

Interactive comment on “Lagrangian characterization of nitrate supply and episodes of extreme phytoplankton blooms in the Great Australian Bight” by Paulina Cetina-Heredia et al.

Anonymous Referee #2

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General Comments

The authors study "extreme phytoplankton blooms" by analyzing model output to infer the source of nitrogen (geographic region, depth), timing, and location of these events. The motivation for the study is not clear: either the focus on the most rapid increases in chlorophyll or the consequences of knowing the sources of N consumed in these blooms. Their conclusions are that much of the N for these extreme blooms originates in the upper 100 m of the ocean between the Great Australian Bight and the Sub-Antarctic front. While this is an interesting analysis, the significance is not clearly communicated.

Specific Comments

C1

The paper is generally easy to understand, but key ideas are frequently undeveloped (why focus on extreme blooms). This particularly problematic in the discussion which I found to consist of many briefly mentioned and not clearly connected ideas.

Would the conclusions of the paper differ if the authors focussed on less extreme phytoplankton blooms? How much of total productivity is in these extreme blooms? (I see this is at page 7, line 10; an earlier motivational mention would be helpful.) Blooms take days to weeks to develop, why do you focus on such short periods (large daily changes)? Perhaps large growth rates would be worth a closer look?

I'm going to echo two comments by the other referee: (1) the study is based entirely on model calculations; some connection to remote sensing data or other observations would be most welcome, (2) the description of decorrelation / memory time should be expanded.

Technical Corrections

Abstract - "novel Lagrangian approach" - what is the value of stressing the novelty? You don't clearly explain why its novel.

"enters the GAB in the upper 100m" – sounds like this is a contrast with "stratification erosion is key supplying nutrients". Stratification erosion does not actually supply nutrients. Are you referring to entrainment of nutrients from below the nutricline? Which is it? Lateral advection or entrainment?

p1, l10. I think "regulates" is an overstatement.

p1, l15. This is an unusual use of the word "catchment".

p1, l17. "Coastal regions account for a significant.." this is vague. Can you be more precise?

p2, l12. "important implications": this is vague. What are the implications of "extreme blooms" (here called episodic) that justify the focus in this study?

C2

p2, l18. "first time": the focus on priority rather than your message is not helpful or needed.

p2, l20. I didn't find a disentangling of the mechanisms later in the paper.

p3, l10. Year missing from citation.

p3, l25. There is some good detail in this paragraph, but I found that I still have considerable uncertainty about what you did. For example, how is memory time defined and calculated?

p3, l28. I didn't understand "prevails", and thus the whole sentence escaped interpretation.

p3, l29. This is another vague explanation of "memory time". A rewriting of this paragraph would be helpful.

p4, l9. Do you really mean that the concentration gradient has a peak (trough?) here? Why does light create a sudden increase (decrease?) in the concentration gradient?

p4, l11. "were" should be "where"

p4, l14. What do you mean by "efficiency" here?

p5, l25. I don't think you need "respectively" here.

p6, l10-15. I found this difficult to follow. if 90% of the N is disappearing, does that imply rapid grazing tightly coupled to very short term increases (daily) in phytoplankton biomass? Are you sure your grazing model is good enough to draw these conclusions and make them interesting?

p8, l2. You compare to the effects of winds here, but I didn't see where you analyzed winds in your methods + results.

p8, l13-16. I found the focus on interannual features, which were not discussed elsewhere in the paper, to be jarring and confusing at this point. Might be very interesting /

C3

important, but should appear earlier, with some evidence or mention of analysis.

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C4