We wish to thank the reviewer for the constructive comments and suggestions. We have carefully revised the manuscript according to the reviewers' comments. Detailed response to all comments is given below (the reviewer's comments are shown in black, while authors' responses are marked in blue. Text from the manuscript is italicized, and the proposed revision are highlighted in yellow).

Reviewers' comments

Reviewer #1: This manuscript attempts to quantify the role of riverine nutrient and sediment changes on long term deoxygenation off the PRE by a coupled physical-biogeochemical model, and emphasize the importance of declining sediment transport on hypoxia extension which has been overlooked before. As the decrease of riverine sediment load is common partly due to the dam constructions, its influences on coastal ecosystems (including hypoxia) need a comprehensive understanding. This study would advance the knowledge of the linkage between terrestrial transport and coastal deoxygenation dynamics. But I find shortcomings in the manuscript that need to be improved or addressed.

This study is process-oriented, and using sensitivity experiments to explore the controlling factors of hypoxia changes between 1990s and 2010s. The authors should confirm simulated results in these two periods are reasonable through model-observation comparisons. It is also noted that riverine organic matter/OM is non-neglectable for PRE hypoxia formation, the authors need to elucidate the long-term change of riverine OM and evaluate its potential influence.

Major comments:

1. Introduction: The authors should cite more international papers to provide a comprehensive review, especially in the paragraph of line70-86.

Response: Following the suggestion, we will add relevant international studies in the Introduction (underlined in the text below):

Line 70-86: "*Plenty of studies were conducted to reveal the mechanism of hypoxia formation and evolution in coastal regions. It has been widely recognized that coastal deoxygenation is largely attributed to the eutrophication-driven production of organic matters (Su et al., 2017; Howarth et al., 2011) , which sink to the subsurface waters and bottom sediments, leading to intense oxygen depletion (Wang et al., 2014; Hagy et al., 2005). This would induce hypoxia when the density stratification restricts DO replenishment from the surface waters (Wang et al., 2018; Murphy et al., 2011). One important reason underlying eutrophication and hypoxia is the excessive nutrients that are discharged into the water column and stimulate phytoplankton blooms (Cullen, 2015; Wang et al., 2021; Cormier et al., 2023). In addition, …*"

2. Model settings and validation: The "1D-3D coupled physical-biogeochemical model" including the river network and estuary, actually is a continuum model. The authors are advised to rewrite the model introduction to better address the advantage of this model.

Response: Many thanks for the suggestion. Regarding the 1D-3D coupled model used in our study, the 1D component was designed to provide riverine inputs for the 3D component of the model. To make it clearer, in Section 2.2.1 (Line 160), we will add the following text to clarify how these two modules were linked:

"*This 1D-3D modeling framework integrates a 1D representation of the Pearl River network with a 3D simulation of the Pearl River Estuary and adjacent shelf region, operating in an offline coupling mode. The 1D component numerically solves the Saint-Venant equations using a Preissmann scheme, discretizing the river network into 299 sections with five upstream boundaries (specified as either discharge or water level inputs). The 3D component employs the ECOM model with 16 vertical layers and adaptive horizontal resolution (400m to 3km), forced by tides, atmospheric forcing, and open boundary conditions. The two components exchange fluxes at eight river outlets: the 3D model incorporates river discharge from the 1D model as upstream boundary conditions, while the 1D model uses water levels computed by the 3D model as its downstream boundaries at each time step. This 1D-3D modeling framework was initially developed to investigate nutrient fluxes to the PRE and has been extended and validated to simulate oxygen dynamics and hypoxia in the PRE (Wang et al., 2017; Wang et al., 2018; Hu et al., 2011; Zhang et al., 2022; Chen et al., 2024)*."

3. The validations here are all from published papers, and model-observation comparison is not done in this study. Do these published papers use the same parameters' values? As they focus on different time periods. In addition, this study needs a model-observation comparison to indicate reasonable simulations in 1990s and 2010s.

