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Climate of the Past Discussions

Interactive comment on "Plateaus and jumps in the atmospheric radiocarbon record – Potential origin and value as global age markers for glacial-to-deglacial paleoceanography, a synthesis" *by* M. Sarnthein et al.

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–> We thank for a very constructive and helpful review. Our response is marked by –> signs.

Response to specific comments

The authors have gone to great lengths to try to organize the paper in a way that helps to wrangle the many topics presented, but I think this paper would benefit from being split into two (companion) papers.

–> We truly pondered to follow this interesting proposal. For two reasons, however, we see problems in its realization: (1) To be published in a journal named CP any dry report on a new marine dating method also needs to display some major implications in the field of paleoc-eanography (as now given in Sections 3.1–3.3) to be attractive for CP readers. (2) A subdivision of this manuscript and subsequent review process of two companion papers would be that time consuming that our manuscript might gradually lose timeliness.

„, the paper could be simplified to enhance accessibility by deleting some of the unnecessary words (hence, thus, moreover etc.).

–> We are aware that native English readers may suffer from our wording being somewhat biased by a foreign mother tongue, where connectional adverbs appear helpful to generate a 'red thread' of reasoning, though perhaps somewhat colloquial. We went through the manuscript and deleted such words where we felt they did not add to the flow.

I think it is very important that they have used the introduction to address some of the criticism that has been raised with the plateau tuning method. However, I think this is an area that could be expanded a bit more to address a few more points such as other explanations for marine 14C plateaus, including local shifts in air-sea gas exchange or upwelling, and if so, how can we account for these.

–> This is an important remark. We now broaden our Results section by a two-page long new subsection 2.1 named "Suite of planktic 14C plateaus: Means to separate global atmospheric from local oceanographic forcings". Based on this resumé we try to meet explicitly potential weak points of the 14C plateau tuning technique (points that actually had already been discussed in our previous publications since Sarnthein et al., 2007).

„, it would be helpful to address why using the Suigetsu record for plateau tuning is preferred to Intcal. It seems that correlation directly to Intcal may be more conservative.

–> As now added to our text (end of Subsection 1.2), we prefer the Suigetsu record, since it is based on original primary atmospheric data and results in small-scale spatio-temporal changes of reservoir age, whereas IntCal is mixing and smoothing a broad array of different data sources with comparatively coarse time resolution, including carbonate-based marine and speleothem records. Combining these diverse records results in various unsolved problems and assumptions that finally resulted in major differences between the IntCal 13 and 20 records.

(If the paper is split into two separate papers), , , , figures S2 and S3 should be included in the main text of the synthesis paper. I found these figures particularly helpful for visualizing the geographic spacing of Plateau tuned records and their findings.

–> Figs. S2 and S3 are now included in the main text.

More detail included for sections 3.2-3.3 would also be welcome along with a picture/diagram of the Zoophycus burrow.

–> Following the suggestion of Ref.#2 we now have deleted the 'Zoophycos story' of former Subsection 3.3, in particular, since details are published in detail by Küssner et al., 2018.

Specific notes: Figure 1: It isn't clear in the figure caption what the difference is between the top and bottom panels.

–> In the figure caption we now specify that the top panel shows the record from 19–29 cal. ka and the bottom panel that from 10–20 cal. ka.

Figure 7: Please include the references for the records used in this figure.

–> As cited in the caption of (new number) Fig. 8, all references are given in Table 3 a-c.

It would also be helpful if I could match the data points in the x-y plot to the data points on the map, perhaps using symbols or colors.

–> All data now are labeled with the sea region wherefrom a sediment record was obtained.

Also, I'm not sure inclusion of the surface currents in panel b or in figure S3 are helpful, they make it a bit more difficult to see where the cores are located and to read the reservoir age differences - especially because the currents are available in figure S2.

–> We regard the arrows of surface currents (now Fig. 8) as important for a straightforward comparison of different reservoir ages to different sea regions linked to different surface water currents in east-west direction, important to assess the limits of spatial extrapolation of reservoir ages.

Lines 601-603: Include the unit the corresponds to the foraminifera habitat depths. –> Thanks: (m)

Section 3.4, Lines 656-663: Might be good to mention the interspecies 14C differences from Lindsay et al., 2015. –> Thanks (ref. is now included).

Sections 3.5.1 and 3.5.2: In a few spots it would be helpful if the results from plateau tuning studies were more clearly emphasized. This would nicely highlight the important role that this technique has played in our understanding of LGM and HS1 MOC. This is done very nicely in section 3.5.3.

–> Thanks for an important suggestion. We now highlight some of the results of our new technique in the text, for instance, the formation of NADW during LGM, the HS-1 reversal of global MOC, and the reach of NPDW up to the South China Sea during HS-1.

Figure 9: This figure is a bit small and hard to see. The overlapping arrows can also be a bit confusing.

–> Indeed, opposed arrows for ocean currents are a bit confusing, since the east-west structures of the ocean are projected on a simple 2D meridional transect. Many arrows show opposed directions because of differential Coriolis forcing, especially so in the

North Pacific and North Atlantic (as now specified in figure caption and text).

Overall, I find that this figure is critical for visualizing the findings from sections 3.51-3.5.2,

–> We hope to display this figure in landscape format spread over a full page of CP. This will require a discussion with the publishing editor.

, , it might be helpful to also include the modern MOC for comparison.

–> Today the display of a modern MOC may appear too repetitive since it has already been published in that many versions of textbooks.

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