

## Report #1:

*The manuscript titled "Conceptual models of dissolved carbon fluxes considering interannual typhoon responses under extreme climates in a two-layer stratified lake " aims to discuss the impacts of extreme typhoon climates on the distribution of carbon (C) in small subtropical lakes, taking the Yuan-Yang Lake (YYL) as an example. The manuscript highlights how typhoons rapidly introduce significant amounts of terrestrial C into the lake, influencing the water chemistry in the lake. The study develops a conceptual dissolved C model and proposes that the loading of allochthonous C and river inflow intrusion affect the distribution of dissolved inorganic C (DIC) and dissolved organic C (DOC) in the lake under extreme climate conditions. This is an interesting study, but some modifications are required.*

**Response:** Thanks for your comments. The manuscript has been revised, taking into account your comments below.

### **General comments:**

*More references should be included in the Introduction section on how extreme climate will impact the water chemistry in both small and large lakes. (e.g. 2023 Water Research, 10.1016/j.watres.2022.119448 and 2020 Water Research 10.1016/j.watres.2020.116471)*

*There are also some grammar and terminology issues to be addressed.*

**Response:** Thanks for your comment. We have revised these sentences by adding new references and have tried to clarify them as you suggested (lines 85 to 88).

### **Specific comments:**

*Figure 1 I can't see any useful information on how river intrusion will change the upper and lower DOC-DIC from this figure. The allochthons C shown in the lower panel seem a little bit too short. Technically, the inflowing river mouth areas are significantly influenced by the rainstorm-induced C inputs. Also, only typhoons are discussed in the manuscript and I think the other extreme climate examples should be removed. The figure needs to be reorganized.*

**Response:** Thanks for your comments. We have removed the figure.

*Figure 2. Inflowing rivers should be included in this figure.*

**Response:** We have enlarged the marker as much as possible. The red arrows show the inflowing rivers. Thanks.

*Figure 3 I can see much higher Chl-a in the lower than in the upper layer of this lake.*

*Higher phytoplankton biomass is usually found in the upper layer of a specific lake. Please double-check your data.*

Response: Thanks for your comment. We have double-checked the data set to make sure it is correct. YYL is a humic and oligotrophic lake, resulting in the low Chl. a concentration in the upper layer (Tsai et al. 2008), but we sometimes found brief algal blooms in the lower layer around the end of March.

*Line 58: It should be written as fluxes.*

Response: We have revised it accordingly, thank you.

*Line111: It should be written as Fig. 2.*

*Line 149: It should be written as Fig. 1.*

*Line 160: It should be written as Fig. 2.*

*Line 284: It should be written as Fig. 6c.*

*Line 752: It should be written as Fig. 8.*

Response: We have revised these abbreviations, thanks.

*Line139 : The specific wavelengths used were 430 nm (blue) and 662 nm (red). Was the portable fluorometer used to measure Chl-a? Please reorganize the text.*

Response: Thanks for your suggestion. We have rephased the sentence (lines 146 to 149).

*Line 246: Please change Lower NEPDOC in the formula, and pay attention to your language.*

Response: We have adopted the correct symbol, thank you.

## Report #2:

*I think this is a nice contribution that couples measurements + modeling on an important issue of quantifying carbon cycling in lakes globally. However, before publication, I think there is still some lacking organization, synthesis of clear results, and connection to the study's broader objective. I have some suggestions and concerns that fall largely into the following categories that the author could consider incorporating:*

**Response:** I appreciate your positive and constructive comments. The manuscript has been revised, taking into account your comments below.

### **1) Introduction edits:**

*Improve the flow to really synthesize the importance. There is also a harsh transition to talking about precipitation in line 80, I think you can weave concepts a little more strategically. From my interpretation, I see 4-5 paragraphs in the introduction addressing the following: we need to keep improving quantifying carbon flux in lakes globally, it is not clear how climate will impact these fluxes, extremes in precipitation are likely to increase in a lot of parts of the world (likely in this study site as well), and it's been shown that precipitation has impacted carbon cycling in lake systems, but it remains foggy. So, in this study....*

**Response:** We appreciate your comments. We have added one more paragraph to introduce how typhoons impacted DIC and DOC in subtropical shallow lakes (lines 82 to 94).

