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Discussions

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Interactive comment on "Dimensions of Marine Phytoplankton Diversity" *by* Stephanie Dutkiewicz et al.

Anonymous Referee #1

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The MS by Dutkiewicz et al. presents a detailed account on the drivers of the marine phytoplankton diversity in a numerical model.

The effort is of great interest since the model considers all the processes that are considered relevant when using a trait-based framework. It is also of interest since the impact the main traits and processes are discussed separately, using a set of well-defined sensitivity experiments. Finally, it focusses the discussion on the immediate implications for the interpretation of real data. In particular it points out that the selection of the environmental variables that are used as explanatory variables in statistical analyses has to be coherent with hypotheses drawn from the current theories. Dramatically, if one uses a trait-based framework the outcome is that most of the variables are hard to be constrained quantitatively (eg, the nutrient fluxes).

Indeed, the actual phytoplankton richness is possibly orders of magnitudes higher than the one emerging from this model exercise. This limitation is possibly due to the strong limitations of the "classical" trait-based approach. In addition, in this exercise there are no significant conceptual novelties on specific processes. Nevertheless, as stated by the authors, a general synthesis of the lessons learnt using this framework is going to be very useful for future studies and, with given its pedagogic clarity, for students and young researchers.

I thus recommend it for publication after addressing some very minor points.

A check is required for all the citations (missing parenthesis or points).

Specific comments:

Introduction.

The last sentence is generally correct for the whole diversity but in most cases studies focus on single groups. Is it still true?

Introduction:

A statement on the different definitions of "diversity" is missing. A general issue with the literature on plankton is the lack of discussion about the importance and the technical and ecological implications of the choice of the metrics for diversity.

The study by Lima-Mendez is not on diversity but on interactions. Their conclusions that biotic interactions are more important than environmental factors in setting the community network derive from the analysis of a dataset that contains much more "species" than this model. I think it is just not possible to compare the two approaches with the current state of understanding. In addition, the model has no interactions except for grazing. Thus citing it it is useful especially to discuss how these results represent a challenge for the current modelling approaches.

L45 "there is evidence suggest"?

Section 2.

What is the definition of richness used for the AMT data? What is the reason for not using a rarefaction of the data prior to define richness? The issue should be discussed shortly, also considering the method used here (L94-95).

The model resolution is very low for the current standards for the ocean physics. Presumably, the computational requirements to run the biogeochemical model are such that using a higher resolution was too demanding. Nevertheless, in discussing the limits of the study the lack of mesoscale and submesoscale processes should be mentioned.

L146 Missing the verb?

L149 micron?

Results.

L191 "Tough note. . . " could be in parenthesis.

L196 "given distributions"?

L199 "likely"?

L214 "enhanced"?

L218 manuscript or article?

L234 Please add the total diversity to the figure on sensitivity. The pattern looks similar to the thermal Norm one and thus it seems to suggest that processes that impact the Thermal Norm diversity (notably, transport here) can be very important in setting the total diversity.

L387 Possibly? Several time in the text there are statements that are too strong. This is the case also for the comment on Lima-Mendez et al. The authors of this MS maybe right but they have no direct evidences to oppose. They can only suggest or hypothe-

size.

L392 and following: The limitation due to the low model resolution is never mentioned.

More importantly, as only briefly discussed at the very end of the Discussion, the trait-based modeling approach, while being much improved here, is still far from reproducing the observed richness (especially if quantified using genetic or genomic approaches). There are issues with data, indeed. But it is unclear from this manuscript which should the future directions of research based upon this kind of modeling approach.

Supplementary: please provide the main parameters values. Is the term in parenthesis in eq. S1.4 (1/T-1/TN) or actually (1/TN-1/T)?

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