

Interactive comment on “A dynamic global model for planktonic foraminifera” by I. Fraile et al.

Anonymous Referee #4

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The manuscript of Fraile et al., on "A dynamic model for planktonic foraminifera", is meant to model population dynamics and sedimentation of planktic foraminifera as a proxy for use in palaeoceanography. The manuscript includes information on the trophic and ecologic state of species, and refers to a couple of earlier publications. Sediment trap data are used as a base to model the distribution of five different species of planktic forams, and an approach is made to integrate data on ecology and sedimentation. Finally, model results on the temporal and spatial distribution of the five species are presented. The manuscript presents an ambitious approach, and is targeted to the right direction. However, to my concern the manuscript bears some major shortcomings.

The manuscript of Fraile et al. is not written to the point. The abstract states that the paper will "explore the response .. to different boundary conditions, and to quantify the seasonal bias in foraminifera-based proxy records. The introduction states that "This

study shows model predictions for the spatial and temporal distribution of the five most important modern planktic foraminifera used as proxies". The authors have "coupled [ecological information] to an ecosystem model" because the "population density [of planktic forams] depends on food". This is an ambitious task, which in the end has not been achieved, possibly because "the ecosystem model is unable to predict a bimodal pattern, related to both monsoon seasons" (page 4348). The authors should clearly present their goals, and should also clearly present the difference of their manuscript to the paper of Zaric et al. (2006).

The information given on the food preference of planktic foraminifers refers to selected publications, and does not represent the general trophic state of planktic forams. Pteropods and ostracods are possibly not a usual food source of planktic forams. Some spinose species can survive on animal prey for some time, but who knows if they prefer animal prey? *G. sacculifer* can survive on zooplankton food in culture for some time, but does it really depend on it? What is small phytoplankton? These are questions of major importance for the manuscript, since it is stated that food is of major importance for the distribution of planktic forams within their temperature bands. Many recent and original publications offer information on the trophic state, ecology, and sedimentation of planktic foraminifers (see, e.g., Bauch, Bijma, Hebbeln, Hemleben, Loncaric, Schiebel, Volkmann, Yamasaki). To refer John Murray's (1991) review paper for the biology of *G. bulloides* is not wrong, but better refer to the original literature (this is true also for other references). *N. pachyderma* (sin.) can survive in sea ice, but it does not grow significantly during polar winter; *N. pachyderma* (sin.) is most productive during the polar summer adjacent to the ice edge. In addition, *N. pachyderma* (sin.) is not "the only species that growth(!) in polar waters". The average biomass of planktic foraminifers (page 4336) is not easy to assess, and the statement given here is pure speculation.

Temperature does possibly control the distribution of planktic forams, but only at its extreme limits. These limits are different for different genotypes of the same morpho-

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species, which is mentioned for *G. bulloides* and *N. pachyderma*. The same discussion should be given for *G. ruber*, of which at least three morphotypes are known, as well as a number of genotypes. *G. sacculifer* does exist in a couple of morphotypes, which is not discussed here. *G. ruber* and *G. sacculifer* are tropical to subtropical species, and do also occur within transitional waters, not "only tropical".

How do the authors know that "competition occurs between different species of [planktic] foraminifera"? Is mortality really the sum of predation + respiration + competition, or rather reproduction + remineralization + predation? A reference would be helpful. In general, statements should be substantiated, and provided with proper references, which is often not the case in the manuscript presented here.

In which way is the manuscript of Fraile et al. different from the paper of Zaric et al. (2006)? The maps presented on the modeled distribution of *N. pachyderma* (sin. and dex.) and *G. bulloides* look very similar to those shown by Zaric et al. (2006).

The authors may check the manuscript for an enormous number of typos and misspellings (e.g., Benguella, Wedell, Pflauman, Ditter and Henrich, trap data are no longer enough, growth/grow). Some expressions are ambiguous, for example: what is the "stratification of the thermocline" (depth of the thermocline?), what is "population density" (abundance, frequency?). Some authors are referred to by their first name: "Motoyoshi and Makoto" should read "Oda, M. and Yamasaki, M. (2005)" (please check other cases). Schmidt is given in the ref. list but not referred to in the main text (check for proper referencing in general). Sentences should not be started with, for example: "Instead of that", or "In(!) this site". Ishikawa and Oda (2007) is a paper on the development of the monsoons during the Pleistocene, and is (page 4348) referred in the wrong way. "The mixed layer is shallow" (page 4333) is a statement which is right but trivial: the mixed layer is the upper part of the water column, and the authors likely want to say that "the mixed layer is thin"? In addition, in many other places in the manuscript the language is not scientific, and needs to be improved before the manuscript is ready for publication.

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