section 4 Results.

Reply The whole paragraph was moved to section 4 Results.

Page 9, lines 11-15: Please, reconsider this in light of Govin et al. (2014. Climate of the Past).

Reply We are now quoting Govin et al. (2014).

Page 9, line 16: Include an introductory subsection where you describe the age model. In this subsection, you should include the last paragraph of section 3.2 and refer to Table 1 and Figs. 2d, e and f.

Reply We have created subsection 4.1 Sedimentation Rates in the Results section. The paragraph mentioned by the reviewer has been moved to this subsection.

Page 9, lines 19-23: In the Results, do not discuss your results, but only present them in a clear and synthetic way. Move these sentences to section 5 Discussion. Why "subtle"? Delete this characterization or justify it. Compare the difference in SST between the Last Glacial Maximum (LGM) and the Holocene to MARGO (2009. Nature Geoscience).

Reply All these suggestions have been incorporated into the manuscript: The results are presented but also compared to other SST studies to remark that results are in line with other tropical SST results. “Subtle” was changed by “SST glacial-to-interglacial amplitude may appear small compared to those from higher latitudes (3.8°C)” SSTa were compared to MARGO database: MIS2 stands out as the coldest interval with minimum SST of 25.1°C and LGM average of 26.2°C (+0.6°C warmer than those in the MARGO database for this area (MARGO, 2009)

Page 10, lines 6-7: Not clear. Please rephrase clearly stating the relationship between the mentioned orbital parameters and warming/cooling trends in the western tropical North Atlantic. If therefore you are not only describing the results but need to discuss them, move this sentence to section 5 Discussion.

Reply This sentence has been rephrased. “The trends (warming/cooling) between maximum and minimum precession in Guiana and Greenland are shown as follows



(Fig. 2A-B in the manuscript)”

Page 10, lines11-21: Move these sentences to section 5 Discussion.

Reply The sentences have been moved to Section 5.

Page 10, line 22: Start this section stating that ïňĄrst you determined an objective way to identify abrupt changes, and then describe the putative abrupt changes. Still, consider my general comment #1 above.

Reply We have reorganized the whole section. Now it starts with the definition of the objective way for the identification of abrupt changes. Please, see Section 4.3.

Page 10, lines 23-25: This belongs to the Discussion. Please move this to section 5 Discussion.

Reply This paragraph has been moved to Section 5 Discussion.

Page 10, lines 25-27: Already mentioned above. Incorporate to item 4.1, and delete from here.

Reply This paragraph has been moved to section 4.1 (now 4.2).

Page 11, lines 1-2: Fits better to section 4.1. Please consider moving to that section.

Reply The lines 1-2 where deleted and rephrased in the reorganized section 4.3 Abrupt changes.

Page 11, line 2 “...shows a maximum fall of...” Did you calculated the SST change between two adjacent samples to get to this value? Not clear, please rephrase.

Reply We added a figure in the supplementary material (Fig S1 in supplementary information) to show that this event is defined by several SST points. As a general rule, all abrupt events considered in this manuscript must have more than 3 points to be considered. This rule was applied to avoid errors related to sampling resolution.

Page 11, lines 6-8: Section 4.2 could start here. I urge the authors to consider deleting

all sentences above in section 4.2.

Reply The above sentences were moved to section 5 Discussions. They fit better in this section.

Page 11, line 10: Text is not appropriate, since +/-0.5oC is not a rate. Please reformulate for more accuracy.

Reply This sentence has been modified. We defined an abrupt event as “a warming/cooling change higher than 0.5°C and 2°C/ka which have more than 3 points in the event”

Page 11, line 18: DeïňĄne acronyms in their ïňĄrst appearances in the text.

Reply The acronyms have now been defined: (Greenland Stadial (GS) and Greenland interstadial (GI).

Page 11, line 26: Use “variability”.

Reply This term is now used.

Page 12, lines 12-14: What is the mechanism therefore?

