

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-59

Robert F. Spielhagen (Referee)

Referee comment on "Upper ocean flux of biogenic calcite produced by the Arctic planktonic foraminifera *Neogloboquadrina pachyderma*" by Franziska Tell et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-59-RC1>, 2022

The manuscript by Tell et al. discusses published and new data sets of planktic foraminifers from plankton tows in the Nordic Seas, Labrador Sea/Baffin Bay and the adjacent Arctic Ocean concerning the quantification of calcite production by the dominant polar planktic foraminifer *N. pachyderma*. This is a species widely used by paleoceanographers for high-latitude paleoenvironmental reconstructions and any additional knowledge on the behavior of this species in the water column, the fluxes and potential burial rates is highly welcome. The manuscript provides this additional knowledge by offering a holistic view on an yet unprecedented number of data sets and is therefore of high significance for the scientific community. Since the manuscript is well written in excellent English, well organized, and equipped with illustrative figures, it will make a valuable contribution and is well suited in "Biogeosciences". My limited knowledge of statistical methods did not allow me to evaluate all the results from such methods in detail and I may have overlooked some critical points. I hope that some more experienced experts can give some comments on these. However, my overall impression is very positive and I suggest publication in "Biogeosciences" after a minor revision which considers the specific points listed below.

General: Be consistent with the use of either British or American spelling (BE/AE): -ise/-ize, -our/-or, etc.

Fig. 1: The map should be concentrated on the actual sampling areas. A cut-out square concentrating on the Arctic Ocean, the Nordic Seas and the Labrador Sea/Baffin Bay area will show these areas in higher resolution.

Line 162: For a better guidance of the reader you may write "in 37 out of X profiles" (where X is the total number). I am aware that the total number of profiles was mentioned earlier, but it is helpful if you repeat it here.

Lines 164, 169: the BPZ

Line 217ff: Consider giving 1-sigma or 2-sigma values for some important data (e.g., mean depths of certain parameters) also in the text. Calculated averages (means) are important, but many readers may be also interested in, e.g., the depth range of BPZ values (and others). The scales in your figures often have only few (or no) minor ticks between labeled ticks (e.g., water depths) and it is hard to visually determine numbers between these labeled ticks.

Fig. 3a: Needs additional explanation in the figure caption on what is shown here (for those who are not experts on statistical methods;-). What is the box? What is the vertical bar in the box? What is the horizontal bar? What are the black dots? If you give this information here, you can refer to it in other figure captions.

Table 2 and lines 228, 248, etc.: Expedition numbers, station numbers and deployment numbers from Polarstern expeditions should be used correctly in the manuscript and not be mixed. Even if individual sample containers or bottles may have been labeled differently during the expedition, links to the PANGAEA data bank (and to, e.g., CTD data from the same station) will work properly only if the authors make a correct use of the numbers which are different in certain details. In the case of the Polarstern expedition in 2015, the following scheme applies:

PS93.1 is the expedition number (i.e., the first leg of expedition PS93 which was split into two legs during a late part of the planning stage).

PS93/20 (or PS93/24 or similar) is a station number (NOT PS93.1 20!).

PS93/20-3 is the deployment number of the multinet haul at station PS93/20 (PS93/20-1 was a handnet deployment, PS93/20-2 was a CTD run, etc.).

A correct use of these numbers is essential in many ways. A similar scheme is applied to expeditions of other vessels (e.g., Maria S. Merian, Meteor etc.).

Figs. 5, 7, 10, 11: It may be related to my poor experience with logarithmic data presentation, but I find the labeling of scales a bit confusing... For example, I assume that the horizontal scale in Fig. 10 shows $\log[\text{shell flux}]$, given in mg per square meter per day(?). Wouldn't it be possible to label the scale ticks as 0.01, 0.1, 1, 10, 100, 1000 ? Similar changes can be made to the other figures with logarithmic scales. Add minor ticks between the labeled ticks, because our brain is trained to think on linear scales, not logarithmic ones...

Lines 375/376: This statement needs at least a reference to a figure (or some explanation). The given number is somewhat confusing because in chapter 3.1 you give 124 and 136 m as BPZ depths. Different ways of calculation? Which number should be cited if future authors want to use your work as a reference? You may also consider rephrasing the sentence ("The average BPZ, calculated as ..., is at ...).

Lines 437/438: "... rules out that empty shells in the upper water column only represent specimens affected by premature depth." - I do not fully understand what you want to say here... What do you consider the "premature depth"?

Line 444: Upper or lower end?

Lines 454-456: Horizontal advection may also play a role, for example in the narrow Fram Strait where specimens from the east (with a thick Atlantic Water layer) may be transported into strongly stratified waters with a top layer of Polar Water.

Line 476ff: For the reader who does not always want to jump back to the Results chapter, it will be useful to find some numbers here when data and data ranges are discussed. For example:

- 492: "... fluxes that are three to five times higher than estimates..."

- 497: "The highest estimated calcite fluxes in our data set..."

Line 534-540: If mesh size is so important, why don't you determine this factor also within your data set? I am aware that many other factors (water temperatures, summer ice coverage, nutrients, etc.) also influence foraminifer fluxes. However, within your large data set you should be able to compare results from studies using different mesh sizes within the same region (where conditions are roughly the same) and even do this for several regions. For example, if you have, say, five studies in the western Fram Strait and western Greenland Sea using 150 microns and another five with 63 microns, you should at least be able to get an idea of the effect of different mesh sizes. This may statistically not be absolutely significant, but it may help to understand the effect.

Line 543: Schiebel

Line 553: Insert commas before and after "taking the abundance of *N. pachyderma* into account".

Line 572: contribution of planktonic foraminifera

Line 572ff: Is it really justified to discuss "the Fram Strait" as an entity? Concerning environments, the western FS resembles large parts of the Greenland Sea, while the eastern FS is more similar to the northern Norwegian Sea (strong near-surface influence of Atlantic Water, higher temperatures, no sea ice...). I do not think that one can say that there is a stronger influence of Atlantic Water in the Greenland Sea than in "the Fram Strait" (as stated in line 576). The advection of AW is largely meridional in the Nordic Seas, with parts of AW branching off to the west in various regions, including the Fram Strait. This (and the potential influence of mesh sizes) makes the statements in lines 576-578 rather vague...

Line 572/573: and a higher

Lines 579/580: ... similar ... as ...

Line 581: than in other

Line 606: Arctic Ocean