

## ***Interactive comment on “A numerical analysis of biogeochemical controls with physical modulation on hypoxia during summer in the Pearl River Estuary” by Bin Wang et al.***

### **Anonymous Referee #1**

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Review of “A numerical analysis of biogeochemical controls with physical modulation on hypoxia during summer in the Pearl River Estuary” by Wang et al. This paper reports on the use of a three-dimensional modeling system to explore the biogeochemical and physical mechanisms regulating O<sub>2</sub> dynamics and bottom water hypoxia in the Pearl River estuary. A novelty of the study is the use of numerical O<sub>2</sub> tracers to quantify the source and sink processes dictating O<sub>2</sub> concentrations. The use of these tracers benefitted a diagnostic O<sub>2</sub> mass balance in this shallow and dynamic estuary. Further, the study demonstrates the spatial connection between processes occurring in different locations in the system. From this analysis, the conclusion is that air-sea mixing and sediment oxygen demand were the primary processes regulating bottom-water

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O<sub>2</sub> concentration and hypoxia. This is a different result than other well studied systems where hypoxia occurs such as Chesapeake Bay and northern Gulf of Mexico. Overall, I think this is an interesting paper that for the first time teases apart the biogeochemical and physical aspects of O<sub>2</sub> dynamics in a shallow, river-dominated system. Two major issues for the paper are the grammar and imprecise/incorrect use of language. I had to read many sentences two or three times for the meaning to shine through. These issues should be resolved by having a fluent English speaker edit the draft. Specific comments: P1, line 14: The use of 'ambient' here and throughout the paper is confusing to me. Do you mean to use 'adjacent'? It seems like you are inferring the advective and diffusive fluxes from adjacent grid cells. Please clarify. P1, line 25: As you haven't yet defined "modulation of physical processes" this phrase appears to be jargon and is unclear to the reader. P1, line 26: The values presented here and following seem like they should be process rates like 4.31 mg l<sup>-1</sup> d<sup>-1</sup>. Or if this value is an average over some seasonal or annual period, please state this. P1, line 32-33: This sentence doesn't make sense. On the one hand it is stated that photosynthesis increased the O<sub>2</sub> concentration, but then it also increased the hypoxic area (decreased O<sub>2</sub> concentration). Please clarify. P2, lines 2-7: These sentences are not clear and appear unnecessary. I suggest deleting them and starting the Introduction with line 8 P3, line 4: "Pearl River Estuary", estuary should not be capitalized P3, line 18: Describe here what you mean by "physical modulation of biogeochemical terms". P3-8: Nice description of the modeling P8, line 7: In the 'Model Validation' section you might also suggest some additional observations that could be measured to assess the modulation model. Perhaps oxygen isotopes or additional rate measures would be useful to validate the biogeochemical O<sub>2</sub> terms. P11, line 29: unclear what '905 l t' is P12, lines 4-6: I disagree with this statement. The O<sub>2</sub> gradient driven by photosynthesis would only be uniform or small if the light were at levels saturating to photosynthesis throughout the water-column P15, line 27: Correct 'Fig.9921a and Fig.9921b P16, line 11: '8 km<sup>3</sup>', use units consistent with what you present from the Gulf of Mexico and PRE (km<sup>2</sup>) Table 2: In the heading do you mean 'WCR' instead of 'respiration by phytoplankton',

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which is hard to measure in practice and which is usually small in comparison to WCR. Fig. 1b: Did you mean to show the cross-section (side-view) as noted in the figure caption? Here it shows the map view of the river network. Fig. 5: In the caption state the bias is between the two models, RCA and modulation Fig 6: Perhaps I missed it in the text, but why do the two models differ? Please discuss in text. Fig 8e: define ABio and LBio in the caption Technical corrections: There are too many for me to enumerate here. Please have an English editor assist with fixing plural noun/verb issues and other grammatical mistakes.

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