### **2) Results edits:**

*I think the results section still remains hard to follow, it was suggested from a previous review that the descriptor "nonseasonal" is confusing. I agree and I think it still remains in the manuscript and hasn't been changed all over (maybe just a few places). If you are also going to use seasons, should you consider using a hemisphere descriptor for clarity (for example, boreal fall for Northern Hemisphere fall...)? I would maybe suggest being clearer about your section headers. Maybe divide into typhoon and non typhoon years and then into measured and modeled results. I think right now it goes back and forth a lot and is hard to follow. I think it will also improve when the term "nonseasonal" is removed.*

**Response:** Thanks for your comments. "Nonseasonal" was confusing, as you pointed out. We have therefore thoroughly removed the results for nonseasonal data.

### **3) Figure edits:**

*Fig 1: In conceptual model, can droughts not also impact lake thermal stratification? Why is DIC connected to photosynthesis and respiration but not DOC? I believe the DOC pool is influenced by those processes? How does the bar of different C pools (auto/allochthon) on the bottom fit into the conceptual model? For example, sediments are in blue like autochthonous C, but it is likely your sediments are a mixture (likely dominated) by allochthonous C too. There are also additional biogeochemical processes + C flux from sediments that aren't addressed in the figure (but are brought up in the conclusion)...*

**Response:** Thanks for your comments. We agree that the figure was confusing. We have removed it.

*Fig 2: I would make your markers bigger on the map.*

**Response:** We have enlarged the marker as much as possible. The red arrows show the inflowing rivers. Thanks.

*Fig 3: should you maybe just write the p values on the respective graph panels instead of the key to the values (ns, \*, \*\*)? For example, since you use the term “nonseasonal” I think ns means that, but I do not believe that is the case...*

**Response:** We have added the *p*-values in the graph panels. Thank you.

*700-702: I see no red values in this table.*

**Response:** We have removed it from the manuscript. Thank you.

*706: Perhaps rewrite figure caption to: “Conceptual diagram of river intrusion (red arrows) and thermal stratification 706 (red dashed line) influencing dominant responses of DIC and DOC in a subtropical two-layer 707 stratified lake under extreme climates” Also the tables in the format (as is) are not well aligned (e.g, titles on two lines, hard to read), you might need to adjust. Maybe add your “Level” characterizations to Table 2 or 3 - the differentiation is getting a bit lost in the methods.*

**Response:** We have removed the figure and added the Level characterizations to Table 2.

#### **4) Discussion: consider**

*Sub-organizing the discussion into typhoon/non typhoon years, or model/measured data, or how the modeled/measured data disagree? I think this will help add flow that feels missing as is. Reviewer #1 suggested adding some additional sentences on*

*seasonal CO<sub>2</sub> emission flux, but it is not popping out to me right now...*

Response: Thanks for your suggestions. We have added the subtitle to sub-organize the discussion and have added some sentences to discuss the CO<sub>2</sub> emission in this study (lines 383 to 394).

### **5) General specifics**

*to be added: I mentioned a few line specific places where I think you can just provide a bit more detail to give the reader clarity, but there are other places throughout the manuscript that can benefit from this. A sentence that I marked but can be used as an example: "The water depth is not only steady but also changes"< I think additional detail is needed to clarify this. Another in the introduction: For example: "River inflows, sediment, and respiration contribute to DIC loading into lakes">> sediment what? Flux? Respiration in the water column or post depositional biogeochemical processes? There are a myriad of steps that exist between...*

Response: Thanks for your comments. We have revised these sentences and tried to clarify them as you suggested.

#### **Line specific comments:**

*Line 21: models to model*

Response: We have made this change. Thank you.

*Line 24: should transportation be transformation?*

Response: Yes, we have replaced the word. Thank you.

*Line 28: change a load to loading*

Response: We have corrected the grammatical error. Thanks.

*Line 39: fresh or salty water columns- can you note?*

Response: Thanks for your comments. We focused on freshwater ecosystems, so this refers to freshwater columns.