Response: The model parameters used in this study were validated against historical data from previous years, as detailed in our previous work (Hu et al., 2011; Wang et al., 2017; Wang et al., 2018; Zhang et al., 2022; Chen et al., 2024). For this study, we retained the same parameter values but applied period-specific forcing representative of the 1990s and 2010s, following the approach of Chen et al. (2024) which has validated the model's ability to reproduce the observed oxygen dynamics and hypoxia during these two decades. Essentially, this study and Chen et al. (2024) both focus on reproducing characteristic summer conditions for the 1990s and 2010s by forcing the model with representative summer inputs. For this purpose, the model was not designed to precisely achieve point-by-point accuracy in reproducing observed dissolved oxygen distributions; rather, it aims to capture the key differences between the two periods and identify the underlying mechanisms driving these contrasts.

To demonstrate that the model's capability in reproducing the characteristic summer physical and biogeochemical conditions in the PRE, we will provide model-data comparisons for the 1990s and 2010s in the Supplement (also attached here; please see Figure S1 below).

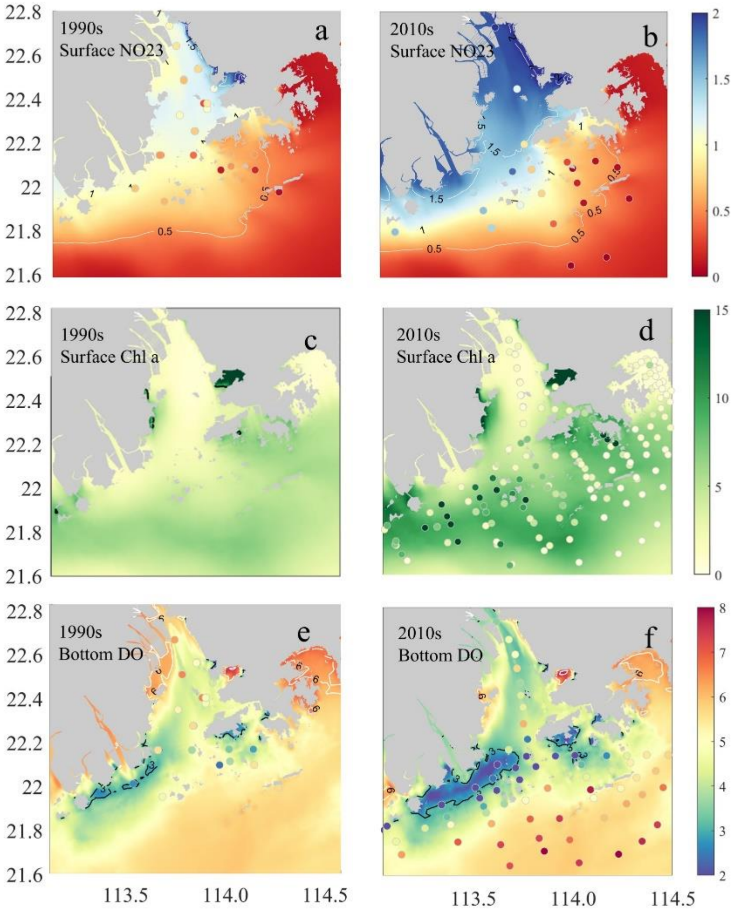

Figure S1. Comparison of observation and modelling result for (a, b) surface NO_{23} *(mg/L); (c, d) surface Chl a; (e, f) bottom DO. The scatters are observation result of each period.*

4. Section3.1.2: The nutrient limitation index here is the of competitive result of N, P, and Si. It is more meaningful to specify the separate limitation of the three kinds of nutrients, especially for N and P. In addition, the changes of nutrient ratio can be addressed by the way.

Response: As requested, we have quantified the individual limiting effects of N, P, and Si on phytoplankton growth (see figures below). The results show that in summer, the primary limiting nutrient in the hypoxic zone of the Pearl River Estuary is P, consistent with previous findings (Yu and Gan, 2022). N limitation occurs only in certain offshore areas farther downstream and thus has negligible impact on nearshore waters. Additionally, Si remains abundant throughout the estuarine and shelf regions, showing no limiting effects in our investigated region. Given that summer nutrient in the PRE is predominantly controlled by a single nutrient species (P), we did not conduct separate model experiments examining N, P, and Si limitations.

