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Interactive comment on "Responses of the diatom *Asterionellopsis glacialis* to increasing sea water CO_2 concentrations and the effect of turbulence" *by* Francesca Gallo et al.

Anonymous Referee #1

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This manuscript looks at the combined effect of both ocean acidification and turbulence on the marine diatom Asterionellopsis glacialis. The authors found that the response to pCO2 in terms of growth rate, elemental stoichiometry and chain size was different in shaken cultures versus non-shaken cultures.

First off, I am excited to see a paper looking at how turbulence can affect cell growth especially as there appears to be a clearly different effect of pCO2 depending on whether the cells were shaken or not. However, I do not think the authors have adequately controlled pCO2 in the bottles (leading to uncertainty as to what actual CO2 concentration is being tested), nor have they quantified how shaking cultures translates into shear stress. I have discussed these concerns in more detail below. I strongly feel these

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issues need to be addressed before this manuscript is ready for publication.

Comments: I would like to see more quantitation of turbulence. How does a shaker at 200 rpm translate into shear stress around the cell? What are the cell size, shape and morphology and how do these factors, combined with the simulated turbulence affect shear stress on the cell? How does the turbulence created by the shaker relate to expected turbulence in the ocean?

I am very concerned with how the CO2 manipulations were monitored. CO2 concentrations changed significantly between the beginning and end of the experiment (especially for the high CO2 treatments). Stating that the CO2 treatment was the average of these two measurements (beginning and end) is not scientifically accurate. First, I doubt there was a linear change in CO2 over time and second, because CO2 concentrations are changing over time, it is uncertain what pCO2 the cells are acclimating/responding to.

I was not convinced by the justification of this experiment to future-world scenarios, where increased storm/wind events would create a more turbulent environment for diatoms. The paper by Moum and Symth, 2001, is a very general paper about increased wind and storm events. There needs to be a more specific discussion about how the intensity and duration of surface ocean turbulence in regions where chain-forming diatoms are found is predicted to change in the future. In addition there needs to be justification for how bottle experiments where phytoplankton have been acclimated to constant conditions for 18 generations translates to the duration and intensity of storm events in the ocean. Also needed is a discussion of how these extremely high CO2 concentrations ($\sim$ 3000 uatm pCO2) is relevant to a future scenario.

There were a quite a few spelling mistakes throughout the text that need to be addressed.

I think it would be useful to also measure cell size under these different CO2/turbulence treatments as I think this may help the authors interpretation of results.

The discussion (and references) presents a one-sided argument for diatoms increasing growth in response to elevated CO2. There is a large body of literature that the authors should acknowledge where no response or a negative response of diatom growth to increasing CO2 concentrations were found. See Table 1 in Gao and Campbell (2014) Functional Plant Biology 41:449 – 459 for a good summary of different CO2 manipulation experiments on diatoms showing enhanced, no effect and negative effect.

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