

Interactive comment on “Modeling pCO₂ variability in the Gulf of Mexico” by Z. Xue et al.

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We would like to thank Referee #2 for his/her comments. Below is our detailed response:

1. We agree with Referee #2 about a lack of details of how pCO₂ is calculated from TA and DIC as well as the information for the constants we used. We will add detailed information into the revised manuscript;

2. Referee #2 pointed out the potential problem of using secular pCO₂ for atmospheric forcing. As we pointed out in our response to Referee #1, initially we would like to use available measurements by NOAA for atmospheric pCO₂ forcing. However, as in-situ measurements in the Gulf so far are spatially skewed (mostly in northern Gulf

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of Mexico and west Florida shelf, as pointed out by Referee #2 as well), we decided to use these measurements for model evaluation. We will provide a comparison between observed air pCO₂ in the Gulf and the secular pCO₂ curve to illustrate and discuss the difference;

3. Referee #2 pointed model-data comparison for the northern Gulf is not ideal. We indicated in the manuscript that the evaluation of model-simulated pCO₂ is challenging because in-situ pCO₂ measurements is still sporadic (data points distribution see Huang et al. 2013). As we indicated in our response to reviewer #1, pCO₂ on the Louisiana-Texas shelf is highly variable due to numerous effects. Indeed our model results have a good agreement with CO₂ influx estimated by Barbero et al (2013). We are carrying out experiments to improve the model-data comparison. As suggested by Referee #2, we will provide a more robust model-data comparison in our revision as well;

4. We will correct the usage of LDEO throughout the manuscript. And we agree that a discussion of the influence from the skewed in-situ data (most in the northern Gulf of Mexico) and how the model would address such data gap would be necessary. We will provide a detailed discussion on this in the revised manuscript;

5. We would also look into the poor correlation between DIC and pCO₂ during the spring season and explore the reason. We agree with Referee #2 that an updated IPCC projection should be cited and we will correct the typo and improve the English expression.

We sincerely hope our referees could understand the challenges we are facing, which is also true for other regional ocean carbon modelers. We anticipate highlighting these challenges through this manuscript as well as our on-going Gulf of Mexico carbon study.