

Responses to Reviewers' Comments for Manuscript egusphere-2025-4190

Assessment of transparent exopolymer particles in the Arctic Ocean implemented into the coupled ocean–sea ice–biogeochemistry model FESOM2.1–REcoM3

Addressed Comments for Publication to
Geoscientific Model Development

by

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Dear Chia-Te Chien,

Please find enclosed the revised version of our previous submission entitled “Assessment of transparent exopolymer particles in the Arctic Ocean implemented into the coupled ocean–sea ice– biogeochemistry model FESOM2.1–REcoM3” with manuscript number egusphere-2025-4190. We would like to thank you and the reviewer for the appreciation of our efforts in replying to the first review. We have addressed the remaining reviewer’s comments in the manuscript. A summary of main modifications and a detailed point-by-point response to the comments are given below.

Sincerely,

Moritz Zeising

on behalf of all authors

Note: To enhance the legibility of this response letter, all the reviewers’ comments are typeset in blue boxes followed by our reply. Rephrased or added sentences in the manuscript are typeset in grey boxes. The respective parts in the manuscript are highlighted to indicate changes. When referred in the text, line numbers point to the revised version of the manuscript. Figure numbers are referenced likewise to the revised manuscript and linked to the automated L^AT_EX numbering in this response letter.

The L^AT_EXtemplate for this response letter was provided by Karl-Ludwig Besser (<https://github.com/klb2/>).

Authors' Response to Reviewer 1

General Comments. The authors have done a great job addressing my previous comments. Their responses in itself are very thorough and comprehensive, which I much appreciate and hope that they can use them to further advance their model in this area (e.g. climatic impacts of PCHO and TEP).

Response: Thank you for your feedback. We appreciate your satisfaction with our efforts in responding to your comments. In the following, we briefly address your newly raised comments on the manuscript.

Comment 1

L419: mg m-3

Response: Thank you for the comment. We included a space for correct unit formatting (L. 419):

TChla of approximately 1–3 mg m⁻³

Comment 2

L446: shelve => shelf

Response: Thank you for the comment. We corrected the spelling (L. 446):

Additionally, the evaluated regions of the model run contain the whole continental shelf grid points...

Comment 3

L515: western Fram Strait

Response: Thank you for the comment. We corrected the geographical description (L. 515):

July 2017 in western Fram Strait...

Comment 4

L527: Thus

Response: Thank you for the comment. We corrected the spelling (L. 527):

Thus, we assume that the implementation of PCHO and TEP might result in a better fit to in situ measurements.

Comment 5

L536: $7.1+/-5.2$

Response: Thank you for the comment. We corrected the statement (L. 536):

$7.1\pm 5.2 \mu\text{g CL}^{-1}$ in September, 0–100 m

Comment 6

L550: shaped by sea ice ..

Response: Thank you for the comment. We followed your suggestion (L. 550):

Each measurement depends on a very local set of ecological conditions shaped by sea ice concentration, nutrient availability, and phytoplankton blooms.

Comment 7

L557: in a very

Response: Thank you for the comment. We corrected the sentence as suggested (L. 557):

Firstly, the Catlin Ice Base measurement in the Canadian Arctic Archipelago, where Wurl et al. (2011) obtained their measurements from an under-ice phytoplankton bloom, which resulted in a very high production of TEP.

Comment 8

Fig. A7 caption: northern

Response: Thank you for the comment. We corrected the figure caption:

Depth profiles of transparent exopolymer particle (TEP) concentration in the upper 100 m as monthly mean of the years 2000 to 2019 for the Arctic Ocean (panel a), the northern hemisphere (panel b), and the southern hemisphere (panel c).

Comment 9

Fig. A3: check units for DFe.

Response: Thank you for the comment. We corrected the units for DFe, the figure can be found as Figure 3 in this document and as Supplementary Figure A3 in the manuscript.

Comment 10

Additionally, if possible, please adjust the thickness of the colorbars in panel (d) of Figure 3, and panels (c) and (f) of Figure 5, to be consistent with the other panels.

