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Discussions

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Interactive comment on "Iron fertilization efficiency and the number of past and future regenerations of iron in the ocean" *by* Benoît Pasquier and Mark Holzer

Anonymous Referee #1

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General Comments: This is a review of "Iron fertilization efficiency and the number of past and future regenerations of iron in the ocean" by B. Pasquier and M. Holzer. The authors present a novel technique to track the life-cycle of dissolved iron (DFe) in the ocean. The authors apply the technique to multiple instances of data-constrained representations of the iron cycle and investigate how many cycles DFe parcels experience before and after participating in the biological pump. The authors use their technique to quantify the efficiency of iron fertilization on biological export, one of the motivations for their study. The manuscript is fairly well written, laying out clearly their novel technique, and they present well-designed experiments to utilize their technique. I think this manuscript will be a useful addition to the literature. I am making suggestions for some

minor changes and/or additions.

Specific Comments:

The abstract doesn't mention that the model used by the authors includes multiple types of external sources of DFe. I think it would be useful to mention in the abstract the types of external sources of DFe under consideration.

The notation for the nonlinear model in Section 2.1 deviates from the notation in the author's previous work (Pasquier & Holzer, Biogeosciences, 2017) (e.g., removal of the Redfield ratio for the uptake terms, and changed notation for the particle transport terms). I suggest that the authors either use the same notation as their previous work, or describe how and why the notation in the current work differs from the previous work.

There is no motivation given for the definition of the equivalent linear model in Section 2.2. I think the paper would benefit from having a paragraph describing what the goals/requirements of the equivalent linear model are, and how goals/requirements lead to the model that the authors are using.

While some symbols chosen for the various terms in the nonlinear and equivalent linear models do seem related to the processes being represented by the terms (e.g., U for uptake, R for regeneration, D for death), not all of the connections are clear (e.g., J for scavenging, L for uptake that gets exported). This makes is hard for the reader to keep track of which terms mean what. I suggest adding a table that describes, in terms of processes, what each symbol denotes.

Have you considered how a particular instance of the nonlinear model would respond to a substantial change to aeolian input, such as would happen in the LGM or a future climate change scenario. Does the technique presented shed light on how the nonlinear model would respond to this change in forcing? This could be mentioned in the Discussion section.