Report #1:

Fig. 1 Yuang-Yang Lake in the lower panel and Yuanyang Lake in the right panel should be changed to Yuan-Yang Lake.

Thanks for your comment. We have revised the text in Fig. 1.

Report #2:

General comments

I appreciate the changes and improvements that were made to this manuscript, but I still think additional editing needs to be completed before acceptance for publication. In this second round of peer review, I believe that the results section and amount of figures is too long, and should be compressed to detail the most meaningful results. As written, I find the results still extremely confusing to get through, and find it hard to streamline what is important and how the authors reach the conclusions from the figures and results presented as is.

We appreciate your constructive comments. The manuscript has been revised, taking into account your comments below.

I would suggest additional time in re-structuring the results. Firstly, I still don't understand how you talk about the measurements (observations) and the simulated (conceptual model) data. It seems like most of your data is simulated, but you still made measurements- can you differentiate more clearly?

Thanks for your comment; we have restructured the results section thoroughly and attempted to depart the results of measurements (section 3.1) and models (sections 3.2 and 3.3).

Right now, I have also found that many of the statements seem redundant and this flows into the discussion. Much of the discussion just reads like a continuation of results, not an actual evaluation of the results in the context of how it's expanded what is known about the current literature/biogeochemical processes in subtropical lakes. I would suggest spending more time discussing specific results as they tie to specific or broader patterns in biogeochemical processes, and removing some of the truly analytical results (perhaps moving those into the results section, like lines 384-391). So, my overall analysis would be to compress the results and figures and expand the discussion as it relates to biogeochemical processes.

Thanks for your comment and suggestion. We have moved these sentences to the results section and added and revised some paragraphs to discuss the biogeochemical processes as your suggestion (Lines 377–390 and 433–441).

I also think you can move some of your figures into supplemental. In my opinion, there is a lot of redundancy (like figures 5 and 6 without clearer explanation of Level 1/2) and figure 4 doesn't seem to add much as a priority figure. Can you consider more succinctly combining some of the findings into figures that make things easier to follow? For example- do you think Figure 7 and 8 are both necessary? Figure 9 comprehensively brings together observations and modeled values (I like this). Is Figure 3 populated by observations or modeled values?

Thanks for your suggestion. We have combined Fig .5 and Fig. 6 to new Fig. 5 and moved Fig. 7 and Fig. 8 to supplement (Fig S1 and Fig S2).

Other conceptual things that need clarity:
What do you mean by interannual variability: are you just referring to seasonal change? For example, how is 3.4 different than 3.1? Can you clarify within section 3.3 too?
Thank you for your comment. Interannual variability means the seasonal dynamics of the two years' data. Also, we have restructured the results section.

Can you clarify/write in more detail your methods of sample collection? Did you collect separate samples for DOC that was not filtered on the GFF filters? What did you use the 0.7 um particulates for? That is too big of a mesh size for DOC concentrations.
Indeed, the standard technique for analyzing DOC in freshwater samples is based on a filter paper with a pore size of 0.45 μm. However, some DOM research community pointed to the pore sizes of 0.45 and 0.2 μm sometimes are constructed from organic substances such as cellulose acetate, that might potentially induce contamination (Denis *et al.*, 2017). Thus, the 0.7 μm glass fiber filters might be better to measure the DOC concentration.

Denis, M., Jeanneau, L., Pierson-Wickman, A. C., Humbert, G., Petitjean, P., Jaffrézic, A., & Gruau, G. (2017). A comparative study on the pore-size and filter type effect on the molecular composition of soil and stream dissolved organic matter. Organic geochemistry, 110, 36-44. https://doi.org/10.1016/j.orggeochem.2017.05.002

Did you only do some of the samples for water quality once? And then the outflow monthly? Maybe include the number of observations on your figure/within your figure caption.
All the water samples were collected monthly, but sometimes, we could not trip to YYL because of the breeding season in April or other accidents, such as tree snaps and landslides. We have added sampling numbers in Fig. 1 and Fig. 5 caption as your suggestion, thank you.

