

Biogeosciences Discuss., referee comment RC1
<https://doi.org/10.5194/bg-2022-105-RC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on bg-2022-105

Anonymous Referee #1

Referee comment on "Influence of GEOTRACES data distribution and misfit function choice on objective parameter retrieval in a marine zinc cycle model" by Claudia Eisenring et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-105-RC1>, 2022

Review of "Influence of GEOTRACES data distribution and misfit function choice on objective parameter retrieval in a marine zinc cycle model" by Eisenring et al.

The authors used numerical models and an optimization technique to explore how the spatially variable Zn:P uptake ratios by phytoplankton can be constrained by synthetic observations. The authors focused on how limited spatial data coverage, model circulation uncertainty, and the choice of objective function, which constitute three major sources of uncertainty in data-model assimilation studies, influence the optimization results. I found the results informative and potentially important to the marine bio-geoscience community. The manuscript is overall well-written except for some minor points listed below.

Main point:

(1) The only major concern is that this study might appear to be esoteric and technical to many readers if model-derived synthetic data are the only target. More specifically, the numerical experiments performed and the results discussed here seem to be an important preliminary step towards using the real (not synthetic) observations to constrain the model formulation of the variable Zn:P uptake ratios. Why don't the authors use the best observation data coverage, the best ocean circulation model, and the best objective function to suggest the best estimate for the relationship between Zn:P uptake ratios and Zn? Has this optimization been done already or is this beyond the scope of the current study? When I came to the section 3.7, I expected something along the line, but was disappointed by reading what has been already written and some discussions only. Perhaps, a previous study already found an optimal estimate for the parameter set, which was used as a reference parameter set in this study? Even if so, it would be worth being stated.

Minor points:

(1) I can see the role of three parameters, i.e., a , b , and c in Equation (2), in determining the relationship between Zn:P uptake ratio and Zn. However, how the ligand concentration L is controlling the relationship is not clear. Is there a formulation relating L and the Zn:P uptake ratio or a formulation relating L and Zn^{2+} ?

(2) In Figure 2, the line color for the parameter “ a ” does not match between the legend and plots. In the legend, it looks like purple to me while it is black in the figures.

(3) I am having difficulty in interpreting Figure 10. What do the X-axes represent in panels (e) and (j)? What do the different lines represent in other panels? (e.g., ‘refALL’, ‘refIDP’, ‘xALL’, and ‘xIDP’)? Are these labels defined in the text or in the figure caption?

(4) The authors discussed additional uncertainties that would rise when applying the optimization to the real observation data in Section 3.7. What about uncertainty in external inputs of Zn (aeolian deposition and coastal sediments, etc.) to the ocean surface? Is it minor compared to the uncertainty associated with model parameterizations of biogenic Zn cycles?