Reply The mechanism is described in the text: “During these cold events (MIS5c,d and D-O stadials) ice sheet discharge increased, strengthening NE trade winds and reducing Guiana current heat transport northward (Chiang and Bitz, 2005, Maslin, 1998). Due to stronger NE winds, ITCZ shifted southward and NEC moved to south cooling the Caribbean region (Schmidt et al., 2004) and Guiana basin.

Page 12, line 16: Reads awkward. Please rephrase.

Reply The sentence was rephrased: “. . .These warmer SSTs favoured the shift northward of the ITCZ driven by SE trade winds which increased heat transport northward to Caribbean Sea and North Atlantic higher latitudes.”

Page 12, lines 17-20: If the authors do want to discuss millennial-scale events of the



last deglaciation, I would urge them to provide a ïňĄgure limiting the x-axis to the last deglaciation and comparing their SST record to other appropriate records (e.g., Ruhlemann et al., 1999. Nature; Schmidt et al., 2004. Nature; Jaeschke et al., 2007. Paleoceanography; Weldeab et al., 2006. Earth and Planetary Science Letters).

Reply We think that in the context of the present study Fig. 3 in the manuscript described the last deglaciation adequately.

Page 12, line 21: “... North Atlantic...” Be more speciïňĄc, by citing a region in the North Atlantic, since MD03-2616 was also collected in the NA. Also, quantify the difference and cite the records to which you are comparing your record.

Reply We have re-written this paragraph: “these SST changes were of lower intensity in the Guiana core than in higher latitudes in Atlantic Ocean and the Iberian Margin (Martrat et al., 2007) but similar to those observed in Senegal basin (Niedermeyer et al., 2009) which is consistent with the common subdued SST variability in tropical regions.”

Page12, line23: But in this manuscript the authors are only showing temperature data. Please rephrase limiting on temperature.

Reply We have deleted this term.

Page 13, lines 5-6: Peterson and Stramma (1999. Progress in Oceanography) suggested that the SEC is primarily fed by the South Atlantic Current. Please consider this and other similar references to rephrase this sentence. Of key importance here is to cite original references, in this case, studies of physical oceanography, and not secondary references like paleoceanographic papers.

Reply We are now quoting this reference.

Page 13, lines 10-12: Please state possible reasons for the absence of similarity in these SST records.

Reply This question is discussed further in Section 5.3.

Page 13, line 14: In many situations the authors claim that there is a coupling between SSTs at site MD03-2616 and "North Atlantic" records. Citing one or more of these records in the text is of prime importance. Also, including one of these records in Figs. 2-5 (or at least in one of them) is of prime importance to support the suggested coupling.

Reply The north Atlantic MD01-2343,4 core (Martrat et al., 2007) has been added to Fig. 2 in the manuscript.

Page 13, line 17: Please be more accurate. It is not clear what the authors mean with "... ocean processes in Guiana...".

Reply This sentence has been reformulated: “ocean processes in Guiana (stronger GC fed by SEC) are directly related to the AMOC strength during the last two interglacials. . .”

Page 13, lines 22-24: Recurrently the authors make reference to changes in salinity off northeastern South America but one such record is not shown. I would urge the authors to base their discussion primarily on the shown SST record.

Reply Mentions to salinity have been removed.

Page 14, lines 3-4: Not appropriate. Please rephrase. The way the text reads now, suggests that the end of MIS3 is a deglaciation period, but the deglaciation only starts after the LGM.

Reply This sentence has been rephrased.” Abrupt changes occurred in the North Atlantic throughout MIS3 (Martrat et al., 2014), as in the Guiana Basin but at lower intensity. . .”

Page 14, line 5: Which events? Be more speciïňĄc by citing, for instance, the section where the discussion is to be found.



Reply This is now indicated “(as defined in section 4.3)”

Page14, lines5-6: Please, be more speciïňĄc. This is a broad statement that would beneïňĄt from a more speciïňĄc formulation as well as from citations to support the statement, since it is probably not based on the results shown here.

