Comment on bg-2020-449

Anonymous Referee #2

Referee comment on "Abundances and morphotypes of the coccolithophore Emiliania huxleyi in southern Patagonia compared to neighboring oceans and northern-hemisphere fjords" by Francisco Díaz-Rosas et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-449-RC2, 2021

General comments:

In this manuscript Díaz-Rosas et al. use Patagonian fjords as a natural study system to investigate the influence of calcification status on the niche of the calcifying phytoplankton species *Emiliania huxleyi*. In the study multiple *E. huxleyi* morphotypes are investigated, and their niche breath and scope are quantified using an ordination method called OMI analysis. The authors find that the more heavily calcified 'R/hyper-calcified' morphotypes show a smaller realized niche, while the less calcified 'A morphotype' shows a larger realized niche. Additionally, it is found *E. huxleyi* shows much higher tolerance scores than other coccolithophore species. The OMI results suggest that carbonate chemistry is the main driver of this difference in realized niche size, which implies that there is an important relationship between coccolithophore calcification status and carbonate chemistry.

This work has important implications for coccolithophore ecology, and provides a novel angle to the role of calcification status in coccolithophore niche. However, I would like to see more discussion on the implications these findings have on global carbonate production, and what it might tell us about the response of coccolithophores to ocean acidification and global warming.

I would also like to see more contextualization of the work with laboratory results in the discussion. Specifically in the context of potential mechanistic reasons for the observed trends.

For the OMI analysis, there should be a bit more discussion about limitations of the method. For example, how would adding parameters like MLD, light, nutrients and grazers change the results?

Finally, I would strongly recommend that the authors upload their data to a FAIR-aligned reliable public data repository such as PANGAEA (specially Tables S1-S3).

Specific comments:

line 36: coccolithophores are the main phytoplankton group to contribute to CaCO3

production, but not necessarily the main calcifying plankton group (see Buitenhuis et al., 2019).

line 37: not sure what it is meant with functional roles?

line 38: expand this to add some discussion about impact of the PIC:POC ratio on global biogeochemical cycles. (e.g. Ridgewell et al., 2007; Ridgewell, et al., 2009).

line 40: define calcite.

line 50: see discussion in Kottmeier et al., 2016, Gafar., et al 2018, Gafar et al., 2019, Paul and Bach 2020.

line 51: please add a citation to back up this statement.

line 85: Fjord systems

line 233: mechanistically pH, CO_2, and HCO_3^- would have been a better choice, as calcite saturation state only indirectly influences sensitivity. See Kottmeier et al 2016, Gafar et al 2018, Gafar et al 2019, Paul and Bach 2020.

line 265 "Thereby, a species having a low OMI (species score close to zero, located in the center of the multivariate space) and high Tol is one that utilizes a wider array of resources and maintains populations within a wider variety of conditions (i.e., generalist), when compared with the specialized and less resilient species with more restricted realized-niche associated to high OMI and low Tol (Dolédec et al., 2000)."

This needs clarification. Although generally true, low OMI values do not necessarily imply a large niche breath and vice versa.

line 270: which environmental parameters were used for the OMI analysis?

line 273: where does the number of this correction factor come from?

line 372: Add another section here summarizing the main trends from Sections 3.1 and 3.2.

line 387: Patagonian fjords.

line 398: What about the Moderate A morphotype? %Rtol suggests that over half of variance is not explained by the OMI analysis?

line 399: This analysis is very interesting and an important part of the manuscript. Consider replacing 'complementary' with 'interspecies'.

line 414: Add some biomass numbers here.

line 426: Is there any satellite data for the Fjords? Why not?

line 439: What are some of these potential environmental and biotic factors?

line 440: briefly define sigma calcite.

line 556: clarify what you mean with 'more subtle patterns'.

line 458: morphologically distinct.

line 463: "Although the moderate-calcified and robust-calcified A morphotypes have also been shown to be present in eastern South Pacific coastal and open ocean waters 465 (von Dassow et al., 2018), the dominance of these A morphotypes was particular to Patagonian interior waters, as revealed by the IndVal analysis (these A moderate-calcified and robust-calcified A morphotypes were consolidated for final statistical analyses as they are not easily distinguished by objective morphological characters and were present in all samples, and preliminary analysis revealed completely overlapping realized niches). "

This is a run-on sentence which should be split for readability.

line 497: This is a interesting observation. How does it fit in with coccolithophore calcification state? The first OMI analysis suggest that the calcification state might influence tolerance, but this result seems not to support that? Why? What are the implications of this wide niche breath on global *E. huxleyi* abundance relative to other species?

line 504: clarify that the study specifically considers temperature and carbonate chemistry, but future environmental change will also include shifts in nutrient availability, mixing rates, and shallowing of the phottic zone. There may also be community shifts which could change biotic pressures like grazing.

line 508: Add a section here contextualizing the results with previous work on coccolithophore calcification and potential biogeochemical implications. How do the omega calcite and pH parameters observed in the Patagonian fjords compare to the RCP 8.5 2100 ocean?

line 513: Remove or define SS for readers skipping straight to the conclusion.

line 514: How small? What is meant by moderate abundances? What are typical Norwegian stocks?

line 518: replace important with abundance and generally rephrase. Why does high E. hux abundance in lower macronutrients imply that E. hux is most abundant when large diatoms are absent?

line 518: briefly mention what the difference is.

line: 525: dominance in.

References:

Buitenhuis et al., 2019 (https://doi. org/10.1029/2018GB006110)

Gafar et al., 2018 (https://doi.org/10.3389/fmars.2017.00433)

Gafar et al., 2019 (https://doi.org/10.1002/lol2.10105)

Kottmeier et al., 2016 (https://doi.org/10.1111/nph.13885)

Paul and Bach 2020 (https://doi.org/10.1111/nph.16806)

Ridgwell et al. 2007 (https://doi.org/10.5194/bg-4-481-2007)

Ridgwell et al. 2009 (https://doi.org/10.5194/bg-6-2611-2009)