Response: Thank you for the comment. We resized the colorbars in Figure 3 and Figure 5 as suggested, as well as in Supplementary Figure A3. The figures can be found below.

Modified/added figures

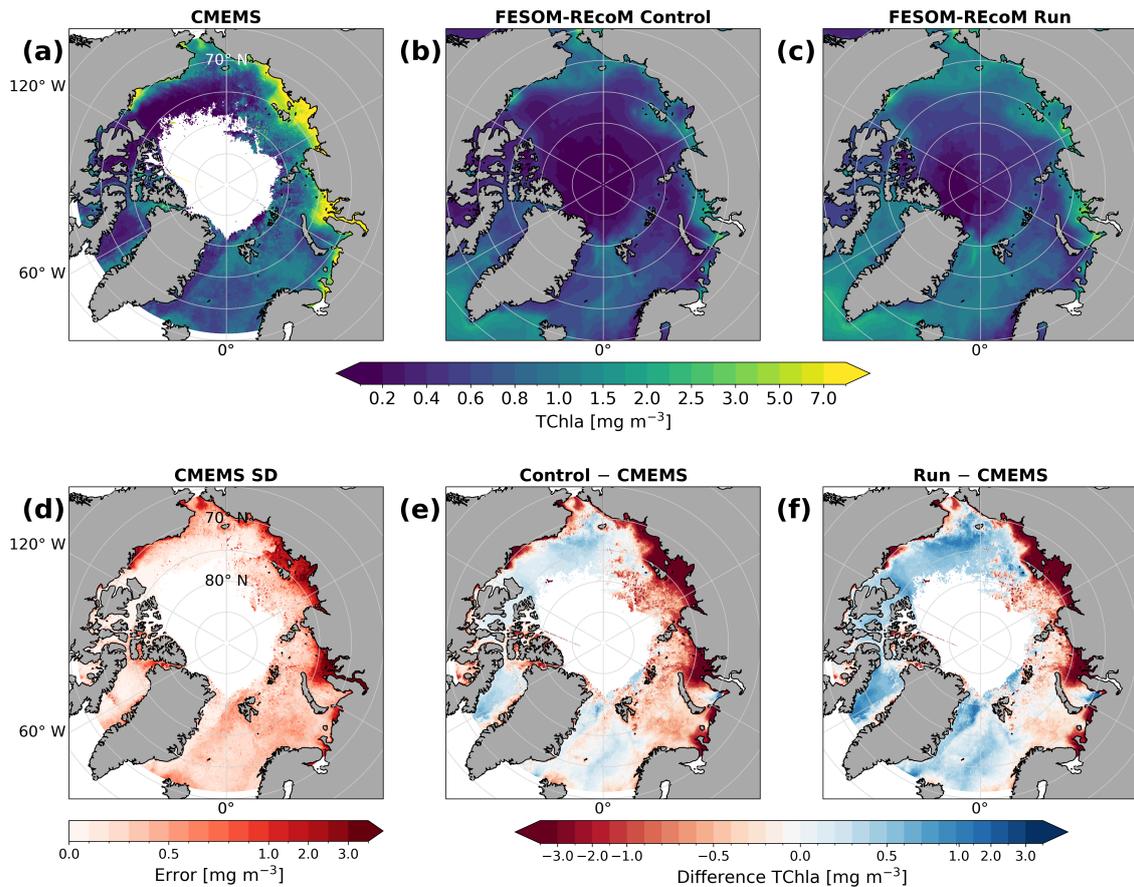


Figure 3: Maps of surface total Chlorophyll *a* (TChla) of Copernicus Marine Environment Monitoring Service level 4 monthly reprocessed Arctic Ocean Color product (CMEMS, panel a), of the FESOM2.1-REcoM3 control run without TEP (Control, panel b), of the FESOM2.1-REcoM3 run including transparent exopolymer particles (panel c), the standard deviation of TChla stated by CMEMS (SD, panel d), the difference of the control run compared to CMEMS (panel e), and the difference of the run including transparent exopolymer particles compared to CMEMS (panel f) as average of May to September of the years 2000 to 2019. CMEMS data does not cover the central Arctic Ocean.