Reply This sentence has been deleted.

Page 14, line 21: Delete “or vice versa”. From page 14 line 28 until page 16 line 3: The way it is formulated, it suggests that DO oscillations, for instance, necessarily left an imprint in SST in the western tropical North Atlantic. Since this is not necessarily, I would suggest the authors to rephrase this sentence.

Reply We have deleted this term. A more accurate comparison between rapid transitions in Guiana Basin and the D-O in NGRIP has been now incorporated to Fig.3 in the manuscript.

Page 15, line 6: Not clear why the authors referenced Fig. 5b, since b in ïňĄgure 5 is the new SST record shown here for the ïňĄrst time. Please revise for more accuracy.

Reply We have re-organized this sentence.

Page 15, lines 8-9: The authors are comparing their new SST record to reïňĆectance data from Cariaco Basin, a proxy for terrigenous input in the basin (Peterson et al., 2000. Science). It would be enlightening if the authors could explain the motivation and rationale behind one such comparison.

Reply SST and terrigenous inputs in the tropical region were a priori modulated by the changes in ITCZ. Comparison of two proxies influenced by the same climate process provides information on the consistency of the overall interpretation of the results and it also highlights specific variations from the general model.

Page 15, lines 11-14: Although the trends as calculated in the intervals suggested by the authors show the same sign between MD03-2616 and GeoB3910, these two

records also present marked differences (e.g., low SSTs at ca. 40 cal ka BP in GeoB3910, high SSTs at ca. 25 cal ka BP in MD03-2616). The manuscript would greatly beneïňĄt from an in-depth evaluation of these differences as well. Also, I would urge the authors to compare their SST record to the one shown by Nace et al. (2014. Palaeogeography Palaeoclimatology Palaeoecology).

Reply Some differences mentioned by the reviewer, i.e. low SST at 40 ka, have changed with the new age model. Now both cores have now a minimum at 40 ka. The core from Nace et al. has now been included in Figure S2 in the supplementary information where together with other core SST profiles is compared to the one in MD03-2616.

Page 15, line 14: What kind of terrestrial records are the authors referring to? Also here it would be enlightening if the authors could explain the motivation and rationale behind one such comparison.

Reply We have modified this sentence: “Lacustrine records of Central America from Lake Peten Itza (Guatemala, 17°N, 89°W, Hodell et al., 2008) also follow the MIS3 abrupt variability recorded in Greenland ice.”

Page 15, line 17: NE or SE trades? Be more speciïňĄc.

Reply NE trade winds. It has been added to the text.

Page 15, lines 18-19: Hydrological perturbations have been simulated on many other areas as well (e.g., Kageyama et al., 2013. Climate of the Past). Please rephrase for more accuracy.

Reply This sentence has been modified: “Model simulations of hydrological perturbations over northern Atlantic due to ice sheets growth or iceberg delivery were shown to induce a southward shift of the ITCZ over the tropical Atlantic region (Chiang and Bitz, 2005, Kageyama et al., 2013, Menviel et al., 2014).” Page 15, line 26: The clear changes in hydroclimate over N South America during HSs cannot be considered a



"muted" reaction (e.g., Arz et al., 1998. Quaternary Research; Petersonetal.,2000. Science; Wangetal.,2004. Nature; Jennerjahnetal.,2004. Science). Also the western tropical Atlantic reacted readily to HSs (e.g., Arz et al., 1998. Quaternary Research; Weldeab et al., 2006. Earth and Planetary Science Letters; Jaeschke et al., 2007. Paleoceanography). Please rephrase for more accuracy. We have reorganized this sentence: “These results show that the marine and continental climate of northern South America was connected with polar variability during glacial periods which was overall dominated by precessional forcing.”