Can you please provide further clarity in the text on what is Level 1 and 2 and what climate extremes does it relate to? Localized extremes? Already known modeled extremes?
Thanks for your comments. We followed buoyancy frequency (Brunt–Väisälä frequency) in YYL (Lin et al. 2021), and expected extreme weather events might induce stronger seasonal thermal stratification from spring to summer and longer overturns from autumn to winter to determine the climate extreme scenarios.

Another read through to clarify (concepts + references) and condense sentences. An example where sentence to me was hard to follow:
369: "Therefore, these physical and biogeochemical processes might describe different patterns between the upper and lower layers (Fig. 4). "In summer, the spatial differences

between layers in DIC and DOC were inhibited due to strong thermal stratification, describing the positive upper net primary production and lower negative net primary production (Lin et al., 2021).”
What specific patterns? What would we expect (provide reference)? Spatial differences between layers in DIC and DOC< what does that mean? Across a transect? Within layers? How is it describing the positive/negative primary production. Missing a link between DIC/DOC variability and PP….
In the paragraph, we have added more sentences to describe biogeochemical and physical processes clearly. That can help us gain deep insight into this study. Thank you. (Line 377–390 and 433–441)

Specific comments
43: Reference at the end of that sentence?
45: important for humans because of the C processing? Or because of C processing providing availability to foodwebs that support human resources? Alternatively, you could mean C storage? < Consider making a better connection there.
Thanks for your suggestions. We rephrased the sentences. (Line 45–47)

49: Start a new paragraph when you begin talking about small lakes.
We revised the paragraph by separating paragraphs as you suggested; thank you for your comment. (Line 48)

56: Remove however
We removed the word, thank you.

66: Consider rephrase “Not only taking is taking in situ measurements difficult, but resolving the dynamics and interactions…. Remains complex.”
Thank you for your comment; we have removed the sentence.

102: was that a different year than 2004, can you clarify?
We added the period (in the summer and autumn of 2015) in the manuscript; thank you. (Line 100)

122: remove second its
We have removed it; thank you.

128: the world annually (half of totally precip in YYL annually)
Thank you for your suggestion. We have added world annually in the sentence. (Line 127))

140-144: please clarify these sentences. You collected water via van Dorn for various parameters (DOC/DIC/Chl.a). You also collected GFF filters for POC at the outflow which would be the filtrate– as 0.7 represents POC not DOC– can you clarify? So, you had liquid samples and filtrate, correct?

Thanks for your comments. We filtrated water samples and used filter paper samples to obtain DIC/DOC and Chl. a concentrations. However, some DOM research community pointed to the pore sizes of 0.45 and 0.2 μm sometimes are constructed from organic substances such as cellulose acetate, that might potentially induce contamination (Denis *et al.*, 2017). Thus, we used 0.7 μm glass fiber filters might be better to measure the DOC concentration.

Denis, M., Jeanneau, L., Pierson-Wickman, A. C., Humbert, G., Petitjean, P., Jaffrézic, A., & Gruau, G. (2017). A comparative study on the pore-size and filter type effect on the molecular composition of soil and stream dissolved organic matter. Organic geochemistry, 110, 36-44. https://doi.org/10.1016/j.orggeochem.2017.05.002

148-153: Provide more detail/clarity here in what you did. What did the fluorometer measurements give you? What machine was used to measure Chla after methanol extraction?

Thanks for your comments. We used a portable fluorometer (model 10-AU-005-CE; Turner Designs, Sunnyvale, CA, USA) to estimate Chl. a concentration. We have revised the sentences. (Line 148–152)

152-153: do you mean all analysis was complete within 72 hours of exposure to light to reduce the degradation?

We have added the sentence in the paragraph; thanks for your suggestion. (Line 151–152)

159: Add a sentence in how the observable data was used within the conceptual equations model– how did you make that link?

We added a sentence to link the paragraphs; thanks for your suggestion. (Line 158–160)

161: extra dash there.

We removed it; thank you.

165: remove one of the uses of meteorological

We removed the text.

172: did you sample the secchi disk depth at a certain interval in that time frame?

We added more information in the manuscript; thanks for your comment. (Line 171–172)

173: How did you confirm there were four strong typhoons recorded? Wind speed/other meteorological parameters? Clarify.