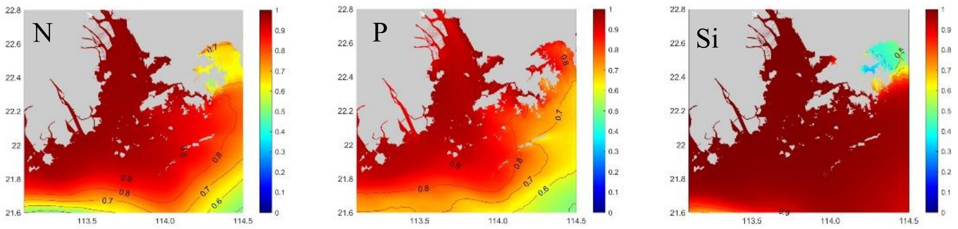

Figure r1. Simulated distributions of the nutrient limitation index for phytoplankton growth, focusing on nitrogen (N), phosphorus (P), and silica (Si), off the Pearl River Estuary in the 1990s. Note that an index value closer to 1 indicates weaker nutrient limitation.

5. Section4.1: Long-term variations of oxygen and the controlling factors of PRE and other hypoxic regions have been discussed in several published studies. Discussions of similarities and differences between them and this study are lacking.

Response: We appreciate the reviewer's comment. While previous studies have primarily examined the impacts of riverine inputs of freshwater, nutrients and organic matter, this study provides a comprehensive investigation on how suspended sediment reduction influences estuarine dissolved oxygen dynamics. As demonstrated in Figures 6 and 7, we reveal distinct spatial patterns of hypoxia expansion and identify profound differences caused by the changes in river-delivered suspended sediments, which have not been examined in previous studies. In additional, we provide detailed mechanistic analysis of the region-specific responses of estuarine oxygen dynamics and hypoxia to river-delivered suspended sediments and nutrients in the Pearl River Estuary. This analysis integrates the nutrient limitation patterns and light availability changes as presented in Section 3.1.2.

To better highlight these findings, we will revise Section 4.1 as follows:

Line 488: "*While previous studies have primarily examined the impacts of riverine inputs of freshwater, nutrients and organic matter, this study provides a comprehensive investigation of how suspended sediment reduction influences estuarine dissolved oxygen dynamics…*

we reveal distinct spatial patterns of hypoxia expansion and identify profound differences caused by the changes in river-delivered suspended sediments, which have not been examined in previous studies."

Line 526: "*It is worth mentioning that the relative importance of riverine nutrient and suspended sediment changes differed fundamentally between the two hypoxic centers in the lower Pearl River Estuary (PRE), directly linked to their distinct distances from river outlets. In the western coastal transition zone adjacent to the Modaomen sub-estuary (proximal to river outlets), elevated SSC levels induced severe light limitation that suppressed phytoplankton growth. Consequently, oxygen dynamics in this region were primarily controlled by SSC variations through particulate-mediated light attenuation. On the contrary, in the eastern transition zone encompassing Hong Kong waters (distant to river outlets), the reduced riverine influence combined with naturally low nutrient concentrations resulted in biogeochemical processes—particularly* *primary production and SOD—exhibiting greater sensitivity to nutrient changes. This established nutrient availability as one of the dominant regulators of hypoxia patterns in the eastern region.*"

6. Section4.2: This study reveals a more important role of SSC then nutrients in long term deoxygenation off PRE. But their relatively importance should depend on their variation amplitude. It is better to point out and discuss that. Climate changes involves a variety of aspects. In addition to ocean warming, other factors like wind changes and extreme flood, can also influence oxygen dynamics.

Response: We thank the reviewer for raising these important points. While the changes in SSC in the PRE are indeed significant, other estuaries may not have experienced comparable variations. However, we emphasize that the impacts of turbidity changes on hypoxia remain critical in specific regions. For instance, Dethier et al. (2022) demonstrated that sediment trapping by dams in the Northern Hemisphere has reduced global riverine sediment fluxes to 49% of pre-dam levels, indicating that substantial sediment decline is a global issue, particularly in areas with intensive water infrastructure development. This study provides critical insights for regions experiencing both dramatic SSC reductions and severe eutrophication, suggesting that hypoxia expansion may be governed by more complex mechanisms, and the impacts of basin-scale dam construction and sediment decline could be far more profound than previously recognized.