Page 16, lines 1-11: This paragraph deserves special attention from the authors. The authors mention the “lack of synchrony between trends in tropical SST records and Greenland” but earlier in the text they claim that “MD03-2616 SSTs showed a remarkable parallelism with temperature changes observed in Greenland”. Please make clear to which speciïňĄc portions of the record you are referring to. Also, if part of the record is not showing the suggested parallelism, I would urge the authors to consider reïňĄning the title of the manuscript by using better suited terms.

Reply We have modified this sentence for clarification: “GeoB3910-2 and MD03-2616 have the same long trend (SEC influence, Fig. S2C, D in the supplementary information) but different patterns in the short trend due to the influence of NEC in the second (Fig. S2B, C in the supplementary information). The MD03-2616 is located in the confluence of northern (NEC) and southern hemisphere waters (NBC-SEC). Obviously, both types of currents could a priori influence SSTs. A comparison of the Uk’37-SST records under the influence of these currents (Schneider and Müller, 1999, Simon et al., 2013, Dyez et al., 2014) and Guiana SSTs has been tentatively attempted despite the differences in time resolution (Fig. S2 in the supplementary information), The equatorial Atlantic SST record of GeoB1105 core is consistent with the Agulhas pattern (Schneider et al., 1996) and has a parallelism with the SST record of GeoB 3910 (Jaeschke et al., 2007, Weldeab et al., 2006) that is under the influence of SEC and NBC waters. SST dynamics of the Agulhas current has been attributed to poleward

displacements of the subtropical front of the southern hemisphere which coincides with warm intervals south of Africa in the western Atlantic Ocean (De Dekker et al., 2012). MD03-2616 shows a different SST variability that is closest to the SST profiles of the cores under the influence of the NEC (Niedermeyer et al., 2009) than the Brazilian cores. This northern influence is also clear in the interglacial in which SST from MD03-2616 and MD01-2343 (Martrat et al. 2007) show significant parallelisms. The lack of consistent SST change in MD03-2616 and the cores from the Agulhas area or the northeastern tropical Atlantic during the last glacial period (Zarries et al., 2011) evidence the long-term decoupling trend between these geographic areas during low intensity of the AMOC."

Page 17, line 2: "MISb"?

Reply Thank you for you observation. MIS5b, the "5" was missing.

Page 17, line 3: "The inïňĆuence of northern waters during deglaciation..." Be more speciïňĄc.

Reply The northern waters were the NEC, this is now included in the text.

Page 17, line 7, Substitute "proïňĄle" by "record".

Reply Done

Table 1: Where did the authors got the DR value from? Please include citation.

Reply The DR value was obtained from website http://calib.qub.ac.uk/marine/. This is now indicated.

Table 1: How did you calculated these values for the different sources of information (e.g.,14Cages,P.obliquiloculatadatum,oxygenisotopicstratigraphy)? Please provide details either here or on the main text.

Reply This is now indicated in the heading of the Table.



Table 2: Please use "Guiana basin", "Cariaco basin", and "off northeastern Brazil".

Reply These sites are now mentioned in the heading of the Table.

Table 3: Add a column with the probable millennial-scale event recorded in Greenland ice cores that correlate temporarily with the events identiïňĄed in MD03-2616.

Reply This column has been added.

Fig. 1: This ïňĄgure needs major restructuration. The Intertropical Convergence Zone (ITCZ) is an oceanic phenomenon; bifurcation of SEC occurs further to the S. No need to keep background world map. Crop it between ca. 0 and 90oW, and place detailed map to the right of it, saving precious publication space. Even better is to delete it, since the only information it is delivering is the location of records 1 and 2(i.e., Greenlandice cores, that are obvious). More important is to have another detailed map with the SSS (e.g., mean annual, mean summer and mean winter) focusing on the Amazon River plume, in order to allow a more in-depth evaluation of the impact that low salinities may have had on the production of alkenones (see my comments #2 and #6 above).

Reply The world map was deleted to save publication space. The location of the SEC has been corrected. The Bifurcation was placed further south. The upper branch of the SEC was maintained. Annual and seasonal maps of salinity and SST have been included in the supplementary material (Figure S3 in the supplementary information).

