

# ***Interactive comment on “Behaviour of Dissolved Phosphorus with the associated nutrients in relation to phytoplankton biomass of the Rajang River-South China Sea continuum” by Edwin Sien Aun Sia et al.***

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## General comments

I would like to thank the authors for their obvious hard work on this manuscript. The role of phosphorus in driving primary productivity is a focus in many systems (Lake Erie, Lake Taihu, Gulf of Mexico, etc.) and so to understand how this relationship behaves in as many different systems as possible is fundamental to eventually being able to design control and remediation protocols. I am glad to see a study that looks at the different

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fractions of dissolved phosphorus (DIP v. DOP), a subject that has been difficult to address in the past, but has been gaining in research focus recently. Additionally, I am pleased to see their focus on the role of the river itself as a fundamental actor in this relationship as opposed to an inert transporter of nutrients from one place to the next. The role of in-stream processing on nutrient loading is poorly understood, and by showing that there are real differences in nutrient concentrations along the entire length of the river helps to show that rivers are chemically dynamic systems. I believe that this study helps to progress the state of the science, and should be considered for publication after some changes, particularly to the grammar and sentence structure of the manuscript.

R: We would like express our gratitude to Ref #2 for the kind comments and acknowledging the work done for this manuscript. The comments and suggestions provided helped to improve the manuscript significantly.

General: As noted above, there are some issues with the language of the manuscript that makes it difficult to understand what the authors were trying to say. This became a problem in the discussion and conclusion sections where it seems the authors are contradicting themselves from one sentence to the next. I don't believe it is a misunderstanding or misinterpretation of their results, rather an issue with word choice and sentence structure.

R: We have employed a professional language editor to improve the language.

I think the comparisons with other rivers is a good idea, but ultimately executed poorly, it feels rushed and not properly fleshed out. I suggest that this section is a good starting point for another manuscript, but probably doesn't belong here.

R: We thank you for the suggestion and will prepare a second manuscript to flesh this out in the near future. For this manuscript, we would, however, prefer to keep our basic comparison with other river systems. The main reason is that the Rajang is the largest river in Malaysia and we feel it would be inappropriate to not compare it to any other

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systems. Similarly, given the influence of the peat areas in the studied system, we do feel that it has to be mentioned and compared, even if only rudimentary.

Introduction: This section, in particular, will require editing/ rewriting. While the general structure of the section is fine, there are a significant number of grammatical issues which make reading and comprehension difficult. I have no issue with the message the authors are trying to convey; they did a fine job of providing supporting sources, however, it took several re-reads to be able to understand what they were trying to establish. Below are some examples of the confusing language used in this section, but is not a comprehensive list; these should be used as examples of what was outlined above.

R: As mentioned above, we have employed a professional language editor to improve the language of the overall manuscript.

Line 52: Awkward phrasing, try something like “The view of rivers as simply passive transporters of nutrients has been challenged in a number of recent studies (Richey et al., Tranvik et al.)

R: Agreed, the sentence now reads: “The view of rivers as passive transporters have recently been challenged by several studies (Richey et al., 2002; Tranvik et al., 2009).”

Line 59-60: Confusing wording- why nonetheless? The previous sentence sets up the fact that eutrophication is increasing.

R: Agreed. The word “nonetheless” was removed. The sentence now reads: “Eutrophication occurs due to enhanced nutrient levels which varies from one aquatic environment to another (Di and Cameron, 2002).”

Line 65-67: Sentence fragment. I think the authors are saying “The rapid increase in economic development, driven by population growth, has resulted in the modification of SE Asian rivers and the degradation of their catchments.”

R: Agreed, the sentence now reads: “Due to the rapid economic development as a

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result of population growth, it resulted in the extensive modification of tropical South East Asian rivers and degradation of catchments (Jennerjahn et al., 2008; Yule et al., 2010).”

There are numerous sentences like theses throughout the introduction, and they make the manuscript difficult to follow. The authors make some good points, and set up their study, it just takes a significant amount of effort to parse the language. This section has the ability to be a fine introduction if and when the language is corrected.

R: As mentioned above, we have employed a professional language editor to improve the language of the overall manuscript.

Methods: Study area: This section is fine, and the authors do a good job of describing their sampling locations/ decisions in selecting their sites. There are still some oddities in the language, but is ultimately easier to read and understand.

Sampling: Again, this section is generally fine, and does a good job of describing their sampling protocol, although I would ask how many samples were collected at each site as well as time of day for each collection. Are these single grab samples or are the authors averaging over a larger number of samples at each site? I may have missed it, but I did not see anything that describes this directly.

R: Thank you for this question. We have added the following sentence: “One sample was obtained for each site whereby a total of 29 samples were collected in the August 2016 campaign and a total of 16 samples were obtained in the March 2017 campaign.”