Indeed, other aspects of human activities, such as land-use changes (e.g., deforestation or urbanization), could increase estuarine suspended sediment loads by exacerbating soil erosion and sediment transport. This scenario warrants serious consideration, as elevated suspended sediments might alleviate hypoxia by limiting light availability and suppressing phytoplankton growth, thereby reducing organic matter production and subsequent oxygen consumption.

Based on the suggestion, we will add the following statement at Line 76:

"*Human activities, such as dam construction (Bussi et al., 2021) and soil-water conservation measures (Yang et al., 2024), can significantly reduce suspended sediment in estuaries.*"

We will add the following description between lines 568-569 in the discussion section:

"*While our study emphasizes the impacts of reduced suspended sediments, human activities may conversely increase sediment loads in estuaries. For example, land-use changes such as deforestation (Kasai et al., 2005) or industrialization (Syvitski and Kettner, 2011) may exacerbate soil erosion and sediment transport, leading to higher suspended sediment concentrations in the water. In such cases, light attenuation due to increased turbidity may suppress phytoplankton growth and reduce primary production, thereby mitigating hypoxia.*"

We agree with your perspective that climate change involves multiple other dimensions. Rising water temperatures and altered wind patterns have indeed been observed in the PRE) We believe these changes could complicate hypoxia dynamics in the PRE. To enrich this discussion, we will revise the content in line 569 as follows:

"Some caveats to our work require further studies. For example, apart from anthropogenic activities, alterations in regional physical conditions aligning with climate changes such as wind and freshwater discharge could also regulate the long-term deoxygenation in coastal regions (Chen et al., 2024). The impacts of ocean warming on deoxygenation (Laurent et al., 2018) remain unclear in the PRE as well, although warming has already been observed in the PRE (Cheung et al., 2021). These issues and their potential cascading effects (e.g., sea-level rise, Hong et al., 2020) may render hypoxia patterns more unpredictable, warranting focused attention in future investigations."

Specific comments:

Line65: What is "increased intensity" meaning? Please specify.

Response: The phrase "increased intensity" here refers to an escalation in the frequency of hypoxic events occurrence.

Line106 "the mechanisms controlling the low-oxygen conditions are different", the different mechanisms should be addressed here.

Response: These disparities arise from distinct physical and biogeochemical controls. We will add the following references at Line 106 to clarify:

"Nevertheless, a quantitative understanding of their relative contributions to the low-oxygen expansion in the PRE is lacking, particularly in different subregions (Fig.1b) where the mechanisms controlling the low-oxygen conditions are found to be different: in the upper part of the PRE (Lingdingyang waters), aerobic respiration of terrestrial organic matter play a greater role (Su et al., 2017); in the downstream regions of the PRE, deoxygenation is primarily controlled by eutrophication (Chen et al., 2024)."

Line117-118: Please double-check here. the Pearl River should be the second largest river according to the freshwater discharge. The annual runoff should be ~$3000\times10^8 m^3$. **I guess your supposed value is 3.26×10^{11} m³.**

Response: We will correct it as advised.

Line121: It is better to specify the source name and the website.

Response: We thank the reviewer for the comments. We will provide a clearer description on the data source as advised.

In Line 120-121: "*The long-term DO and water quality data used here were collected from open sources and published studies (detailed in Data availability and Table S1 of Supplement).*"

We will revise the Data availability and Table S1 as follows:

"Data availability

The dissolved oxygen observation datasets off the Pearl River Estuary were obtained from published studies (Hu et al., 2021, DOI: 10.5194/bg-18-5247-2021; Su et al., 2017, DOI: 10.5194/bg-14-4085-2017; Li et al., 2021, DOI: 10.1029/2020JC016700) and the Hong Kong Environmental Protection Department (www.epd.gov.hk). The obs *erved nutrients, oxygen, and suspended sediments data in the Pearl River are available from Hu et al. (2021) and publicly accessible databases maintained by China's Ministry of Ecology and Environment (https://www.mee.gov.cn/) and the China River Sediment Bulletin (http://www.mwr.gov.cn/sj/tjgb/zghlnsgb/).*"

Table S1. Data source of long-term water quality changes in the Pearl River Estuary.

