

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2020-375

Anonymous Referee #2

Referee comment on "WAP-1D-VAR v1.0: Development and Evaluation of a One-Dimensional Variational Data Assimilation Model for the Marine Ecosystem Along the West Antarctic Peninsula" by Hyewon Heather Kim et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-375-RC2>, 2021

General comments

This work develops a one-dimensional data assimilation model for the West Antarctic Peninsula and compares the model output with data from the Palmer Long-Term Ecological Research site. Overall, this paper provides a useful model to aid in data assimilation techniques and modeling efforts for the WAP. One general comment is that it would be beneficial to describe how well the optimized and updated parameters compare to measured parameter values from the field, lab, or both. That is, are the optimized and update parameters realistic or is there no baseline?

Specific and technical comments are described below as further suggestions to improve the manuscript.

Specific comments

Lines 72-73--Can you please provide support for the appropriateness of including just two phytoplankton groups (diatoms and cryptophytes) in this region?

Lines 130-135—The authors mention microzooplankton had a limit on the amount of diatoms they grazed and instead grazed cryptophytes to be able to simulate elevated diatom Chl. Can you comment on the ecological appropriateness of these grazing dynamics? That is, is there evidence to support that this prey switching occurs? What other mechanisms might lead to elevated diatom chlorophyll beyond microzooplankton changing their food preferences?

Lines 159-160 state that microzooplankton growth is based on grazing on cryptophytes and bacteria, while krill growth is based on grazing on diatoms and microzooplankton. However, in lines 130-135, the authors mention there is a limited amount of microzooplankton grazing on diatoms. Please reconcile this information. Does it mean the limit grazing mentioned in lines 130-135 is no grazing on diatoms by microzooplankton? That would contradict lines 74-75. Line 317 also mentions microzooplankton only grazing on bacteria and cryptophytes.

Relatedly, in Fig. 1, there are two grazing arrows going from diatoms to microzooplankton and no grazing arrows for cryptophytes. Please reconcile this figure with information in the text.

Line 224 and Table 2 – Consider indicating the literature sources from which the model parameters were taken.

Fig. B1 – can you please clarify what you mean by “Errors represent how much larger model output is compared to observations”?

Fig. 5—Can you please clarify what is leading to the oscillating patterns seen in the model state variables such as diatoms and cryptophytes?

Technical corrections

Line 153 – should the sentence read “...by remineralizing NH₄ and PO₄ if C is in short” rather than “if C in short”?

Line 428—should this read “There could be several additional...” instead of “There would be several additional...”?

Lines 467-468, 473—the citation formatting changed. Please fix it to be consistent

Fig. 3, 5, 6 – consider putting the year on the x-axis

Fig. 5 – the caption should be updated with the correct figure (presumably not “Figure SX”)

Fig. 7 – The arrows in this figure are presumably for the same processes in Fig. 1. Consider labeling them and/or referencing the reader to the arrows in Fig. 1, assuming that is appropriate.