Dear Dr. Yool,

Thank you for your patience with this manuscript revision. Please see our responses below.

Dear Authors,

Thank you for your revised manuscript and response to your referee.

I have examined both and find that most of the issues raised by the referee have been sufficiently addressed. However, I have listed below a few points where I believe that the manuscript could be made clearer:

- Regarding your statement “We can not plot the vertical distribution of sinking opal because we do not model this quantity explicitly”, it should be possible, even with implicit variables, to plot the vertical distribution of sinking opal (and/or its dissolution). It may be that you have not stored this diagnostic output, but that is different. As the description of this process is clearly complicated, if you could plot a profile of the opal flux or its dissolution, that would help readers.
We have now included a new Fig. 2 which provides fluxes of implicit opal, opal dissolution, and loss to the seafloor.

- Regarding Table 6, the seafloor Si fluxes at the 3 depth-bands don't sum to the total. Since there's no overlap in the bands, this is a little surprising. What's the explanation?
This was a mistake on my part, for which I apologize. While I had a script for calculating the depth bands, it appears I did not use it when I entered the values and used a mix of k vs z gridding in Ferret, which produced inconsistencies. The numbers are corrected and sum to the total.

- Also regarding Table 6, the KMBM3 model appears to have completely flipped the dominance of phytoplankton from LP (96.2% to 5.5%) to diazotrophs (3.8% to 81.8%), but there is only slightly more N2-fixation (+25%). Is this the correct interpretation? While your text already acknowledges that your diazotrophs can uptake nitrate rather than fix N2, this isn't as clear as it could be when the phytoplankton types are introduced (ln. 75-78).
Yes this is correct. We have clarified this now at lines 75-78:
“slow growing phytoplankton which can fix nitrogen when necessary, including diazotrophs”

- Ln. 82: your amendment here is still ambiguous. Could you rephrase as "lost due to burial at the seafloor"? The referee rightly questions whether all material reaching the seafloor is “lost”, or whether it is just a fraction of this.
I apologize that the amendment was inadequate. Burial is not modelled explicitly, but the model prescribes a loss based on opal flux rate. The language is changed to:
“is lost due to implicit burial at the seafloor”

- Ln. 118: Are you just describing Leibig's law here? That is, realised growth is a function of potential growth multiplied by the strongest limitation factor. If so, it may be worth simply noting this.
Yes, thank you. This is now explicitly stated:

“These equations are applied to obtain maximum possible growth rates as a function of temperature and nutrients following Liebig’s law of the minimum”

- Regarding eq. 8 and ln. 129, the amendments are OK, but would these read more straightforwardly if the numbers were expressed in mmol Si / m3 rather than mol Si / m3? Eq. 8 would then become something like ... k_si = 0.8 + 7.2 * ([Si] / (30 + [Si]))

The units are changed back to mmol. Early on the units were in mmol, but I recall an early reviewer requested consistency.

- Regarding your statement “As with CaCO3, opal produced by diatom losses to the bacterial loop are not considered”, perhaps it may help to add a qualification like the following: "In linking opal production to diatom mortality, our model essentially focuses on the importance of its export pathway in establishing vertical gradients. Opal that is not exported is effectively assumed to be recycled to dissolved silicate within the surface layer."
This is added as a new sentence (L 228)

As an aside, I also noticed that your revised manuscript also contains mark-up that should really only appear in the tracked-changes version.
I apologise for this. Two different versions are uploaded in this iteration. In the marked up version the colour for the most recent modifications are shown in blue.

If any of the above points are unclear, please get in contact with me. Hopefully these should only be minor amendments.
Thanks again for your patience and assistance with this manuscript.

Best wishes,
Karin

With best regards,

Andrew Yool