

**Detailed responses to reviewer 2** (reviewer comments are included in black, responses in blue font)

### **Overview**

The paper investigated the impact of P limitation on hypoxic zone in the East China Sea using a coupled physical-biogeochemical model. The results shown spatio-temporal variability of P-limitation in this region in details, and provided mechanism explanation on how hypoxic region was modified by N+P, P-only, N-only scenarios from primary production to water column respiration. It also provided management suggestions that N+P reduction was the best strategy to mitigate hypoxia, and quantitative measure on how much hypoxic area would be reduced for intermediate and long-term reduction in N+P reduction. Modelling hypoxia in China coastal ocean is a very hot topic these days. Most of them focused on mechanism explanation. The research had a very special perspective on hypoxia management strategy, which was great and important for hypoxia study in this region. The paper is very well written and organized. It should be published after minor revision.

*Response:* We appreciate the constructive feedback. Below we provide detailed responses for each.

### **General comments**

#### **Comment:**

1. Figure 1: Why zone 1 to 6 was separated like this? Any standard?

*Response:* To clarify our choice of Zones 1-6, the following sentence will be added at the end of section 2.2:

“For analysis, the shelf region adjacent to the Changjiang Estuary (CE) is divided into 6 zones. Zone 1 represents the Jiangsu coastal area ( $z < 25\text{m}$ ,  $31.70 < \text{lat} < 33.50$ ). Zones 2 and 3 are the northern and southern hypoxia cores, respectively, defined in Zhang et al. (2020). Zone 4 represents the Yangtse Bank area ( $z < 50\text{m}$ ,  $30.75 < \text{lat} < 33.50$ ), whereas Zone 5 ( $30.75 < \text{lat} < 33.50$ ) and 6 ( $28.52 < \text{lat} < 30.75$ ) represent the northern and southern deep shelf waters ( $50 < z < 100\text{m}$ ), respectively.”

#### **Comment:**

2. In results section 3.3. It mentioned the limitation factor is  $< 0.85$ . It should be mentioned in the method section, how this limitation factor is defined and why, although a citation paper has been provided. It will be wonderful to include those crucial information without go back and forth to other references

*Response:* We will add this information in the Methods.

#### **Comment:**

3. In the results section and Figures, except comparison for the nutrients. A comparison for surface chlorophyll concentration and salinity with satellite data, and hypoxic zone with cruise data overall should also be provided.

**Response:** An extensive model validation was carried out in Zhang et al. (2020) for the same model. We only present nutrient validation here because it is the focus of the investigation and also because PO<sub>4</sub> validation was not available in Zhang et al (2020).

**Comment:**

4. Line 270-275: A comparison with the Gulf of Mexico has been mentioned. A recent study on P-limitation on the Pearl River Estuary system. “Reversing impact of phytoplankton phosphorus limitation on coastal hypoxia due to interacting changes in surface production and shoreward bottom oxygen influx” by Yu et al. 2022 (Water research) should also be mentioned. What is the difference and similarity between the three system? Any relation with the land cover and land use change in China? (More urbanization, sewage discharge)?

**Response:** We will provide some discussion of our results in comparison to other systems, such as the Gulf of Mexico and the Pearl River Estuary. The relationship between P limitation, nutrient mitigation and the land cover/land use change in China is an interesting new study and will be mentioned as such in the conclusions.

**Comment:**

5. In the code availability part. Only general ROMS code downloaded was mentioned, did the Fennel module in the most recent ROMS has incorporated all 10 state variables mentioned from Line 94-Line 100. If not, that should be uploaded to Zenodo or somewhere. Also, the parameter scheme in the biological model should be provided. I did not find that in Zhang et al. (2020)

**Response:** Yes, the 10 state variables are available in the current ROMS repository. We used the same parameters as in Zhang et al. (2020), which are available in their Table S1 (supplement). We added this information at the end of section 2.1 as follows:

“The model equations are available in the supporting information of Laurent et al. (2017); setup and validation are described in detail in Zhang et al. (2020). Biogeochemical model parameters are also available in Zhang et al. (Table S1).”