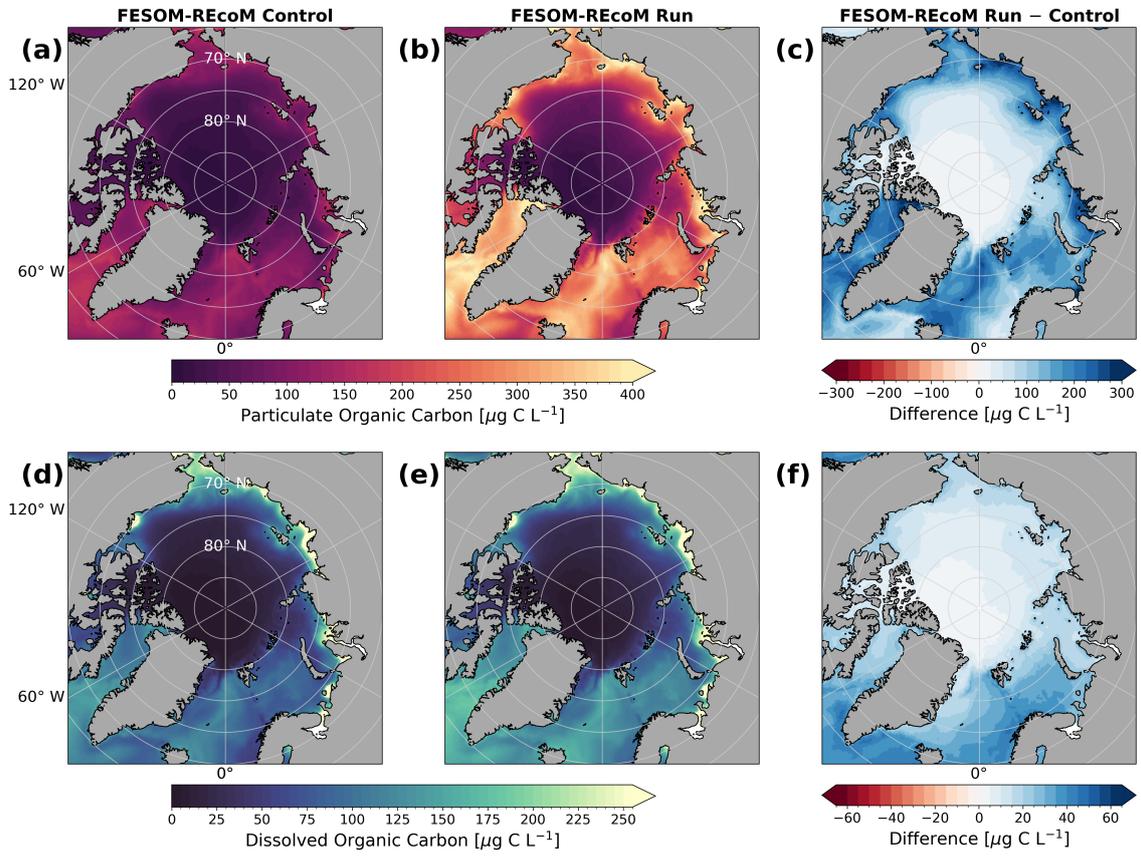


Figure 5: Maps of volume-weighted organic carbon concentrations of the upper 30 m of the FESOM2.1–REcoM3 control run (first column) compared to the model run (second column), and their differences (third column). The panels depict particulate organic carbon concentration as sum of diatoms, small phytoplankton, TEP and detritus (first row, panel a-c), and dissolved organic carbon (second row, panel d-f) as average of May to September of the years 2000 to 2019.

