

## ***Interactive comment on “Simulating the growth and distribution of planktic foraminifer using an ecophysiological multi-species model” by F. Lombard et al.***

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I have read with pleasure the manuscript of Lombard et al., on modeling planktic foraminifer growth and distribution. The paper presents a different way of predicting and reconstructing planktic foraminiferal population dynamics of what has been published earlier, and may be step towards a better understanding of the biogeochemical affect of planktic foraminifer production and remineralisation in the modern and ancient oceans. The paper hence merits publication. In the following, I give some comments, which are meant to improve the manuscript. In addition to the comments I give here, I have made many notes on grammar and syntax within my copy of the manuscript,

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which might be better communicated to the authors in personal.

After having read the manuscript of Lombard et al., I would suggest changing the title of the paper to ‘Modelling planktic foraminifer growth and distribution using an eco-physiological multi-species approach’, which would suit the content of the manuscript better than the current title.

The model presented by Lombard et al. is largely based on the earlier paper of Lombard et al. (2009), on modeling temperature dependent growth rates of planktic foraminifers. Accepting the ideas of Lombard et al. (2009), those results should be presented as brief as possible. In general, the present manuscript of Lombard et al. is very long, and would benefit from shortening. I would suggest combing the eight panels presented in figure 1, and including the model results (lines) only (possibly in colour), and in one panel. I do not agree to the modeling result of growth rates of *N. dutertrei*, though, which are not supported by data (dots in figure 1). Maximum growth rates around 25 deg C coincide with a gap in data, and maximum growth rates would be around 17 deg C from the data presented here. When re-evaluating temperature dependent growth rates of *N. dutertrei*, Lombard et al. may want to do the same for the other species presented here.

I do not entirely agree to the statement that there is ‘about no information on the foraminifer population biology (i.e. fecundity, reproduction, mortality)’ (p.23, lines 13-14; see also p.10, lines 7-9) [in general, Lombard et al. use the word population in a very broad sense, and might want to reconsider the use of the word for each specific case]. Information on reproduction cycles and mortality rates of planktic foraminifers can be deduced from, for example, Schiebel et al. (1997; and references therein). Information on all modern species is presented by, for example, Schiebel and Hemleben (2005). If not in the present model, the information on reproduction and mortality could be utilized in a future model approach of Lombard et al. I would be happy to supply more (published and unpublished) data to support the modeling approaches of Lombard et al. In combination with the growth rate, the mortality rate would then facilitate

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better estimation of foraminifer abundance (see p.12, lines 19-20).

Does the initial carbon weight of  $0.73 \mu\text{g}$  used by Lombard et al. (p.7, line 8) refer to cytoplasm carbon or calcite carbon or both? I would arrive at about  $1 \mu\text{g}$  for the shell calcite C only.

The paper of Bé and Tolderlund (1971) provides a good first approach to model planktic foraminifer distribution, but on a relatively limited size spectrum ( $>200 \mu\text{m}$ ). More modern data bases might include smaller specimens, and would add information on small sized specimens (e.g., *T. quinqueloba*). Please take this as a suggestion on future work. In turn, p.17, line 22 to p.18, line 1 (Secondly...) could be cut from the manuscript, since it makes no sense to comment on work on different species, which has not been done. The discussion of different morpho- (and geno-) types of *Neogloboquadrina* (p.24, line 23 to p.25, line 6) is insufficient and unnecessary in the context given here, and should be cut from the manuscript. The same is true for the discussion on carbonate ion concentration (p.25, lines 11-14).

Figures 9 and 10 do present the final outcome of the modeling approach, and are hence of central importance for the manuscript. I would hence suggest providing more detailed figure captions. I guess that Lombard et al. want to say 'Estimated LOCATION of maximum growth rate...', which would explain the maps presented here.

Please take into consideration all of the papers so far published on the modeling of planktic foraminifer population dynamics, including:

Fraile, I., Mulitza, S., Schulz, M., 2009, *Marine Micropaleontology* 72 (1-2), pp. 1-9

Fraile, I., Schulz, M., Mulitza, S., Merkel, U., Prange, M., Paul, A., 2009, *Paleoceanography* 24 (2), art. no. PA2216

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