

Reviewer 2

RC2: 'Comment on egusphere-2023-2868', Anonymous Referee #2, 22 Jan 2024 reply

The manuscript entitled "Ocean alkalinity enhancement using sodium carbonate salts does not impact Fe dynamics in a mesocosm experiment" by Gonzalez-Santana et al., is an interesting manuscript in which a mesocosm experiment to study the effect of Ocean Alkalinity Enhancement over the iron fractionation and other physicochemical and biological variables is evaluated. Although the authors indicate that 1) some contamination problems could have happened because the experiment was not conducted under stringent trace metal conditions according to the GEOTRACES protocol and 2) the main conclusion is that "The iron size fractionation, concentration and iron-binding ligands data obtained supports the fact that the addition of sodium salts in this mesocosm experiment did not lead to significant changes in the iron cycle, i.e., did not alter the Fe cycle, therefore phytoplankton was not affected by changes in this essential element", in my humble opinion the present work deserves to be published after some minor changes. The purpose of the study (iron cycle under environmental changing conditions) is of great interest for the scientific community.

We would like to thank the reviewer for their inputs on our manuscript. We have accepted all minor comments requiring small modifications in the text and added a "Done" in each comment so as to confirm the modification. Answers to comments that required longer modifications are explained below each comment.

Minor comments:

Page 1, line 15. "consisting on the controlled variation of total..."

Done, we have modified the sentence.

Page 1, line 19. The differences between TdFe and dFe should be explained.

We have added a description of each. The new sentences is "Iron (Fe) speciation was monitored during this experiment to analyse whether total dissolved iron (TdFe, unfiltered samples), dissolved iron (dFe, filtered through a 0.2 µm pore size filter), soluble iron (sFe, filtered through a 0.02 µm pore size filter)..."

Page 1, lines 22 and lines 28. In my humble opinion, these messages are contradictory. "There were variations in Fe size fractionation..." and ..."this mesocosm experiment did not modify iron dynamics..."

After the addition of the carbonate salts, there were changes in the Fe size fractionation (Figures 2 b and c). However, conditions returned to background levels within the next sampling period. We have modified the text to clarify.

Page 6, line 120. The symbol "j)" after sampling should be deleted.

Done

Page 9, line 195. The symbol “” After mesocosm should be deleted.

Done

Page 9, line 213. Some information is missing after “Their variability...”

We have eliminated this sentence. It was left from a previous version of the manuscript.

Page 10, line 230. Authors talk about sediment resuspension. Is the mesocosm open in the bottom to consider this possibility? Please explain.

The idea behind the sentence was considering the initial water collection that would contain particulate iron within the samples. There could potentially be a small iron source due to opening the mesocosms during individual sampling. We have expanded the sentence so as to consider these factors “...which would increase initial Fe concentrations used in the mesocosms compared to open ocean locations.”

Page 10, line 239. This argument would be enriched by including the following study:

Cabanes, D.J.E., Norman, L., Santos-Echeandía, J., ... Laglera, L.M., Hassler, C.S., 2017. First evaluation of the role of salp fecal pellets on iron biogeochemistry. *Frontiers in Marine Science*, 2017, 3(JAN), 289.

We have added the recommended reference which fits nicely with the ideas in the paragraph.

Page 12, line 284. This statement is only true for treatment $\Delta 1500$.

We agree, we have modified the sentence to make this clear. The great increase was seen in this treatment for both parameters.

Page 12, line 301. Please change “...and biological” by “...or biological”

Done.

Page 13, line 306. This statement is only true for treatment $\Delta 1500$.

We have modified the statement to make it clear that this was observed in the $\Delta 1500$ treatment: “...particularly during the emergence of nanoeukaryotes blooms and peaks of *Synechococcus* in the $\Delta 1500$ treatment...”

Page 13, lines 316 and 317. Could this behaviour be associated to the buffering capacity of seawater?

Initially we thought the same. However, this behavior is observed in all mesocosms without having a correlation with the increase in alkalinity (and salt addition), therefore there should be some other factor influencing the decrease in cFe which is aggregated towards the pFe fraction.

We have added : “Nevertheless, the observable decrease is not proportional to the increase in alkalinity. Where other factors such as aggregation due to increases in particles or added mineral salts produce a short term cFe decrease.”

Page 13, line 319. What does CDR mean? Please explain.

It was explained in line 34 but not used again. We understand how it is very far from the first mention, so we have added the definition in this line.

Page 13, line 321. Please insert a space before “Also....”.

Done

Page 13, lines 320-321. comparison between the study carried put by Santana-Casiano et al., 2010 and the present study in which different salts that make the water more alkaline are added would be of great interest.

In the Santana-Casiano et al. (2010), the researchers investigated the effect of the major seawater ions on the Fe(II) regeneration. They observed that calcium and magnesium competed with Fe for the available organic compounds. On the other hand, sodium does not strongly interact with organic compounds.

We are planning future research studies considering olivine and calcium carbonate minerals where the studies following Santana-Casiano et al. (2010) will be required as explained by the reviewer. In the text we make a reference to this article so as to alert future mesocosm or natural experiments where other salts are added.

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