

Biogeosciences Discuss., referee comment RC3
<https://doi.org/10.5194/bg-2021-156-RC3>, 2021
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Comment on bg-2021-156

Anonymous Referee #3

Referee comment on "Modeling cyanobacteria life cycle dynamics and historical nitrogen fixation in the Baltic Proper" by Jenny Hieronymus et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-156-RC3>, 2021

Jenny Hieronymus et al. Modeling cyanobacteria life cycle dynamics and historical nitrogen fixation in the Baltic Sea

This study incorporated a cyanobacterial life cycle model with phosphorus dependency, which improved the prediction of diazotrophic cyanobacterial blooms in the Baltic Sea. The research is quite interesting and challenging; however, I found the whole manuscript lacks a clear hypothesis, clear clarification of why phosphorus is important, and the interpretation of results is not deep enough. I could see that the authors were trying to explain the methodology as it is a complicated study, however I got lost easily as there is not a clear approach or conceptual diagram to lead the readers. I have also got a few major concerns as listed below.

Introduction

From the manuscript it is not clear to me phosphorus utilization of the diazotrophic species is important in the Baltic sea, and what critical roles P plays in the dominance of the three species.

Methods

Fig. 2 seems very complicated and busy to me, and I cannot tell what processes the authors have modelled and tried to test. What is your hypothesis? To someone who is not familiar with CLC model, I am suggesting the authors making Fig. 2 easier to follow, also by adding a conceptual diagram to illustrate what life cycle really means – what are the physiological processes, timescale, input conditions and output, etc.

Please also specify why CLC model needs to be modified to include P utilization. Did you mean by superior P uptake, P storage or DOP scavenging strategies?

L100 – why some of the predicted temperature were much higher? Please kindly explain the reason behind it.

L110 – But you could already see cyanobacterial species vary in physiology from a great many publications. I wonder if it could be better to allocate a range or different C:N:P ratios for the modelled species, maybe a sensitivity analysis could help you find out whether this ratio really matters for the simulated outcomes.

L125 – I am sure the internal nutrient quotas also affect the growth and life cycle transitions; however, I cannot tell if you have included internal nutrient quotas impacts. A schematic including how processes involved in the model, alongside the methodology of this manuscript may help clarify the uncertainty here.

Results and discussion

L565 – There are some extreme biomass values that were not predicted, why is that?