Nutrient Analysis: I am not sold on the use of DIP as a proxy for PP, particularly in areas away from the estuaries, but I don't think it would have a significant impact on this study's results.

R: Noted.

Line 203: What fraction is it?

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R: The word fraction was replaced with “portion”. The sentence now reads: “In order to analyse correlation between humic acids and DIP or DOP, dissolved organic carbon concentrations (DOC) were used as a proxy for humic substances. This is because as the part of the hydrophobic fraction portion of dissolved organic matter (as DOC) forms part of humic substances are generally derived from humic substances (Findlay et al., 2003).”

CHL-a determination: The methods used are fine, although for blue-greens, chlorophyll can be misleading, and perhaps phycocyanin would be a better measure.

R: Thank you for the suggestion. As the chl a used here is just a proxy for phytoplankton biomass, the interpretation would remain the same. Furthermore, as the concentrations of chl a are already rather low, the concentrations for phycocyanin would be similarly low.

Data analysis: The methods outlined and statistical software used are fine. Export Calculations: I am not familiar with some of the calculations that they used here, but after looking into them I don't see anything that would raise any issues based on how they have described using them.

248-254: Is this the equation standard for this journal? Just seems like an odd way to write all of this out.

R: Thank you for pointing this out. The equations have been rectified in text.

Results: There are many of the same sort of language issues in this section that were present in the introduction. While it doesn't nullify the results it does make it difficult to read in a timely way. The results section is excessively wordy, and feels like it was written in several different pieces and then combined instead of being a singular effort.

R: Thank you for the comment. We have tried to summarise the results and employed a professional language editor to improve the overall language of the manuscript.

Lines 206-262: This seems like it should be a figure caption. There are a couple of

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other spots in this section with the same sort of “disconnected” feel. If you can use figures or graphs, do so, and limit the amount of writing, particularly in a results section

R: Thank you for highlighting this. The sentences that form part of the figure captions were removed and appropriately placed as a figure caption.

Line 316 and elsewhere: Be careful in how you describe your DIN:DIP ratio comparisons. R: Noted and amended.

Discussion: I think that the language issues that came up in the introduction and results are present in this section as well. In a number of places it is not readily apparent what the authors are trying to say, and it takes multiple re-readings to understand. Additionally, there are a few places where they seem to contradict their own discussion points, but I think that it is through the use of incorrect phrasing as opposed to a misunderstanding of the results.

351-359: This is an example of what was described above, is it increasing or decreasing as it moves towards the coast?

R: Thank you for this question. The “removal” here refers to the theoretical conservative index of mixing. If the data falls on theoretical dilution line, no removal or addition occurs. The concentration is increasing, but at a lower rate than the theoretical amount.

378-381: What? Consider removing.

R: Thank you for this suggestion. We have removed the sentences as suggested.

416-418: Ratios are not concentrations are not loads. Flow weighting the loads could be helpful.

R: Thank you for the suggestion. We will calculate them and see if they aid the discussion.

485-529: I think that this is an important topic, but feels “jammed-in” here, and doesn’t really advance the narrative in the way I think the authors wanted- if anything it muddies

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things up a bit. I would cut this section way, way down or remove altogether. It is the seed of another manuscript to be honest and is not done justice here.

R: Thank you for this. We have reduced the content of this section and will prepare another manuscript in future.

Conclusion: Again, I think language issues hinder the author's ability of bring a significant amount of work to a fine enough point. The authors are trying to extend their results into places I'm not sure they actually go. This study is a good survey of the P exports of the river, and describes spatial and temporal variability in those measurements, but it is dangerous to compare to other systems (i.e. The Detroit River exports significantly more N and P to Lake Erie than the Maumee River, but the Maumee has an outsized role in harmful algal bloom formation due to the concentrations of those nutrients, and its relatively warmer water).

R: Thank you. As indicated above, we will follow your advice and prepare a second in-depth manuscript comparing various systems. As outlined above, we do feel that a short comparison to other river systems is necessary though. We have therefore reduced this section accordingly.

Tables and Figures: Table formatting is odd. This may be due to the way it printed out for me, but there are line jumps and returns that should be removed.

R: Thank you for pointing this out. The tables have been formatted to make it tidier.

Figure 2-4: the dots are difficult to see when printed out- mainly there is not enough contrast between the points and the map base layer.

R: Thank you for this. In the final version, we will include the high resolution pictures which will aid with the clarity and contrast of the figures.

Figure 5 and others: Be careful with axis font sizes, they are all over the place and make it difficult to read a number of the plots.

R: Thank you for highlighting this. The figures have been amended.

Figure 6 and 7: Look weirdly stretched out, like they were not resized properly.

R: Thank you for pointing this out. They have been rectified.

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