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Biogeosciences Discussions

Interactive comment on "Long-term response of oceanic carbon uptake to global warming via physical and biological pumps" *by* Akitomo Yamamoto et al.

Anonymous Referee #2

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The manuscript by Yamamoto et al explores through a large suite of experiments under fixed atmospheric concentrations the role physical changes in climate play on ocean carbon uptake. Their conclusions suggest, in contrast to other papers, that the change of circulation dominate the response. It took me a little while to get into this paper, but once there I enjoyed the paper much and really appreciate the larger number of simulations that went into this work - thank you. Overall this is well conceived and executed piece of work, that will be of interested to a wide readership. I do have some minor comments that I feel once addressed would strengthen the paper, otherwise I am happy to recommend this paper for publication.

Minor Comments:

1. The authors predicate the study on global warming, and state that global warming will decrease ocean carbon uptake. However in the present day, as CO2 levels continue to rise - the ocean will take up carbon at a rate proportional to this i.e. gradient driven. I do understand in this study, if we assume fixed CO2 levels then this supposition is correct, but I do think this needs to clarified in the text.

2. The study puts more heat and carbon into the ocean over a much shorter period than under CMIP3/5 change changes runs, even the business-as-usual scenario; this of course has implications for where the heat and carbon are stored. As the authors make a number comparison to these climate change runs - could they comment on what the implications of this maybe - perhaps on the timing of events e.g. sinks to sources etc, and whether its a fair comparison?

3. The experimental methods section is super critical to this paper, however I needed to read this at least 5 times to be really clear. I recommend that the authors break up the 3rd paragraph to make it more accessible

4. The study uses offline simulations, which make sense, could the authors comments on whether on or offline makes much difference - given the challenges of capturing short-term processes in the fields needed to run the model. I am sure that they have tested this somewhere, and if not it should be acknowledged.

5. The timescales calculated in the paper are based on a fixed atmospheric concentrations. In the real world i.e. driven by emissions, the ocean carbon uptake would significantly slow as the gradient between the ocean and atmosphere decreases. I think this probably needs to be mentioned in the discussion, as do the implications for timing of changes.

6. Otherwise some minor typos etc need to be addressed, but I am sure they will be picked in the proofs.