

Comment on bg-2021-358

Anonymous Referee #1

Referee comment on "Interannual variabilities, long-term trends, and regulating factors of low-oxygen conditions in the coastal waters off Hong Kong" by Zheng Chen et al.,
Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-358-RC1>, 2022

Review Chen et al. 2022, Interannual variabilities, long-term trends, and regulating factors of low-oxygen conditions in the eastern Pearl River Estuary, MS No.: bg-2021-358

General Comments :

Chen et al. evaluated long-term patterns in DO in the eastern Pearl River Estuary (PRE) across seasons and regions, computed an aggregated metric of low DO, and then tested possible controlling factors of it with multiple regression. They found dissolved nitrogen and wind speed were the most explanatory variables for interannual variations and long-term trends. They use additional water quality observations to evaluate the changes to the system over time and hypothesize shifts in the system dynamics. Overall, this is a very interesting study making good use of a long-term data set to evaluate long-term change. I appreciate their thorough treatment of the data both spatially and temporally. My major comments involve clarifying the methods and what is represented in some of the graphics. Clarification is needed throughout as to which months of data are included in different average results and how the data is aggregated to represent "summer". In addition, more clarification is needed on the PCA approach as well as some re-organization of which information is presented in the Methods or Results.

Specific Comments:

- Lines 60 – 81: Within this section, please incorporate the reasoning for your focus on the Eastern PRE. Can you describe whether this region was selected from the larger

PRE because this is where the longest term data is, or is it because this is where the lowest oxygen occurs? It would provide more context if you included some description in the Introduction about how water quality in this eastern region compares to the rest of the estuary.

- Line 104 – Please describe what spatial interpolation approach was used in MATLAB for the interpolations. Also, since you have land in between some of the stations, how did the method deal with that? It would be helpful to show what the region looks like in vertical cross-section as a 2nd panel of Figure 1 with the sample locations and depths indicated with dots. This would be like one of the panels of Figure A2, showing which depths each station is sampled at. This would be a helpful way to visualize the depths at each station.
- Lines 108-120: This discussion of the PCA needs modification. Please include a table of the variables used in the PCA. I kept having to look back in the text to see how “low oxygen”, “Area3,” etc, were defined. I’d suggest including just that table and a description of the approach here in the Methods section. The resulting equation (Line 117) and description of it should probably be moved to the Results section. Also, please summarize the rest of the PCA results (in an appendix table), such as what % of variance the other components had, and what their weights were.
- Line 125 – show an equation to describe this standardization
- Lines 123-134: There need to be some discussion of these different test results in the Results section.
- Figure 4a – can you describe the values plotted here more? Is the minimum, mean and range just from the bottom observations, or is it generated from the interpolation?
- Figure 4 (b) and (c)– We need information on the spatial interpolation to get the area and thickness. Also, if samples are collected every month, it is unclear what the bars in (b) and (c) represent. Are they the average of each month’s spatially-aggregated values? If so, please put range bars on each bar to show the range across the summer months. Or pick one month to show.
- Figure A2 – Similarly to Figure 4, specify which month of the summer these plots are for. If they are average of all the summer cruises, please justify that approach.
- Figure 5 – The min and mean DO symbols in legend seem switched.
- Figure 5a-h – I’d like to see the surface and bottom graphs with the same vertical scale (0 to 10). It can be confusing to have them different when they are right next to each other.
- Figure 5 – I’m unsure from the descriptions as to how the mean and minimum were calculated with multiple stations and months of the summer. Is the minimum the absolute minimum observed in that region in the summer, or an average of the lowest value across the stations? Also is the mean a spatial and temporal mean across the summer?
- Figure 6 – The really high values in the range in recent years in July are worth mentioning. Is that just one location that is causing that range to increase, or is it some indication of increased variability?
- Line 233 – A diagram or flow-chart that describes the sampling and cases used in the regression analysis to get to the results would help my understanding (and probably other readers) of the methods. This could go in the Appendix.
- Figure 9 – The wind speed decrease over time seems very large. Because the results indicate this is an important variable, this deserves more discussion or investigation. If the authors already know other work that has investigated decreasing wind speeds, please cite it and describe briefly. But if there is no other research explaining this wind decrease, it would be a good idea to double-check the data and be sure that it is not an artifact of sampling dates or density shifting or sensor height changing.
- Appendix Figure A1 is important b/c it doesn’t suffer from any possible aggregation or averaging bias. It might be useful to make an addition panel that shows how the bottom summer counts have changed over time – maybe make one for the first half and one for the 2nd half of the record. This could also show if there’s a spatial shift.

Technical Corrections:

- Abstract, Line 15 – change “was” to “were”
- Abstract, line 17 – suggest changing “through the principal component analysis” to something else. Maybe “as a result of a principal component analysis”
- Abstract, line 25 – It is unclear what “It” refers to in this sentence. Please re-write.
- Abstract, last sentence – the phrase “in the context of” is fairly awkward. Consider re-wording this sentence to make your summary stronger.
- Intro, Line 33 – suggestion you use “organisms” instead of “creature”
- Intro, Line 43-45 – Simplify (or remove) this sentence since the next few sentences cover a lot about oxygen depletion. I’d suggest just “Terrestrial organic matter discharged to estuaries can lead to intense microbial respiration.”
- Intro, Line 54: For the Ni et al. 2020 paper, it is important to change “ocean” to “estuary.” They did not study the external impact of the Atlantic Ocean warming on the Chesapeake Bay.
- Methods, Lines 84-93 – Who collected this data?
- Results, Line 144 – I do not think the word “varied” is correct here.
- Results, Line 168 – wording like this sentence can be simplified. You could just start with “DO concentrations exhibited significant...”
- Results, Line 192, and other places – The phrase “DO content” is not something I’ve seen very much before in the hypoxia literature. I’d suggest using “DO concentrations” or just “DO”.
- Figure 6 – It would be helpful to use the same open circles for the blue symbols as in Figure 5.
- Discussion, Lines 297-298: Please revise the sentence that starts with “As quantified by statistic methods...” to work on the wording. Maybe “Our analysis showed that increasing DIN...”