*50: with to within*

Response: We have corrected the error. Thank you.

*Line 80: big scale shift to talking about rain– expand on what is known about rainfall impacting DOC and C cycling...*

Response: Thanks for your suggestion. We have revised this paragraph.

121-123: *what nutrients? What organisms– can you be more specific?*

Response: Thanks for your suggestion. We have revised the wording to make it more specific.

183/184: *Fix sentence “The water depth is not only steady but also changes”> also is this different font?*

Response: We have removed the sentence and revised the font. Thank you.

233: *different font*

255: *different font*

Response: We have revised the subtitle fonts. Thank you.

256-258: *clarify this sentence– what is the difference between typhoon and non typhoon years here, and what is this result trying to compare or conclude?*

Response: We have revised the sentence, thank you.

261: *be more specific- what are you comparing in this t test?*

Response: We have revised the sentence, thank you.

275-276: *should this conclusion (correlation with resp, DIC and chl) be in the discussion? Or give a reference for this interpretation...*

Response: Thanks for your suggestion. Because we had investigated this before, we added references (Lin et al. 2021 and Tsai et al. 2008) to this sentence.

282: *define NSE*

Response: As in equation (8). Thank you.

285: *best fit different text*

Response: We have revised this, thanks.

298-299: *is this a statistical output or an interpretation?*

Response: It is an interpretation of parameter values. We have revised it. Thank you.

311-312: *Can you clarify “the upper layer DIC and DOC consumed approximately 3.7 times more DIC in the typhoon years than in the non-typhoon years”? How does DIC and DOC consume, maybe missing biogeochemical steps here....*

Response: Thank you for your suggestion. We have added some sentences about that in Sect. 4.1 (lines 380 to 394).

323: *in saying “upper layer ratios” are you referring to DIC:DOC in the upper layer? Likely should clarify....*

326: *You talk about ratios varying within this paragraph, but only use a value at the very end in regards to the lowest... keep that consistent throughout the paragraph if you'd like to compare values/numbers.*

Response: We have removed this paragraph because it did not show necessary information for this study and because the sentences were confusing, as you pointed out.

341-345: *more specifically describe the result or point of this result.*

Response: We have added more sentences to describe Figs. 8-9 (lines 342 to 351). Thank you.

351: *be more specific about what parameters changed. What do you consider water quality data? How might remineralization change with anoxic conditions.*

Response: Thanks for your comment. We have revised the wording and described the change with anoxic conditions (lines 359 to 367).

355: *probably good to specifically reference microorganisms rather than just organisms here?*

Response: Thanks for your suggestion. Indeed, the use of “microorganism” in this sentence (line 362) is well advised.

365: *corresponds or proves hypothesis?*

Response: “Corresponds” is correct. Thank you.

372-375: *Can you clarify the following: “Additionally, 372 because of the absence of typhoon-induced mixing and allochthonous C loading, the absolute 373 values of total fluxes in the non-typhoon years were less than those the non-typhoon years 374 (Table 4). “*

Response: Thanks for your suggestion. We have added CO<sub>2</sub> emission and other flux data to support this sentence (lines 383 to 394).

377: *seasonal C what? Concentration? Flux? Sequestration?*

Response: Concentrations. We have clarified this. Thank you.

408: Remove the phrasing “to our knowledge”

Response: We have removed the phrase, thank you.

414: two commas

Response: Thank you, we have fixed the problem.

420: Typhoon disturbances or seasons?

Response: Typhoon disturbances. We have clarified the sentence. Thank you.

421: Rephrase sentence:” Without typhoons, the strength of thermal stratification was the primary determinants (determinant of) the seasonal and interannual patterns of DIC and DOC concentration. Typhoon-induced upwelling and loading facilitated 102.2 mg-DIC m<sup>-3</sup> d<sup>-1</sup> and 62.3 mg-DOC m<sup>-3</sup> d<sup>-1</sup> flux in YYL, respectively.”

Response: We have rephrased the sentences. Thanks for your suggestion (lines 435 to 438).