Response to comments from reviewer #1 on manuscript egusphere-2026-1597

We appreciate the thoughtful comments from reviewer #1. In this document, the reviewer comments are in black and our responses are in blue.

The manuscript by McElhany et al. examines how mCDR involving changes in carbonate chemistry could impact marine organisms and applies a qualitative systematic review approach to answer this question. They identify thresholds, defined as the level at which the first statistically significant result is found to determine when impacts occur. I consider this is a good approach. However, the manuscript itself has some major issues, including missing papers (and therefore responses). If the manuscript is revised to include all relevant work using appropriate methods, then I would be happy to provide more detailed comments on a revised version of the manuscript.

Major comments:

The authors should follow the procedure of PRISMA: https://www.prisma-statement.org/. Here, the search terms are not exactly noted, search dates etc. in the main methods. This has led to other issues. I can see that they are missing a number of studies that I can think of off the top of my head. For example, what about the work of Steeve Comeau? There are a handful of his papers that explore high pH and/or high TA (through high DIC). None of these are here. The manuscript must be reproducible and must be systematic if it is to be published.

We agree that the paper would benefit from a more explicit description of search terms and inclusion criteria. In response to this comment, we have already initiated an automated systematic review of Google Scholar involving 60 complex boolean search statements designed to identify all relevant papers. We plan to present the search results in a PRISMA style format.

With regard to the papers of Steeve Comeau highlighted by the commenter, we reviewed 85 papers on which he was an author. We did not identify any papers from which we could extract a threshold, as we have defined it based on the data presented in the paper. Although several of the papers do include treatment at high pH or alkalinity, they are generally present as part of a study on ocean acidification and the data are analyzed as a regression that included the high pH, pre-industrial treatments, and the low pH OA treatments. Since there was no statistical comparison of the control and pre-industrial treatment, we could not determine whether the high pH was or was not a threshold. Such determination might be possible with new statistical analysis of the raw data, but that is beyond the scope of our project. In the revision, we will note the Comeau and other OA-focused papers that have pre-industrial treatment and potential mCDR-relevant data that may be extracted with new analysis. We will also make clear that we are not re-analysing data from published papers.

I think it is confusing to use the term “studies” and “articles or reports” as being mutually exclusive. Instead of “studies” I would describe them as “responses”, a term typically used in the field of meta-analyses.

We defined a “study” as a combination of a particular exposure set and a particular species or community, sometimes made up of a succession of experiments. With our terminology, an article can report on multiple studies, and a study can include multiple measurements that result in more than one “biological response”. For example, a study might result in a mortality threshold at one exposure level and sub-leathal threshold at a different exposure level. The data points in summary plots (Figures 7 and 8) could therefore be considered a “response”. We find the use of the term “study” helpful in clarifying the hierarchy of paper -> study -> response. In revision, we can highlight these definitions and how the terms are used in meta-analysis.

The figure quality needs to be improved for this work to be published. The text is currently grainy (and font sizes inconsistent), and the internal gridlines could be removed, colours improved etc.

We will modify the figures as needed to ensure that they meet Biogeosciences resolution and formatting requirements. The color palette (Obabe-Ito) is designed to be colorblind accessible, as requested by Biogeosciences editors. We can remove gridlines as recommended by the reviewer.

Minor comments:

The table legends and tables should be on the same page (except table 5, where are the others?). E.g. the one on Diatoms. This could be better suited in the supplementary materials.

Page breaks will be resolved with final formatting.

The results section is far too long and very list like at time.

We will edit the results section so it is more concise and move some of the information to the supplementary material.

The supplementary data set should provide studies in alphabetical order.

The file “mCDR threshold database references.doc” provides full citation information for all the papers in alphabetical order. We will sort the “mCDR thresholds database 2026_02_12.csv” file so that the rows are in alphabetical order.

Could line numbers please be added in order to facilitate review?

The pre-print does have line numbers. We are not sure why they were not visible to the reviewer.

The introduction presently has too much results. This is an odd approach. Introduce the topic, its importance and relevance and then (maybe) discuss the results at the very end of the introduction.

Although the introduction includes background information on how mCDR carbonate chemistry may affect biology, the introduction does not include any of the data from our review of thresholds. Therefore, we do not believe that the introduction includes any results from our analysis.

Page 4: a lot more references required. Here and elsewhere. If it is not a novel finding, please use a reference to introduce the point.

Page 4 contains general background information so we primarily cited overview documents rather than a lengthy list of references. However, we will ensure that there is a citation accompanying every sentence on page 4. The additional references will include 1) Boyd PW, Bach LT, Hurd CL, Paine E, Raven JA, Tamsitt V (2022) Potential negative effects of ocean afforestation on offshore ecosystems, . Nat Ecol Evol 6:675–683, doi: 10.1038/s41559-022-01722-1, and 2) Oschlies A, Bach L, Fennel K, Gattuso J (2025) Perspectives and challenges of marine carbon dioxide removal, and 3) Peltola P, Bajamundi C, Hakala J, Komatsuzaki Y, Maeda K (2026) Electrochemical approaches for direct ocean capture of CO2: Status, challenges, and future perspectives, Frontiers in Climate. doi: 10.3389/fclim.2024.1506181.

Box 2 the figure should be elementary for many readers. The authors should focus on the table, being more specific about what methods have been proposed to induce OAE and what chemical effects this would have for example. Are all the methods equal? These are the things important to the readers.

The focus of our paper is on how organisms respond to changes in carbonate chemistry. Although in the introduction it is important to state that mCDR affects carbonate chemistry and that changes in carbonate chemistry are method-specific, we needed to keep this section concise, because it is not our focus. There are many other references that go into detail on the potential exposures that can be generated by each of the mCDR methods and we will add more citations to address this concern. However, as we explicitly state in the introduction (line 201), “In this paper, we did not attempt to characterize where, when or how organisms might be exposed to conditions that exceed thresholds in the field.” Comparing the relative risks of mCDR methods from changes in carbonate chemistry is outside the scope of our paper. Some additional references we will add to this section are 1) Doney S, Wolfe W, McKee D (2025) The science, engineering, and validation of marine carbon dioxide removal and storage, Annual Review of Marine Science. doi: 10.1146/annurev-marine-040523-014702 , and 2) Findlay HS, Feely RA, Grabb K, Jewett EB, Keister EF, Kitch G, Artioli Y, Bhadury P, Blackford J, Crabeck O, Ghosh A, Li Y, Lowder KB, Mehta S, Salaah SM, Ragazzola F, Wright-Fairbanks L (2025) Perspectives on Marine Carbon Dioxide Removal from the Global Ocean Acidification Observing Network, Oceanography. doi: https://doi.org/10.5670/oceanog.2025.e308 .