Data	*Year*	*Source*
Bottom DO	1985-2013	Hu et al., 2021 (DOI: 10.5194/bg-18-5247-2021)
Bottom DO	2014	Su et al., 2017 (DOI: 10.5194/bg-14-4085-2017)
Bottom DO	2015&2017	Li et al., 2021 (DOI: 10.1029/2020JC016700)
Bottom DO	1990-2017	Environmental Protection Department of Hong Kong (www.epd.gov.hk)
Riverine DIN, DIP, DO	1990-2017	Hu et al., 2021 (DOI: 10.5194/bg-18-5247-2021); Ministry of Ecology and Environment of the People's Republic of China (https://www.mee.gov.cn/)
Riverine SSC	1990-2017	China River Sediment Bulletin (http://www.mwr.gov.cn/sj/tjgb/zghlnsgb/)

Note: DO (dissolved oxygen); dissolved inorganic nitrogen (DIN); dissolved inorganic phosphorus (DIP); suspended sediment concentration (SSC).

Also, we will add the links and citation in **Data availability:**

Su, J., Dai, M., He, B., Wang, L., Gan, J., Guo, X., Zhao, H., and Yu, F.: Tracing the origin of the oxygen-consuming organic matter in the hypoxic zone in a large eutrophic estuary: the lower reach of the Pearl River Estuary, China, Biogeosciences, 14, 4085-4099, 10.5194/bg-14-4085-2017, 2017.

Li, D., Gan, J., Hui, C., Yu, L., Liu, Z., Lu, Z., Kao, S.-j., and Dai, M.: Spatiotemporal Development and Dissipation of Hypoxia Induced by Variable Wind-Driven Shelf Circulation off the Pearl River Estuary: Observational and Modeling Studies, Journal of Geophysical Research: Oceans, 126, e2020JC016700, https://doi.org/10.1029/2020JC016700, 2021

Hu, J., Zhang, Z., Wang, B., and Huang, J.: Long-term spatiotemporal variations in and expansion of low-oxygen conditions in the Pearl River estuary: a study synthesizing observations during 1976–2017, Biogeosciences, 18, 5247-5264, 10.5194/bg-18-5247-2021, 2021

Environmental Protection Department of Hong Kong: www.epd.gov.hk/

Ministry of Ecology and Environment of the People's Republic of China: https://www.mee.gov.cn/

China River Sediment Bulletin: http://www.mwr.gov.cn/sj/tjgb/zghlnsgb/

Fig.1 caption: "(d-f) the nutrients and DO in the outlets" means their average of all the eight outlets or just some of them?

Response: They are mainly from Humen outlet. Humen is one of the major river outlets of the PRE, exhibits not only higher freshwater discharge and nutrient fluxes compared to other outlets but also possesses longer-term and more comprehensive data records.

Line138-139: the year “1980” can be ambiguous here. As we know, China's reform and opening up was initiated in 1978.
Response: We will replace “1980” with “1978”.

Section2.2.1: A description of “A 1D-3D coupled physical-biogeochemical model” is needed here: explain frameworks of 1D- and 3D- components.
Response: In Section 2.2.1 Line 160, we will add the following text to describe the model framework:
“… and oxygen content (Fig. 1c-f). This 1D-3D coupled model integrates the Pearl River network (1D) and the Pearl River Estuary/shelf region (3D). The 1D component solves Saint-Venant equations using a Preissmann scheme, discretizing the river into 299 reaches with five upstream boundaries (discharge or water level inputs). The 3D component employs the ECOM model with 16 vertical layers and adaptive horizontal resolution (400m-3km), forced by tides, atmospheric data, and observed salinity/temperature profiles. Both domains exchange boundary conditions at eight river outlets: the 3D model receives 1D river discharge, while the 1D model uses 3D water levels for downstream boundaries at each time step. Originally developed for nutrient flux studies, the framework has been extended to hypoxia and sediment-nutrient exchange research.”

