

## **Review 2 of " A numerical model study of the main factors contributing to hypoxia and its interannual and intra-seasonal variability off the Changjiang Estuary"**

Thank you for the work that you have done on the manuscript since the last version. The manuscript has improved, I do however think that it is still in need of major revisions before a potential publication.

### **Major comments:**

1. In the introduction you already mention other studies that have investigated the oxygen dynamics in this region, and that they have found that the oxygen consumption, the wind and stratification are important drivers behind. It is not clear to me what new knowledge that you study brings in to this. To clarify this, please develop your discussion of your findings in perspective to these studies in your manuscript.
2. You need to develop your mechanistic explanation of the variations in hypoxia. You find that the extent of the freshwater plume and the primary (organic matter) production /oxygen consumption are important controlling factors. But, are these linked? Does the freshwater plume stabilize the water column in a way that promotes primary production? Or is it just that the stratification and primary production contribute separately to the variability in the oxygen? Have you considered a link with the load of riverine organic matter? (I cannot find it in the manuscript)?
3. A revision of the structure of the text/study, might also help the reader to understand what new knowledge your study bring to the community:

### *Suggestions for the abstract:*

You do not need to write that the model was validated reproduces the observed temporal and spatial variability in the abstract. If you use the model for process studies, the reader already assumes that the model has been/ is evaluated in the study.

You start by writing that the interannual variations in hypoxic extent is partly explained by.... Start instead by describing the main mechanism behind, i.e. the spatial extent of the freshwater plume. Describe why it is important for the hypoxic extent. Then you can go on writing that the extent of this plume is mainly dependent on the wind, and to a lesser extent on the freshwater discharge.

### *Suggestions for the structure of the study:*

In the way your manuscript is currently written, you are dealing both with intra-seasonal and interannual time scales, and it feels like you do not fully go into either of them and sometimes mixing them up (I think you will see from my minor comments that this is a bit confusing to me). Wouldn't it be better to focus on one of these time scales? If you choose to focus on interannual time scales, you could in the end do one budget for annual means. I think that your budget analysis is very nice and provides useful information. With this one you more directly (compared to correlations) see the contributions from different processes. For example you see that, apart from oxygen consumption, the vertical fluxes of oxygen are important for the bottom oxygen. This you could link to the wind events that you also are looking into. One idea could be to do budgets for different years, and then you will see how much the vertical mixing (wind) and the oxygen consumption contribute to the hypoxic conditions for each year?

Maybe you could even start your manuscript with this budget, and thereafter dig into the different terms to get a more mechanistic understanding behind? For example, the vertical mixing can be

influenced by both freshwater input and wind events, and oxygen consumption is related to the input/production of organic matter, which can also be influenced by freshwater input through a stabilization of the water column, or input of riverine organic matter.

Would it be possible for you to focus on one measure of hypoxia, i.e. either hypoxic extent or oxygen concentration? As it is now you are switching between these in the manuscript which makes it confusing for the reader.

4. Is the division into two regions necessary? In the end it seems like the governing processes are similar in these two regions (Figure 12)?

Minor comments:

- section 2.2: you write on lines 168-169 that you include riverine organic matter in the model. But you do not describe what values you use for concentration in the rivers.

- 174: Change "Freshwater discharge reaches the minimum" to "Freshwater discharge from the Changjiang River reaches the minimum"

- line 187: add "river" after Changjiang

- section 3.1: you need to explain what all the correlations you write about in there are based on, is it spatial correlation, or temporal correlation? If it is spatial correlations, are these correlations enough to say that your model reproduces the dynamics on intra-seasonal and interannual timescales?

line 232: you have to define "hypoxic" somewhere in the manuscript. Either here or in the methodology section.

- figure 4a) add legend

- lines 232-43: please describe if this is in agreement with observations?

- section 3.2.1: Have you looked at the relation with the load of riverine organic matter?

- Figure 4: It is confusing that you put the variable that you are investigating both on the y-axis and the x-axis. I would be consistent all over the subplots and keep one axis for you variable of investigation.

- line 278: refer to figure 4d) after low-oxygen zone

- line 278: you need to describe somewhere how you calculate the plume area. You have written two different definitions in the table and figure 4. Please correct this and put also somewhere in the text how you define it.

- line 303: change "riverine inputs" to "riverine inputs of nutrients" or "riverine inputs of nutrients and organic matter", if you also have looked at that.

- Figure 6: I would remove this figure, I do not think that you need it for your story. It is enough that you argue in the text for your choice of separation of the domain into two different zones. Alternatively you could put it in a supplementary material.

- line 339-340: I do not think that you can argue that because the annual FW input is correlated with the annual mean extent of the freshwater plume, the daily plume extent can be used as a measure of daily freshwater input. On these shorter time scales the wind have a larger influence.

- What new information does figure 7 come with in addition to figure 5? I see that they are considering different time scales. If the main processes acting at smaller time scales are similar to those on longer time scales, it is enough that you make a note on that in the text.

- Figure 8: I think that this one goes more under interannual variability, as you look at variations between years.

- Figure 9: Have you calculated this based on the whole simulation period?

- section 3.3: why do you calculate the budget only for March to August?