

REVIEW

Calcium carbonate dissolution rate changes under future climate scenarios

Trossman (2026)

The manuscript by Trossman investigates the changes in CaCO_3 dissolution rates under different future climate scenarios, including scenarios involving geoengineering interventions. The study builds upon the methodological framework developed by Sulpis et al. (2021). The research topic is relevant, particularly in light of recent studies that have revised our understanding of the distribution of CaCO_3 dissolution throughout the water column and have already highlighted detectable impacts of climate change, especially at regional scales.

However, the manuscript suffers from severe shortcomings in its framing, organization, synthesis, clarity, coherence, and overall quality. As a result, it is extremely difficult to follow and leaves a very poor overall impression. Both the scientific approach and the way the work is communicated raise serious concerns. Reviewers are not expected to reconstruct the authors' reasoning or conduct an investigation to decipher the content of a manuscript. In my opinion, the manuscript falls well below the standard that should be expected before submission to an international scientific journal.

I will therefore limit my review to a few major comments, as the manuscript requires substantial and fundamental revisions before a detailed assessment of the science can reasonably be undertaken.

Major comments

1. Manuscript content

The scientific messages conveyed by the manuscript are not sufficiently supported by the analyses presented and therefore appear insufficiently robust. For example, the conclusion that salinity is the dominant driver of changes in CaCO_3 dissolution rates is not convincing due to the methodology employed. Similarly, the geoengineering component remains largely descriptive and lacks the level of synthesis and critical analysis required to provide conclusions. Finally, the section on suspended sediments appears largely disconnected from the rest of the manuscript, making it difficult to understand its role in the overall scientific narrative.

2. Manuscript structure

The overall structure of the manuscript requires a thorough redesign. Different sections overlap substantially, making the manuscript difficult to follow and unnecessarily confusing.

- The Methods section is particularly problematic. It is far too limited to provide readers with a clear understanding of the methodology, while methodological information is scattered throughout the manuscript instead of being presented in a dedicated section (e.g., lines 88-93, Fig. 2, and lines 210-221).
- The Results section mixes methodological details, evaluations, results, and discussions without any clear organization. In addition, the distinction between the CMIP6 and GeoMIP analyses disappears from approximately line 170 onward, where both are discussed together despite remaining within the GeoMIP section.
- The manuscript lacks a genuine Discussion section, while the Conclusions section is excessively long and contains extensive discussion that should instead appear in a dedicated Discussion.

3. Methods

The methodological description is far too incomplete for readers to understand what has actually been done, and it is clearly insufficient to ensure reproducibility. Overall, the section lacks clarity, logical progression, and internal consistency. Concepts are frequently introduced without adequate explanation before being used in the analysis.

For example, the introduction of seawater excess alkalinity (Alk^*), seawater age, and their relationship with CaCO_3 dissolution rates is much too brief. Without consulting Sulpis et al. (2021), it is difficult to understand the methodological framework underlying the study. Likewise, the introduction of temperature, salinity, mean age, and dissolved oxygen concentration as explanatory variables comes without explanation regarding how these variables are incorporated into the analysis.

The descriptions of the CMIP6 and GeoMIP experiments are intertwined when they should instead be presented separately and clearly. Essential information regarding the climate models is omitted, forcing readers to retrieve this information from previous publications. Conversely, material that corresponds to discussions is included in the Methods, further reducing the readability of the manuscript.

4. Figures

The figures are well below the standard expected for publication. There are too many figures and very little effort has been made to synthesize the results into a coherent and accessible story. Rather than helping the reader identify the key findings, the figures largely add to the confusion.

Figures suffer from poor readability, including small or missing labels, insufficient resolution, the absence of sub-panel lettering, and incomplete legends that make it difficult, or sometimes impossible, to distinguish the different curves or interpret what is being shown. Overall, the figures require substantial redesign to improve both readability and scientific communication.