

## ***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.***

**B.F. Jonsson (Referee)**

bjonsson@princeton.edu

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The authors use output from a  $1/10^\circ$  GCM with biogeochemistry to assess sources of nitrate into the Great Australian Bight. They connect the input of nitrate to episodic blooms in the model. The analysis is conducted by applying Lagrangian particle tracking.

The paper has great potential and shows very interesting results. I have, however, some minor questions about the methodology and there is further analysis that might strengthen the authors' statements.

The study is entirely based on model data. It would be good to see a validation of the

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results from observations for example from remote sensing. Such data would show conclusively if/where/when the reported modeled production events occur in real life. There must be plenty of cruises with north-south transects in the area? If so, maybe you could compare the decrease in NO<sub>3</sub> along trajectories with the change between stations from such cruises.

It seems to me from figure 1 that the model significantly overestimates the drawdown of NO<sub>3</sub> in the central part of the study domain. This difference needs to be explored since it can dramatically change the relative importance of different NO<sub>3</sub> sources. Also, please use either hotter colors for high values or a truly sequential colormap in figure 1a. I thought for the longest times that green areas had lower levels of NO<sub>3</sub> than yellow areas.

Page 3 line 27 – page 4 line 11. I didn't follow how you calculated the decorrelation time of NO<sub>3</sub>. My interpretation is probably wrong since it doesn't make any sense, but it seems like you don't take absolute concentrations of source NO<sub>3</sub> into account? I'd recommend that you make this section more explicit, and that you write out how you apply the method from Emery and Thomson better.

Page 4 lines 14-28. It would be very useful to compare these values with growth rates from the model, which should be explicitly calculated by the NPZD module.

Page 5 lines 8-27. How do you take vertical diffusion of nutrients into account? I would assume that a significant amount of tracer below 100 meters could be transported in ways not picked up by the particle tracking?

How much of the NO<sub>3</sub> in GAB/SAFn as SAF originates from the southern or indian ocean? It's possible that some of the available nutrients in nearby areas in fact has been transported there from afar.

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