The coupling of 1D and 3D models is offline or online?
Response: The coupling of 1D and 3D models are online models. We will add this information in the description of the modeling framework.

Line360: Hypoxia is more extensive in 2010s without doubt. But “the observed shift” is confusing, is there a regime shift of hypoxic area that has been verified?
Response: We apologized for the confusion. We meant the hypoxia expansion, as shown in Fig 2a. We will change the term from “the observed shift” to the “the observed expansion”.

Line495: It should be 2010s.
Response: We will correct it as advised.

Reference

Bussi, G., Darby, S. E., Whitehead, P. G., Jin, L., Dadson, S. J., Voepel, H. E., Vasilopoulos, G., Hackney, C. R., Hutton, C., Berchoux, T., Parsons, D. R., and Nicholas, A.: Impact of dams and climate change on suspended sediment flux to the Mekong delta, Science of The Total Environment, 755, 142468, https://doi.org/10.1016/j.scitotenv.2020.142468, 2021.

Chen, Z., Yu, L., and Hu, J.: Disentangling the contributions of anthropogenic nutrient input and physical forcing to long-term deoxygenation off the Pearl River Estuary, China, Water Research, 265, 122258, https://doi.org/10.1016/j.watres.2024.122258, 2024.

Cheung, Y. Y., Cheung, S., Mak, J., Liu, K., Xia, X., Zhang, X., Yung, Y., and Liu, H.: Distinct interaction effects of warming and anthropogenic input on diatoms and dinoflagellates in an urbanized estuarine ecosystem, Global Change Biology, 27, 3463-3473, 10.1111/gcb.15667, 2021.

Cormier, J. M., Coffin, M. R. S., Pater, C. C., Knysh, K. M., Gilmour, R. F., Guyondet, T., Courtenay, S. C., and van den Heuvel, M. R.: Internal nutrients dominate load and drive hypoxia in a eutrophic estuary, Environmental Monitoring and Assessment, 195, 1211, 10.1007/s10661-023-11621-y, 2023.

Cullen, J. J.: Subsurface Chlorophyll Maximum Layers: Enduring Enigma or Mystery Solved?, in: ANNUAL REVIEW OF MARINE SCIENCE, VOL 7, edited by: Carlson, C. A., and Giovannoni, S. J., 207-239, 10.1146/annurev-marine-010213-135111, 2015.

Dethier, E., Renshaw, C., and Magilligan, F.: Rapid changes to global river suspended sediment flux by humans, Science, 376, 1447-1452, 10.1126/science.abn7980, 2022.

Hagy, J. D., Boynton, W. R., and Jasinski, D. A.: Modelling phytoplankton deposition to Chesapeake Bay sediments during winter-spring: interannual variability in relation to river flow, ESTUARINE COASTAL AND SHELF SCIENCE, 62, 25-40, 10.1016/j.ecss.2004.08.004, 2005.

Hong, B., Liu, Z., Shen, J., Wu, H., Gong, W., Xu, H., and Wang, D.: Potential physical impacts of sea-level rise on the Pearl River Estuary, China, Journal of Marine Systems, 201, 103245, 10.1016/j.jmarsys.2019.103245, 2020.

Howarth, R., Chan, F., Conley, D. J., Garnier, J., Doney, S. C., Marino, R., and Billen, G.: Coupled biogeochemical cycles: eutrophication and hypoxia in temperate estuaries and coastal marine ecosystems, Frontiers in Ecology and the Environment, 9, 18-26, https://doi.org/10.1890/100008, 2011.

Hu, J., Li, S. and Geng, B. 2011. Modeling the mass flux budgets of water and suspended sediments for the river network and estuary in the Pearl River Delta, China. Journal of Marine Systems 88(2), 252-266.

Hu, J., Zhang, Z., Wang, B., and Huang, J.: Long-term spatiotemporal variations in and expansion of low-oxygen conditions in the Pearl River estuary: a study synthesizing observations during 1976–2017, Biogeosciences, 18, 5247-5264, 10.5194/bg-18-5247-2021, 2021.

