

Geosci. Model Dev. Discuss., referee comment RC3  
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## Comment on gmd-2021-279

Anonymous Referee #3

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Referee comment on "ECOSMO II(CHL): a marine biogeochemical model for the North Atlantic and the Arctic" by Veli Çağlar Yumruktepe et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-279-RC3>, 2022

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### Narrative

The manuscript describes and evaluates the coupled HYCOM-biogeochemistry ECOSMO II model, configured for the Arctic Ocean. Its evaluation includes some suggestions for fine-tuning of the parameterization according to the geographical characteristics of the expanded domain. The technical description of the ECOSMO II model is well written and constitutes a good baseline for the modeling community. The evaluation of the model results, against observational values, is also of value for a quantitative validation of the model and it is well complemented by the commentary and the figures therein.

The paper is very well written, but it would benefit, in my opinion, by a better and more organized description of what observations were used in what experiments. The selection of the areas (and experiments) to show and compare seems ad-hoc. What is the justification for these selections? Why not compare all of the areas in all comparisons and statistics? Seems that it wouldn't add much more content and would be of better use in a comprehensive descriptive assessment of the model for this region at large. Perhaps a way to scope the comparative analysis would be to concentrate on one or two of the subregions of the model domain. The performance comparison for the model would be well prescribed in a table of EXPT vs. AREA with some objectively-derived performance metric value (i.e. rmse/skill score). This would allow for a good summary of the many combinations of experiments and areas covered. The many regions, very comprehensive, somewhat dilutes the detailed validation of the model itself, only providing a general descriptive validation with some statistical quantification for some of the areas.

While technically, this is a paper of excellent value, scientifically, it could have been further elaborated to elucidate what the model brings in terms of better understanding of the hydrodynamics and biogeochemistry of the Arctic region. It would also benefit from a more detailed description, via equations, diagrams, and text, of the plankton group dynamics and again, the scientific value of those results.

In summary, the paper is very well written and the technical topic is well covered, but the scientific value of the paper could be improved with more details on the model parameterization, inherent errors therein, and the "take home" message of what is learned scientifically.

### **Line-item comments**

- There is still some "proof reading" needed to correct typos, inconsistencies, etc. throughout the paper, figures, equations. Some equations are not full described (e.g. Eq. 4) and some figures could use further clarity in terms of colors and legends. Following are mostly such items:
- Line 11: "online" -- shouldn't that be "inline" -- it is a more common way to describe coupling "inline or offline".
- Line 38 (entire paragraph could use rewording -- better "the transfer of the ECOSMO II model to a different...)
- Line 45: Comma after which, no comma after that ( consistency throughout the paper for easier reading and clarity).
- Line 71: "description"
- An introductory atlas-like figure (indicate where Station-M is, etc.) of the domain, with a temperature or density climatology background or similar, will benefit the introduction -- perhaps in combination with Figure 2 or complementary to Figure 2.
- Line 229: Not clear - reword.
- Line 271: "The consistent late spring..." needs rewording or a comma (before and) or separate into 2 sentences.
- Figure 3 and Figure 4 seems redundant for the fields that overlap. Figure 3 may benefit from a ~surface-100m integrated quantity and will cut the redundancy and give a better assessment of the water column constituency.
- Line 285: Fig.Fig repeated
- Line 293: ...maxima are...
- Line 313:... concentration ranges...
- Line 315: ...the lower nstd is underestimating...
- Line 340: ... ". The model..."
- Line 341: "primary production shows"
- Line 348: ... ". The southern part..."