

Response to Referee #1's comments:

Thank you very much for your time and effort in reviewing our manuscript and providing valuable comments, which have greatly helped us in revising the manuscript. We have carefully read your comments and have revised the manuscript in accordance with your suggestions. Our responses to each comment are provided below.

Overview: "please change the title and use plural for scenario"

We have changed the title into "*Carbonate mineral saturation states in the East China Sea: present conditions and future scenarios*"

Detailed comments:

P5558, L10, for magnesian calcite is not defined by this equation. Please refer to Walter, L.M. and Morse, J.W., 1984. Magnesian calcite stabilities: A reevaluation. *Geochimica et Cosmochimica Acta*, 48: 1059-1069. if you intent to discuss Mg-calcite, although I suspect this mineral is not needed in the context of this paper.

We agree that Mg-calcite is not needed in the context of this manuscript. Therefore, we have deleted magnesian calcite from the text.

P5558, L26, it should be more CO₂ is dissolved in seawater as low temperature facilitate this dissolution.

We have revised the sentence as follows: "*because cold temperatures facilitate CO₂ dissolution and thus precondition the seawater in high-latitude regions to have lower saturation states of calcium carbonate compared to temperate and tropical regions.*"

Throughout the text, pH at 25°C could be written as pH₂₅ (subscript) to reduce the redundancy.

pH at 25°C has been replaced by pH₂₅ throughout the text.

P5570, L15-18, it is still higher DIC/TA ratio in low temperature environment. The authors may want to point this out in the beginning.

Agree, and we have revised the sentence as follows: "*This discrepancy can be partially attributed to the fact that the higher temperature on the subtropical ECS shelf decreases the solubility of CO₂ and preconditions the bottom water to have lower DIC/TA ratio and thus higher carbonate saturation states compared to that in the cold bottom water on polar shelves.*"

Sections 4.2. and 4.4, it appears that the authors derived the projected Ω for surface and

bottom waters differently. Although it may not matter much, I would suggest that they stick with one (i.e., ΔDIC) instead of applying future CO_2 to the CDW directly, as production of biomass could probably maintain a CO_2 equilibrium in the surface water regardless of air CO_2 level.

We understand that using the equilibrium approach to project future changes in carbonate chemistry may be subject to the uncertainty in the status of air-sea equilibrium. For the surface water being under-saturated with respect to CO_2 (generally corresponding to the highly productive areas such as the CDW area), the equilibrium approach may over-estimate the decrease of carbonate saturation states. Unfortunately, to our knowledge, the only approach that can provide a projection by accounting for air-sea CO_2 disequilibrium is based-on global-scale ocean models (Orr, 2011), which is apparently beyond the scope of the present study. Therefore, the equilibrium approach is conventionally adopted by the non-modelers to conduct a first-order estimation on the future change of carbonate chemistry. For instance, Jiang et al. (2010) used the same approach to predict surface water $\Omega_{\text{aragonite}}$ by the year 2100 at a monthly time scale in the South Atlantic Bight. In order to remind readers of the indigenous uncertainty in the equilibrium approach, we have added the following paragraph to the revised manuscript: *“As a result, under the assumption of air-sea equilibrium, the projected Ω_a decrease between the present day and the year 2100 would be larger for waters with a higher chemical potential for atmospheric CO_2 sequestration (corresponding to the larger reciprocal of the Revelle factor in Fig. 7b), suggesting that the projected Ω_a decline in the highly productive CDW area may represent a high-end estimate.”*

References:

Jiang, L.-Q., Cai, W.-J., Feely, R. A., Wang, Y., Guo, X., Gledhill, D. K., Hu, X., Arzayus, F., Chen, F., Hartmann, J., and Zhang, L.: Carbonate mineral saturation states along the U.S. East Coast, *Limnol. Oceanogr.*, 55, 2424–2432, 2010.

Orr, J. C.: Recent and future changes in ocean carbonate chemistry, in: *Ocean acidification*, Gattuso, J.-P and Hansson, L. (Eds.), Oxford University Press, New York, 41–66, 2011.

Figures There are a lot of contour plots for the water chemistry parameters, I would suggest that the authors to use larger fonts. Right now some of them for example Figs. 2-4 are a little hard to read.

We have enlarged the fonts in the revised Figs. 2-4.