

Interactive comment on “Spatial and temporal variations in the sea surface $p\text{CO}_2$ and air-sea CO_2 flux in the equatorial Pacific: model sensitivity to gas exchange and biological formulations” by X. J. Wang

Anonymous Referee #2

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General comments

This is a manuscript which discusses the potential influences of gas transfer and biological processes in the equatorial Pacific based on model results and through comparison with previous modeling and observational results. As the equatorial Pacific is the world's largest oceanic carbon source and the role widely varies both spatially and temporally, the modeling studies in this region are still highly variable. The primary problem in this study, however, is that most of the results seem to be too dependent upon the model that the author has been developed for last several years. If the author

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wants to insist effectively the results shown in this manuscript are universal enough, she will need more justification through more concrete and accurate comparison with other studies, both from observation and modeling. Especially, further comparisons of results between models are required in order to avoid readers suspecting the results shown in this manuscript are valid only in using this model. Therefore, the reviewer would recommend the author to put previous results from various models applied to the equatorial Pacific together again, and clarify which results are from previous modeling studies and which are very new from this study, before thinking of submitting a revised manuscript to Biogeosciences. Otherwise, the manuscript does not seem to be worth being published from the journal.

The other general concern is that the way to evaluate the validity of the DON model in comparison with the non-DON model, which has also already been pointed out by Reviewer #1. For example, is it possible that different choice of surface layer, for example, from 50 to 100 or 150m, affect the model results? Discussion of the choice of gas exchange formulation in this manuscript is also vague, and overall conclusion about the choice of the formulation is missing. Different gas exchange rate should be used according to the sort of the wind data used (e.g. as described in W-92). The difference does not arise from the choice of the formulation but from that of the gas exchange rate. Therefore, the reviewer strongly recommends the author to describe fundamental differences in biogeochemistry if one chooses different gas exchange formulation from several previous studies.

Specific comments

Page 3884: The author will need to mention about a reference for Equation (3).

Page 3886, Lines 3-6: “As shown in Table 2, . . .” The two sentences seem to be better to move to Session 5 (“Model results”).

Page 3886, Line 12: The reviewer supposes “Wyrki box” is well known, but at least the text needs some description and reference(s) about this term. Part of explanation

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appears in captions of Table 4 Figure 7, but the author needs to add to the text, too.

Page 3887, Line 7: “with published delta pCO₂ data” The author should clarify the sources or references of the data.

Page 3887, Lines 17-18: “Model simulations except the W-99 one . . .” This sentence seems better to appear in earlier part of this paragraph, in Line 11 (before “Despite of”), for example.

The tables should be numbered in order of appearance in the text (Table 5 appears earlier than Table 4).

The reviewers think the title of Section 5.2 should be more definite.

Page 3888, Line 2: “seems do” → “seems to do” (insert “to”)

Page 3888, Line 2: “do a better job” Could the author verify the model “does a better job” objectively, for example, through comparison with data?

Page 3888, Lines 11-13: “A recent study suggests . . .” It is fine that the author refers to results from previous studies, but it is required that they are always considered to be associated with the author’s own model results.

Page 3889, Lines 1-3: “. . ., particularly during the warm events . . .” The reviewer could not figure out fully what this sentence means when only referring to Figure 7, and therefore, additional explanation seems to be needed.

Page 3889, Line 17: not “(M-04 < W-92 < M-01 < W-99)” but “(M-04 > W-92 > M-01 > W-99)”?

Page 3889, Line 18: Similarly, not “(W-99 < M-01 < W-92 < M-04)” but “(W-99 > M-01 > W-92 > M-04)”?

Page 3889, Lines 18-21: “Overall, the modeled delta pCO₂ and . . .” The author insists that the model results agree substantially with data. If so, could you justify the

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insistence by describing quantitatively, with values?

Page 3890, Line 1: “0.54 Pg C yr⁻¹ (Table 5)” → “0.54 Pg C yr⁻¹ for the year of 2000 (Table 5)” (insert “for the year of 2000”)

Page 3890, Lines 5-6: “The modeled temporal variations . . .” Again, the author needs to justify the model results are in good agreement with the observations quantitatively, by showing values, for example.

Page 3890, Line 10: “with large overlapping” What does this phrase mean?

Page 3891, Line 1: “high” → “higher” ?

Page 3891, Lines 6-8: “Particularly, the most sensitive parameters are . . .” The reviewer wonders if the difference is slight if the author discusses within the Wyrтки box, and if so, the author needs to mention about this.

Page 3891, Lines 14-16: “These analyses demonstrate that . . .” The reviewer could not understand this sentence. Could the author clarify or rephrase this sentence?

Page 3892, Line 1: The author mentions about SST, SSS and DIC, but is it fine that the author did not mention about the alkalinity here? Is the role relatively small compared to that by SST, SSS and DIC? If the role of the alkalinity cannot be negligible, the author should describe more about the alkalinity. The alkalinity is considered to contribute substantially to the interannual variability of biogeochemical cycles in some other oceanic regions, although most of the regions are more close to the coast.

Table 5 caption: It may be better to describe the period, such as adding a phrase of “during 1990-2007” to the end of this caption.

Figure 3 caption: The author needs to describe what the asterisk shows here, as well as the source(s) or reference(s) of the data.

Figure 4: What does the area shown in white mean in (c) and (d). If the area in white means lack of data, then the difference in (e) ((a) minus (c)) and (f) ((b) minus (d))

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should include white area similarly.

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