

## ***Interactive comment on “Modal shift in North Atlantic seasonality during the last deglaciation” by Geert-Jan A. Brummer et al.***

**Anonymous Referee #2**

Received and published: 10 June 2019

Review of the manuscript "Modal shift in North Atlantic seasonality during the last deglaciation" by Brummer et al. The authors present a study using single specimen isotopes on the planktonic foraminifera *G. bulloides* and *N. pachyderma* to show that during the deglaciation in the North Atlantic two different populations of *pachyderma*, one in spring and one in late-summer, occurred, while only one existed during the glacial and the Holocene. This variation would not have been possible to resolve using traditional pooled specimen analyses. These results suggest that these two populations are reflective of modern conditions from the present Irminger Sea further to the north, where sediment trap data for *pachyderma* show a similar double abundance peak. An interesting implication of the results is that when the pooled specimen record is reflecting a change of population rather than presenting the same signal, does this

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imply that no deglacial warming took place in this area of the North Atlantic? This study is a very interesting application of single foraminifer analyses of stable isotopes showing the use of single foraminifer analyses, highlighting the increasing attention it receives in the literature. The manuscript is mostly clearly written and easy to follow.

My main issue with the study is that the number of analyses, i.e. specimens, per sample is too low to give a representative split up in different populations. Up to 20 specimens were picked per sample, and for quite a few samples less than that were successfully analysed. What is the risk that the split into two populations for these samples is not simply due to highly variable values that only give the impression of separate populations?

Page 1 Line 24: are you suggesting the deglaciation lasted for 10 kyr? Line 32: many more references could be cited here to better reflective the literature. These references are all from the same lab.

Page 2, Line 29: delete the first "and"

Page 3, 2.3 title: add single specimens to it to distinguish from 2.4 where the bulk analyses are described. Line 21: the *pachydermas* weighed >10  $\mu\text{g}$ ? 2.4, line 24: how many specimens/what weight were used? Line 37: "varoes"

Page 4, line 20: missing year in Jonkers and Kucera Line 32: I assume these are the pooled  $\delta^{18}\text{O}$ ? Line 36: "during IRD events"

Page 5, line 4: The striking bimodality is quite difficult to see, it could simply be more variation in the analyses. Why not plot the results also as histograms? And similar for the  $\delta^{13}\text{C}$  results; it is not easy to see now how the variations are. Additionally, why is the x-axis labelled in x time 10 4 years? This is confusing, just stick to the regular ka.

Page 6, line 7: Is 250-300  $\mu\text{m}$  correct? Line 8: were any of the sediment-trap *pachydermas* genetically determined? Line 35: *pachyderma* is also unlikely to have lived in this meltwater; they normally stick below this relatively fresh layer.

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Page 7, line 31: delete “.”

Page 8, line 7: the Bard, 2001 reference is missing from the References Section 4.3: the results here show that in a setting like the North Atlantic the pooled specimen analyses may be biased when not enough specimens are being used. Could you provide an estimate how many specimens would be needed to give a reliable estimate?

Figure 2b: Is this 14C age of 41900 years used for the age model or not? It seems not, so then it should be deleted from the figure or indicated as such. Figure 5: Add headings of the different areas on top of each “column”.

To sum up, this manuscript is very suitable for *Climate of the Past* using a technique that is receiving more and more application. The manuscript illustrates the opportunity of single foraminifer analyses. After the authors have especially dealt with the number of specimens used per analyses and the minor comments, I see no further issues with this manuscript being published.

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Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2018-144>, 2019.