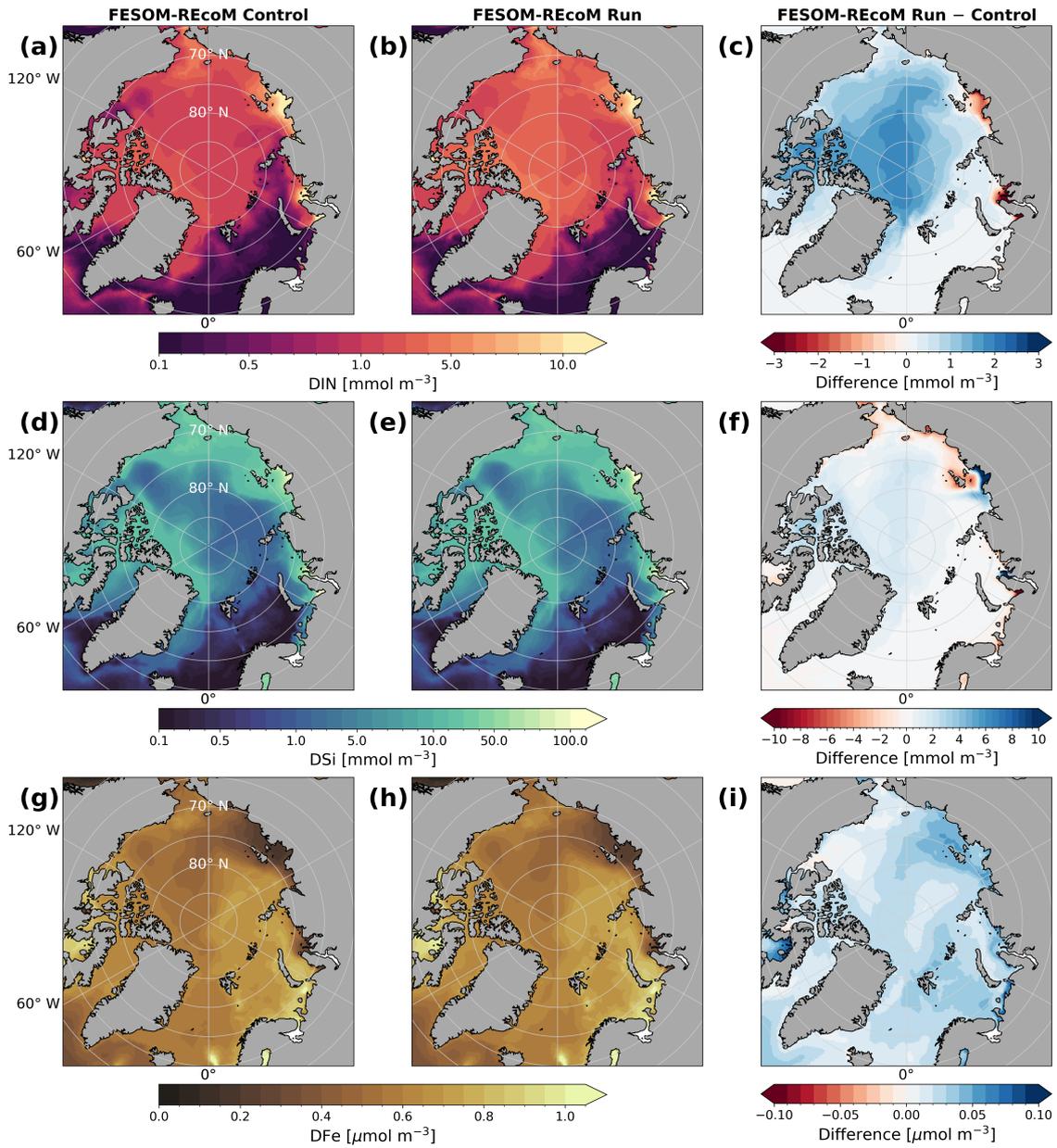


Figure 3: [Supplementary Figure A3] Maps of volume-weighted main nutrient concentrations of the upper 30 m of the FESOM2.1-REcoM3 control run (first column) compared to the model run (second column), and their differences (third column). The panels depict dissolved inorganic nitrogen (first row, panel a-c), dissolved silicic acid (second row, panel d-f), and dissolved iron concentration (third row, panel g-i) as average of May to September of the years 2000 to 2019.