The topic of the presented manuscript is relevant and the data presented seems to be of good quality. I see potential for a valuable contribution to the field.

However, in my opinion, the manuscript is not well written. The storyline and take-home messages are lost in detail and the analysis lacks streamlining. I could therefore not follow throughout much of the results and discussion. This made it difficult if not impossible for me to judge the scientific soundness and conceptual value of the content presented. While I am not an expert on coccolithophores, I have worked on upwelling systems, phytoplankton and export. Someone like me should be able to understand.

In conclusion, I have to recommend rejection of the manuscript in its current form. In my opinion, a complete re-work of the manuscript is needed, prioritizing storyline and conciseness. If done successfully, the manuscript may be reconsidered. As I said, I am not questioning the quality or significance of the data.

**1. The manuscript would benefit from proper and standardized statistics.**

1) A **"data analysis" section in the methods** would help incl. assumptions. This can be short but the logic should get across.

2) Some of the relationships are only shown visually (e.g. Fig. S9 and 10, Fig. 9), although they are part of the main results (e.g. lines 195-201). Please, also **show the hypothesis tests**. The models in Fig. S9 and Fig 9 are not even plotted with uncertainty. Not showing confidence bands is fine but only if the test results are shown.

3) I recommend to present all the main **stats tests in a compact format** in 1-2 tables in the supplement, with p-value, df, F-ratios/t-values etc. and any further info you deem relevant. Showing this info in the figure captions (e.g. figure 7) leads to long and technical captions that are hard to absorb. The statistics are also difficult to compare this way. You could show the most critical stats information (e.g. p-value and/or R2) directly in the corresponding subplot.

**2. The storyline is not sufficiently clear and the manuscript lacks conciseness.**

To be honest, I was lost throughout much of the result and discussion. I recommend that the authors identify their storyline and the few most important results to support it. All other detailed results are better reduced or removed. This concerns the result text, captions, figures/tables and discussion.

- The manuscript has **9 fully filled pages of figures and tables**. Readers will not be able to absorb that much. Please, make a selection.

- The **result text is too long** relative to the primary content it holds (2400 words). Much of the text describes some detail and is filled with highly technical info. The main messages are lost amongst all this. I believe it is the authors' responsibility to pre-digest the data for the reader. Below is a typical result sentence, as example:

"In late-spring 2015, the highest abundances of coccospheres (> 3.0 x105 L-1) and detached coccoliths (> 45 x105 L-1), along with PICTotal (> 3 µg C L-1) and PICCocco pools (> 2 µg C L-1), were found in surface or near-surface waters (depths < 25 m) closer to the coast at ~20º S (stations T1-T2), extending south to ~24º S (stations L1-L3; Fig. 3l-o)."

-> Could the info in the parentheses be reduced? The figures are already conveying the absolute values and their range. Make text and figures complementary. I recommend to state absolute values only in situations

where they are particularly relevant, to emphasize. What matters rather is the magnitude of change and direction.

- **Figures captions could be simplified**. They are currently very long, technical and redundant and thus hard to read.

As an example, figure 3:

The first sentence states “Spatial variation in POC, PICTotal and coccolithophore...” and the next sentence repeats this “POC (k), PICTotal (l), coccospheres (m), detached-coccoliths (n), and PICCocco (o) ...”. Either merge sentences or make them complementary: e.g. use first sentence as general “topic” sentence and second one to introduce individual variables.

-> Simplify “recorded during late-spring 2015 (left) and mid-summer 2018 (right).”. The year and side (left vs right) are already in the figure. No need to repeat. You could also add “late-spring” and “mid summer” directly into the figure, next to the years.

-> Only use “Depth (m)” once on y-axis for each 2015 and 2018. Also, the long-lat axes are difficult to understand. Look at the same/similar figure in Vargas et al 2021 as an example.

-> Remove “POC = Particulate Organic Carbon. PIC = Particulate Inorganic Carbon.” Instead clarify abbreviation directly when you introduce the variables: “Particulate organic carbon (POC) (k), particulate inorganic carbon (PIC) (l), ... “. This is overall shorter and more natural.

- I feel like the discussion is missing **conceptual depth**. Several topics in the discussion are approached by re-stating a result, followed by a detailed comparison to literature values. However, the subsequent conceptual discussion (i.e. what do we learn from this) falls short or is lost amongst the detail. If the authors cannot expand this latter part, I recommend to keep to discussion more concise overall (currently 3800 words). The figures and tables in the discussion already provide a substantial comparison to other regions. Maybe there is no need to go into such detail again in the text. That the storyline is not well developed becomes also clear in the conclusion. Here, the authors mainly provide a list of results instead of conceptual take-home messages and their wider significances. This is fine with me. But if this next step is not taken, such a long discussion not justified.

**3. Across the manuscript, assure to not imply causality**.

Your observational study can only establish correlations between variables not cause and effect like an experiment. Use wording that conveys the uncertainty (“may”, “possibly”, “indicated” etc.) and/or terms that reflect your observational approach (“associated”, “linked” etc). Here several examples were this was not done:

abstract line 19: “emerged as key factors influencing PIC”.

line 106: “assess the influence of the OMZ on PIC and POC concentrations”

conclusion line 534: “variation in PICTotal and PICCocco pools in the OMZ region strongly depends on temperature”

Also use past tense for statements that refer to your results: conclusion line 524: “Coccolithophores-PIC pools are highest within the first 30 m depth” but also several other conclusion statements.

**4. Detailed comments:**

line 11: sentence structure sounds somehow wrong. Correct would be for example: “A predicted consequence of ocean acidification is the decrease in coccolithophore-produced Particulate Inorganic Carbon (PIC) pools.”

line 11 and 12: “Particulate Inorganic Carbon” and “Particulate Organic Carbon” should not be capitalized in my opinion. It infers with readability. There are more such cases across the manuscript.

line 24-25: Structure of concluding sentence too complicated and thus difficult to read. Please revise. Removing “its role” already helps a lot.

line 35: you mean “feed back”?

line 45: “studies are increasing” sounds strange. Better use “research is increasing” or “studies are becoming more common”

line 51: “peaking in austral summer”

line 58: sentence too complicated. Consider splitting after “coccolithophore-derived PIC”. Alternatively remove “calculated from them” and keep everything in one sentence.
This is the first sentence specifically for your study. It should thus be easy to understand and general. It would also help if your “aims and approach intro” is separated from the general introduction. So, consider starting a new paragraph after “OMZ systems” line 57.

line 64: “in situ” is not saying much, maybe better state what variables, e.g. “environmental”, “physicochemical”

line 77: Not sure putting several pages of raw data into the supplement like this in pdf format is helpful. Better upload this data to a proper data repository, where users can view and download it in an appropriate format.

line 78: “SST”, “SSS”, “Chl-a” etc. spell out at first mentioning

line 93: “plotted using R” -> “R Studio” is just giving you a nice interface, the actual job is done by R. Also, strictly speaking you would need a reference for R here incl. the R version. You can of course mention RStudio in addition to R, e.g. “R in RStudio”, but then again with reference. Same for line 171. Actually, best would be to include a general “data anlysis” section in the results. Here, you can state once which program was used incl. reference.

line 148: “slopes were highly linear”. Do you mean “relationships were linear”?

line 193: “fluorescence” in mg m-3 units? Do you refer to a pigment concentration? Then you have to add this info to the variable name for it to make sense. Do you have two different Chla measures and one of them is based on fluorescence and the other on e.g. HPLC? While you reference Vargas et al 2021, you still need to communicate the basic meaning of these variables in your manuscript.