Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-392

Anonymous Referee #1

Referee comment on "Adaptive time step algorithms for the simulation of marine ecosystem models using the transport matrix method implementation Metos3D (v0.5.0)" by Markus Pfeil and Thomas Slawig, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-392-RC1, 2022

General Comments:

I went through the manuscript from the beginning to the end twice carefully. As an ocean biogeochemistry modeler, I found the manuscript is very hard to understand and follow. It was not like a model technique paper, but more like a bunch of model testing results report. I reject the paper and provide my comments below for authors to improve in the future.

Specific Comments:

- **The model technique that was intend to address**

The prepared manuscript tried to improve the time step selection in the transport matrix method (TMM). It argued the used time step affects both the computational effort and accuracy of the steady annual cycle computation. I think both the "computational effort" and "steady annual cycle" should be well explained in the introduction part. What are they? Are they being recognized as a common problem in previous research? How that impact the follow modelling results? It was very hard to feel the importance of the

technique problem presents in so far writing.

- **Experiment design and way to present results**

"The experiments are designed to shorten the running time of the computed steady annual cycle. The accuracy and cost save the calculated approximation. It was very hard to understand the present results from so far figures and tables." Why not have a figure to show what is the non-steady state annual cycle globally look like and what a steady state annual cycle looks like? Why not have comparisons between on- and off- line methods to show how they impact the steady annual cycle and the accuracy. It was also very hard to tell how much accuracy has been improved and cost saving was necessary from so far results.

It will be good to read and learn the cited manuscript "Accelerated simulation of passive tracers in ocean circulation models" carefully and learn how to present results like this to guide the reader. Another good example is "Performance of offline passive tracer advection in the Regional Ocean Modelling System" by Thyng et al. on GMD

- **Mathematical forms**

` I felt there was too much details about how to get A from B, which are very annoying to follow the final results. It should be provided in the supplementary material. It should also provide some math in matrix form, which will be easier to follow

Technical Corrections:

L68-L71:

"Due to the fully coupling of the ocean circulation with the tracers, ……, the tracer concentrations affect the circulation, the simulation of a fully coupled model … to single model evaluations."

It was not correct to say this. Commons like this for online and offline methods should be careful. Online coupling is a mature technique and widely used. With the development of the computational source, the computational cost is not that high. It was true the offline model will be more efficient, but it was also difficulty in accurately representing vertical fluxes due to deep convection.

L83:

"No fluxes on the boundary"

Need to state all experiments are for global run.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2021-392/gmd-2021-392-RC1-supplement.pdf