

Interactive comment on “Role of the North Atlantic circulation in the mid-Pleistocene transition” by Gloria M. Martin-Garcia et al.

Anonymous Referee #1

Received and published: 13 April 2018

General Comments Martin-Garcia use foraminiferal assemblages from a drill core in the eastern subtropical Atlantic (U1385) to reconstruct glacial/interglacial variations in surface hydrography during the latter stages of the mid-Pleistocene transition (MPT) (Marine Isotope Stages 20-14, ~800-530Ka). Their overall conclusion, as stated in the abstract, is that beginning with MIS 16, there is an increase in poleward warm surface water transport in the North Atlantic Current, which would act as a positive feedback prolonging the more extreme, 100 kyr-paced glacial maxima.

The MPT is at the center of much research because the underlying mechanisms responsible for the evolution of the 100 kyr cycle are not well understood, although a number of hypothesis exist. Therefore, the manuscript is of timely importance contributing new information about the state of the surface ocean during this interval of

C1

time.

The current version of the manuscript text is not written in a way that makes it easy to evaluate whether or not the data support the major findings. The Results and Discussion sections need reorganization to better highlight how the data lead to the stated conclusions. I suggest describing all time series to guide the reader through the study. In the context of Figure 3, why not show the N. pachy counts from Site 607? Interpretations regarding heat transport are based on spatial thermal gradients, yet none of the figures show such gradients. The reader is asked to figure this out from the SST records shown in Figure 4. It is also really difficult to follow the argumentation in the discussion because statements are not followed-up with appropriate call-outs to figures.

There are a few statements in the text that seem to go against what is generally known about deep water circulation on glacial/interglacial time scales. For example, in the abstract the authors imply that NADW is strong during MIS 16 (lines 20-27)? To my knowledge, and shown in Figure 3b, the relative flux of NADW increased during the deglaciation. So perhaps this is just a matter of carefully rewording the pertaining sentences. There are numerous other instances in the text where the wording of the sentences does not clearly communicate the message (see details below).

Interpreting changes in percentages is complicated by the fact that an increase in one species results in an apparent decrease in another, when, in fact, there may not be a change at all in the accumulation of the latter species. The authors should address this so-called 'closed sum' problem.

Regarding the description of deep water mass changes, I suggest rewording the sentences to make it clear that it is the relative fluxes of NADW and AABW that are changing.

How do these results compare with Alonso-Garcia et al. (2011) specifically? The time intervals of study overlap, so there is potential to make more of this comparison. Or,

C2

are the interpretations of the shifting fronts based on their findings? In this case the study should be cited in the discussion.

Specific Comments

Lines 59-62: include Alonso-Garcia et al 2011 in the list of citations?

Line 64: Alonso-Garcia's record begins with MIS 19. Therefore, it is not entirely appropriate to cite their study in the context of something that "began" during MIS 21?

Line 66: Why abbreviate the reference to Wright and Flower (2002) with W&F02? None of the other citations are abbreviated.

Line 92: "to obtain an conclusion" seems awkward. Perhaps replace with: to reach basin-wide conclusions? Or to obtain a basin-wide picture/view/reconstruction?

Line 96-97: Awkward sentence. Do you mean that the records extend far back into the past, or that they have been studied for a long time?

Line 134: "generally present" is vague. Figure 2b shows that *N. pachy* are present throughout the entire study interval, but their relative abundance increases during these glacial intervals. I suggest specifying what percentages are considered significant and why. For example, there is also a peak during MIS 15.

Line 149-151: This reads as if you are implying that MIS 20 is an interglacial interval.

Line 156: I would suggest changing the section heading to specify that the focus is on MIS 20 and MIS 18

Line 169-170: The sentence needs a specific figure call-out. I found the info in Figure 4c and d.

Line 181: Vague: What is the difference between very low and relatively low? And, it is confusing to read about low ice volume in the context of glacial intervals (MIS 20 and 18).

C3

Line 192: Define what the thermal gradient is. What does it mean when it is negative in terms of the temperature difference between the sites? Once this is established, it is easier to follow the interpretation with respect to heat transport.

Line 214: I am not sure that I see that the thermal gradient was significantly different during MIS 18 from MIS 16. This is true only for some intervals of time, but not consistently. For example, the same SSTs are recorded by the sites during MIS 16 at ~640-650 Ka. In any case, significance, which is a statistical term, is not demonstrated in this data set.

Line 220: It is really difficult to follow how these records show a negative thermal gradient. Would it be possible to just calculate the SST difference between the records to support this point?

Line 226: I am not sure I detect a repeating pattern in the data set. MIS 14 has quite a bit of variability, as you point out, so which pattern are you referring to?

Line 251: Is this correct? Do these studies really show that AABW is reduced during glacial intervals? There is a study by Lang et al., 2016 (Nature Geosciences) that shows % NADW for the past 3 million years. They show that NADW goes to zero, or almost zero during glacial intervals beginning around 0.9 Ma.

Technical Comments

The following is an incomplete list of editorial-type fixes.

Line 23: "At" the surface

Line 30: Blocking

Line 68: ...during interglacial periods

Line 69: related "to"

Line 86: "...which makes it an ideal location. ..."

C4

Line 99 meters. ... At the surface. . . ; at depth. . .

Line 122: on average

Line 123: commas before and after 1 cm thick?

Line 131: associated with

Line 141: replace 'since then' with 'after'

Line 215: higher

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2018-30>, 2018.