Fig. 2: In the ïňĄgure caption: (i) state which curve is insolation and which curve is precession (c); (ii) state what the circles in the continuous line stand for (c); (iii) for "summer solstice" specify if NH or SH (c); (iv) cite reference López-Otálvaro et al. (2009. eEarth) (e); (v) please state that the length of the colored straight lines is based on C. Why is there no trend for Greenland in MIS5e?

Reply Insolation and precession have been identified. The circles mark maximum and minimum of insolation at 7 °N. This is now indicated. Boreal summer. This is now indicated. The cite has been included. The trends for NEEM core have been included.

Fig. 3: Do not show in the ïňĄgure the 14C age not used to produce the age model.

Reply We have modified the figure for this purpose.

Finally, I would urge the authors to archive their data in a world data center.

Reply They will be archived.

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/11/C1355/2015/cpd-11-C1355-2015-supplement.pdf

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Interactive comment on Clim. Past Discuss., 11, 1143, 2015.



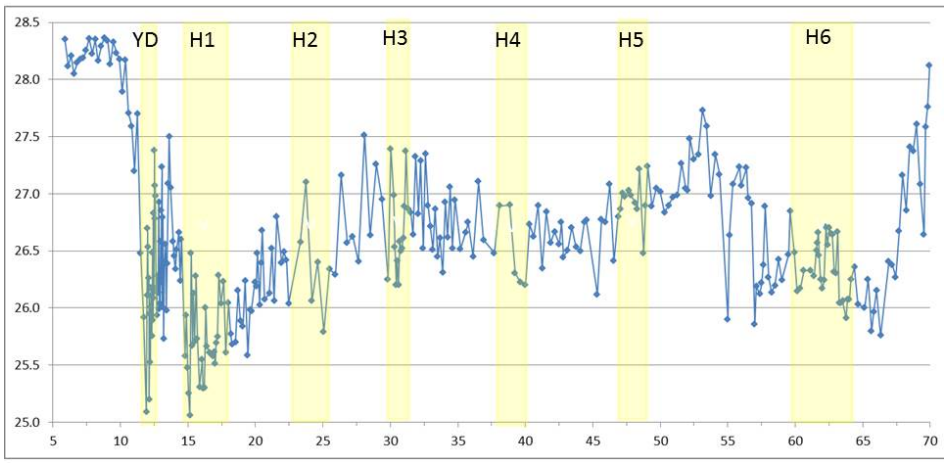


**Fig. 1.** Uk'37-SST profile of core MD03-2616 indicating the individual measurements used for the generation of the profile in the interval between 5 and 70 ka.

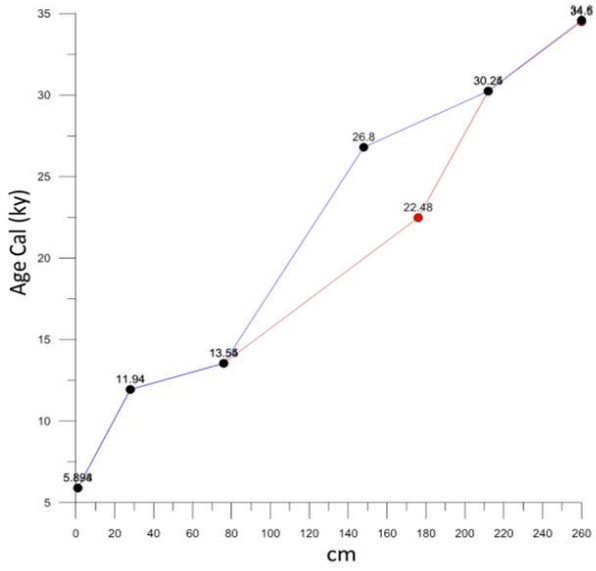


**Fig. 2.** Ages vs. depth