

***Interactive comment on “A model study on the sensitivity of surface ocean CO<sub>2</sub> pressure with respect to the CO<sub>2</sub> gas exchange rate” by P. Landschützer et al.***

**Anonymous Referee #1**

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General comments: While the paper is clearly written, I don't think it provides sufficient substance for a full scientific publication.

1.Does the paper address relevant scientific questions within the scope of BG? yes  
2.Does the paper present novel concepts, ideas, tools, or data? no  
3.Are substantial conclusions reached? no  
4.Are the scientific methods and assumptions valid and clearly outlined? Yes, to a certain extent. However the physical basis of the set up of the studies is insufficient and not very clear.  
5.Are the results sufficient to support the interpretations and conclusions? Yes, however they don't contain any new insights  
6.Is the description of experiments and calculations sufficiently complete and precise

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to allow their reproduction by fellow scientists (traceability of results)? yes 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? yes 8. Does the title clearly reflect the contents of the paper? Fair, I would have expected more substance 9. Does the abstract provide a concise and complete summary? The abstract somewhat overestimates the outcomes. E.g. The conclusion "an accurate quantification of the gas transfer velocity ...provides a potential source to enhance model predictions" is correct, however, the study does not include an accurate quantification of the gas transfer velocity, but rather tests one single, rather arbitrary, change. 10. Is the overall presentation well structured and clear? yes 11. Is the language fluent and precise? mostly 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? yes 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, see details 14. Are the number and quality of references appropriate? Seems reasonable 15. Is the amount and quality of supplementary material appropriate? n.a.

Specific comments: Title: Maybe replace "ocean CO<sub>2</sub> pressure" with partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>) on the ocean Abstract: 1. Which are the controlling factors? 2. On what base has the gas exchange rate been increased by 44% 3. Line 11-15: Is that something new? 4. an accurate quantification of the gas transfer velocity ...provides a potential source to enhance model predictions" this is correct, however, the study does not include an accurate quantification of the gas transfer velocity.

text 5.p.10798 Line 24-26 correct but what controls the gas concentration difference? 6.p.10799 6/7 what has the poleward shift to do with k? 7. Lines 28/29 What is the basis for only changing k in the three regions separately. What would happen if it is changed consistently everywhere? 8. P 10802 line 1, what does quantitatively correct parametrization mean? 9. 17/18 Again, rationale for the 44%. Would it not make more sense to do a general sensitivity study, consistent increases and decreases with specific response on the carbon cycle? If this is supposed to be representative for potential future changes in wind, why not change the wind??? 10. Lines 23-25 are

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repetitive, this has been stated already in the same paragraph. 11. Page 10804: I don't think the result that increased gas exchange velocities increase the gas fluxes justifies a scientific publication. 12. Page 10804/805 It is also to be expected that this intensifies the intra-annual signal and that the signal is weaker in the equatorial band, which as I understand has been chosen because of its lower gas exchange velocities ???!!!!. 13. Page 10805 lines 14-18 Again, what is the physical basis for increasing  $k$  only in that specific region? 14. P10807 line 6/7 which sensitivity experiment? 15. Line 14/15 "largest model data discrepancies" this has already been mentioned several times - can be removed. Also please note, model output is data as well. If referring to observations it is clearer to use the word observations. ( model- observation discrepancies) 16. p10808 line 2 what means "on the long run" in this context? A longer model run? How long? 17. Lines 7-9 Where does this result come from? If this was the reason to do this study, it should be mentioned earlier and could be discussed in more detail. This might actually strengthen the paper. 18. P 10808 line 23 Local model.....benefit from including these effects Why not include them, then? This would also strengthen the paper. Also note that e.g. Bubble exchange does not only increase the exchange, but can also lead to additional influx when bubbles totally dissolve, deviating from the functional dependence on the concentration difference between ocean and atmosphere.

Figures: Figure 3 It might be better to combine all experiments and the standard run in one panel. It would show enough variability and the end effect ??? Figure 4 What is the difference between the individual triangles etc. If they are for different years, please state. Maybe it would be helpful to plot the numbers instead?

technical corrections: p10804 line 6: observing => looking at ( leave the term observing for observations) line 7/8/9 reformulate: "does not simply show little effect..." shows little effect... line 12 remove a in "as a no surprise" p10806 last line and -> an increasing bias p10807 line 6 get improved by => improve in p10808 line 2 do not strongly => only weakly p10808 line 15/16 remove "by adjusting the gas transfer rate" this is already at the beginning of the sentence. Line 28 corrected => corrected

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