Kasai, M., Brierley, G. J., Page, M. J., Marutani, T., and Trustrum, N. A.: Impacts of land use change on patterns of sediment flux in Weraamaia catchment, New Zealand, CATENA, 64, 27-60, https://doi.org/10.1016/j.catena.2005.06.014, 2005.

Laurent, A., Fennel, K., Ko, D. S., and Lehrter, J.: Climate change projected to exacerbate impacts of coastal eutrophication in the northern Gulf of Mexico, Journal of Geophysical Research: Oceans, 123, 3408-3426, 2018.

Li, D., Gan, J., Hui, C., Yu, L., Liu, Z., Lu, Z., Kao, S.-j., and Dai, M.: Spatiotemporal Development and Dissipation of Hypoxia Induced by Variable Wind-Driven Shelf Circulation off the Pearl River Estuary: Observational and Modeling Studies, Journal of Geophysical Research: Oceans, 126, e2020JC016700, https://doi.org/10.1029/2020JC016700, 2021.

Murphy, R. R., Kemp, W. M., and Ball, W. P.: Long-Term Trends in Chesapeake Bay

Seasonal Hypoxia, Stratification, and Nutrient Loading, ESTUARIES AND COASTS, 34, 1293-1309, 10.1007/s12237-011-9413-7, 2011.

Su, J., Dai, M., He, B., Wang, L., Gan, J., Guo, X., Zhao, H., and Yu, F.: Tracing the origin of the oxygen-consuming organic matter in the hypoxic zone in a large eutrophic estuary: the lower reach of the Pearl River Estuary, China, Biogeosciences, 14, 4085-4099, 10.5194/bg-14-4085-2017, 2017.

Syvitski, J. P. M. and Kettner, A.: Sediment flux and the Anthropocene, Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 369, 957-975, doi:10.1098/rsta.2010.0329, 2011.

Wang, B., Hu, J., Li, S., and Liu, D.: A numerical analysis of biogeochemical controls with physical modulation on hypoxia during summer in the Pearl River estuary, Biogeosciences, 14, 2979-2999, 10.5194/bg-14-2979-2017, 2017.

Wang, B., Hu, J., Li, S., Yu, L., and Huang, J.: Impacts of anthropogenic inputs on hypoxia and oxygen dynamics in the Pearl River estuary, Biogeosciences, 15, 6105-6125, 10.5194/bg-15-6105-2018, 2018.

Wang, J. J., Bouwman, A. F., Liu, X. C., Beusen, A. H. W., Van Dingenen, R., Dentener, F., Yao, Y. L., Glibert, P. M., Ran, X. B., Yao, Q. Z., Xu, B. C., Yu, R. C., Middelburg, J. J., and Yu, Z. G.: Harmful Algal Blooms in Chinese Coastal Waters Will Persist Due to Perturbed Nutrient Ratios, ENVIRONMENTAL SCIENCE & TECHNOLOGY LETTERS, 8, 276-284, 10.1021/acs.estlett.1c00012, 2021.

Wang, K., Chen, J., Jin, H., Li, H., Gao, S., Xu, J., Lu, Y., Huang, D., Hao, Q., and Weng, H.: Summer nutrient dynamics and biological carbon uptake rate in the Changjiang River plume inferred using a three end-member mixing model, Continental Shelf Research, 91, 192-200, https://doi.org/10.1016/j.csr.2014.09.013, 2014.

Yang, H., Wang, T., Yang, D., Yan, Z., Wu, J., and Lei, H.: Runoff and sediment effect of the soil-water conservation measures in a typical river basin of the Loess Plateau, CATENA, 243, 108218, https://doi.org/10.1016/j.catena.2024.108218, 2024.

Yu, L., Gan, J., 2022. Reversing impact of phytoplankton phosphorus limitation on coastal hypoxia due to interacting changes in surface production and shoreward bottom oxygen influx. Water Res. 118094 https://doi.org/10.1016/j.watres.2022.118094.

Zhang, Z., Wang, B., Li, S., Huang, J. and Hu, J. 2022. On the Intra-annual Variation of Dissolved Oxygen Dynamics and Hypoxia Development in the Pearl River Estuary. Estuaries and Coasts 45(5), 1305-1323.