

## ***Interactive comment on “A numerical model study of the main factors contributing to hypoxia and its sub-seasonal to interannual variability off the Changjiang Estuary” by Haiyan Zhang et al.***

### **Anonymous Referee #3**

Received and published: 17 November 2019

Summary: The manuscript introduces and shortly evaluates a new setup of a coupled physical-biogeochemical model of the East China Sea. With this model the authors show that the model reproduces observed hypoxic events and that it closely relates to the river discharge of the area, and present an oxygen budget that includes physical and biogeochemical processes.

Major comments: 1. The manuscript is overall well written and the figures are representative and easy to understand. However, as the manuscript is built at the moment, I lack a red thread and a consistent story in there. The manuscript starts by focusing on observed hypoxic events but it does not really go into details describing the processes

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behind, and why it looks different from year to year. Then the manuscript goes into describing the passage of typhoons and their effects on the oxygen concentrations, and after into describing oxygen budget for the area. This latter budget seems to be constructed by using simulated means over the whole simulation period (a description of how the budget is calculated is lacking). I would suggest that the authors focus on describing the hypoxic events, and that they dig more into the processes behind these to understand why it looks different from year to year. The authors see that the extent of hypoxic waters closely relates to the river discharge. However, they do not explain whether the increase in hypoxic waters is related to a stronger nutrient loading and thus an increase in the primary production and remineralization, or whether it is related to a stronger stratification preventing the exchange of oxygen between deep and surface waters. This could be analyzed by calculating a budget as the one that is presented in Figure 7 for each year. Further, it would be interesting if the authors could describe why they see a difference in the phenology of the hypoxic extent, and what causes the seasonal and interannual variations in the extent of CDW?

2. At the moment I do not see what your story gains with the section on typhoons. These processes are acting on much smaller time scales, and do not seem to have a large influence on the seasonal variations that you say that you will study in the abstract and in the introduction. I may be wrong, but in that case this should be clarified. If not I would suggest to remove this, or only briefly mention it and put the figure in the supplementary.

3. Are there more observations that you could use for your evaluation? Are there for example profiles of temperature/salinity/oxygen/nutrients measured during the hypoxic events that you present?

Minor comments:

- the manuscript uses a lot of abbreviations that makes it difficult to follow. I would suggest to reduce them. You could remove abbreviations that are only used a few

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times, and keep those that are used all over the manuscript.

- use the word "evaluated" instead of "validated" all over the manuscript
- you need a section where you describe the observational data
- in the figures you have to specify what time-average you have plotted. Is it the modelled monthly means?
- page 1, line 16: replace "and reproduces" to "and it reproduces"
- in the introduction you could also add some examples from the Baltic Sea that also suffers from an increasing volume of low-oxygen waters.
- page 5. line 126: please specify how much 1/12 degree is in kilometres as these latitudes.
- page 5, line 128: do you have a reference for the MPDATA?
- page 5, line 134: I guess the atmospheric forcing also contains solar radiation?
- page 5, line 137: describe in more detail what the SODA dataset contains, is it hourly, daily, weekly, monthly ... data?
- page 5, line 144: please specify why you use daily river-runoff for this river and not the others. I guess it is because it is the major river in the area?
- Figure 1: what do the dots in the right hand panel show?
- page 7, line 173: is this instantaneous remineralization described in Laurent et al 2017? If not maybe you should describe it a bit more and why you have no burial in the sediments. What are the assumptions behind?
- page 7, line 179: Maybe you could put a map in the supplementary material showing the attenuation coefficient? Does it compare well with observations (if there are any)?
- page 7, line 180: 1 year seems a bit short as spinup. Don't you have anymore drift

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after this? What is the volume turnover time of the area?

- page 7, what is the output frequency of diagnostics from the model?
- page 10, line 223-225.
- Oxygen budget: you need to put some more details on how this is calculated. Is it calculated online or offline? If it is calculated offline, what output frequency do you use?
- Page 14, line 282: You have not explained what the abbreviation WR stands for.
- Page 15, line 307: why is the turbulent diffusion stronger in the Northern region?
- Page 16, line 341 and 348: Two sentences starting with "And". Sentences should not start with this word. Please reformulate.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2019-341>, 2019.

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