Dear Dr. Xie,

Thank you for your valuable feedback and for the opportunity to revise our manuscript. We have carefully addressed all the points raised in the review process, with particular attention to the two key issues you highlighted.

Regarding riverine organic matter (OM), our modeling framework comprehensively accounts for the dynamics of organic carbon, nitrogen, and phosphorus. Combined with historical observations of organic matter concentrations, this model (with identical framework and parameter settings) has been used to quantitatively assess the impact of riverine organic matter on hypoxia development in the PRE (Wang et al., 2018). Despite lacking long-term observation on riverine OM, we found that chemical oxygen demand (COD) did not exhibit significant trends compared to clear increases in nutrients and declines in DO in long-term observations at the river outlet (Humen station, Lai et al., 2022). This suggests the minimal temporal variation in oxygen-consuming organic matter inputs over the past periods. We have added the following clarification in methodology of the revised manuscript (clean version, Line 287-292):

"*Long-term monitoring at river outlets showed no significant temporal trend in COD compared to the marked increases in nutrients and decreases in DO, indicating stable oxygen-consuming OM inputs. We therefore maintained constant OM concentrations between study periods (organic carbon: 2 mg/L; organic nitrogen: 0.2 mg/L; organic phosphorus: 0.03 mg/L), consistent with published historical observations (Wang et al., 2018).*"

We have also provided additional responses regarding this question to Reviewer #1, which can be found in "*Follow-up Response to RC1*".

Concerning CDOM, we wish to firstly correct our description of the light attenuation parameterization, which previously omitted the influence of particulate organic carbon (POC). The formulation has now been revised as follows (Line 281 in revised manuscript):

"$k_e = k_{ebase} + k_c * a_{cchl} * P_c + k_{sed} * SSC + k_{POC} * POC$

Where k_e is the light extinction coefficient (m^{-1}); k_{ebase} is the background light extinction coefficient of water (m^{-1}); k_c is the phytoplankton-related extinction coefficient (m^2 mg^{-1} Chl a); a_{cchl} is the ratio of chlorophyll to phytoplankton carbon biomass; k_{sed} is the SSC-related extinction coefficient (m^2 mg^{-1} SSC); k_{POC} is the POC-related light extinction coefficient (m^2 mg^{-1} POC)."

Our light attenuation parameterization, based on background turbidity, chlorophyll, suspended sediments, and particle organic matter (including riverine and phytoplankton-derived POC), effectively reproduces observed dissolved oxygen patterns. While CDOM is not explicitly modeled as an independent variable, we

acknowledge that some of its effects may be implicitly captured in our parameterization during model calibration. We fully agree that CDOM plays an important role and warrants more detailed characterization in future studies. Additional long-term CDOM observations would be particularly valuable for investigating its potential contribution to long-term deoxygenation trends. We have revised the Discussion to acknowledge this factor in the revised manuscript (Line 627-632):

"*The current light attenuation parameterization in our model primarily accounts for the effects of chlorophyll and suspended sediments. Previous studies have demonstrated that CDOM (colored dissolved organic matter) also plays a significant role in light attenuation within the PRE (Cao et al., 2003; Wang et al., 2010), particularly during algal bloom periods. Although our model does not explicitly treat CDOM as an independent variable, its influence is indirectly accounted for within the existing parameterization. However, to accurately quantify CDOM's contribution to oxygen dynamics—including its long-term trends—future work should incorporate an explicit representation of CDOM's effects on light attenuation in the model, alongside sustained observational monitoring of CDOM.* "

We have also provided additional responses regarding this question to Reviewer #2, which can be found in "*Follow-up Response to RC2*".

All additional revisions are clearly marked in the tracked-changes version of the manuscript.

Sincerely,
Nan Yue
(on behalf of all authors)