Thanks for your comment. Four strong typhoons were recorded by using wind speed and rainfall meteorological parameters (Table 1). We added more explanations in the manuscript. (Line 177–178)

173-174: Please clarify this concept. It is not 35.6% of annual rainfall, it's 35.6% of rainfall across 2 years of typical rainfall (>3000 mm/y).

We revised the sentence to rainfall across two years of typical rainfall. Thank you. (Line 173–175)

176: So, 2017 and 2018 are both below average years? ~1268 mm/y instead of 3000 mm/y as suggested in line 127?

Thanks for your comment. The rainfall was recorded around 1800 to 4500 mm yr^{-1} from 1995 to 2005 in YYL, depending on annual typhoon numbers (Lai et al. 2006). Yes, the annual rainfall from 2017 to 2018 was below average. We revised the sentence in the manuscript. (Line 176–178)

177: Was average water depth higher in 2015/2016?

We added more information in the manuscript; thanks for your suggestion. (Line 176–179)

178-179: In general, please clarify how you defined typhoon/non typhoon years at the beginning of this paragraph. The way it is written makes me think the rainfall in 2015 and 2016 is less than 2017/2018 (which you are considering non typhoon), I think you need to be really clear that it's not rainfall alone, but it is temporal variability of the rainfall (falls all between X months), avg wind speed higher, discharge overall lower, etc.

We added the annual averages of wind speed in the paragraph and Table 1; thank you. (Line 173–180)

194: variated to varied

We revised the text; thank you. (Line 196)

197: add "was used to establish"

We added it to the manuscript; thank you. (Line 199)

205: missing parentheses

We added the parentheses in the manuscript; thank you. (Line 207)

219: Start new paragraph when talking about climate change.

Thanks for your suggestion. We separated the paragraph as you suggested. (Line 222)

224: what were the extreme conditions based on? Qin? how did you define Level 1 and Level 2 respectively? How can we compare this to real-time projections of what is expected in climate scenarios for the YYL– rainfall amounts?

Thank you for your comment. We expected that "Extreme weather events might induce stronger seasonal thermal stratification from spring to summer and longer overturns from autumn to winter, thereby changing C distribution and transportation within water bodies (Kraemer et al., 2021; Olsson et al., 2022a; Woolway et al., 2020)". Thus, we changed the QU and QL by using the ratios of Qin (Table 2) to test our river intrusion hypothesis. Thus, we used the river discharge and considered buoyancy frequency (Brunt–Väisälä frequency) to obtain the projections.

267: I am confused- are these results modeled or measured?

Thanks for your suggestion. We revised the subtitles in the results. The measurement results were shown in section 3.1, and the simulation results were shown in sections 3.2 and 3.2.

299-300: can you clarify what you are comparing here- DIC measured/modeled? Best fit to what sort of regression/relationship?

Thank you for your comment. We used NSE (Nash–Sutcliffe model efficiency coefficient) and R^2 to know the robustness of how the model fits the field observations to find the best-fit conditions. We revised the sentence.

310-311: Can you clarify how you got to that conclusion? What did you compare- state it directly?

We removed the sentence as the sentence does not show the conclusion clearly; thank you.

318: Was this relationship between Fc and Flux DIC in both typhoon and non typhoon years– consider rephrasing the sentence as you are talking about both?

We rephrased the sentence; thanks for your suggestion. (Line 330–331)

320-321: consider rephrasing sentence: two 'declines' in a short sentence.

We replaced one of the 'declines' in the sentence; thank you. (Line 333–336)

322: What's with the quotations? The text size also looks different…
We removed the quotations and corrected the text size.

You start section 3.4 with mentioning these are simulated results, but seemingly the references to figures in the above sections are also the conceptual model simulations. I find this confusing. Streamline what is observed and what is modeled.
Thanks for your comment. We have restructured the results and attempted to separate the results of measurements (section 3.1) and models (sections 3.2 and 3.3).

328/329: looks like different text size
We corrected the text size; thank you.

359: As Table 1 shows, four strong typhoons were recorded, contributing a total of 2,254 mm 173 of precipitation in all 24 months of 2015 and 2016, This accounted for 35.6% of the annual 174 precipitation. However, no typhoon rainfall was recorded at YYL in 2017 and 2018; the total 175 precipitation in that 2-year period was around 2,537 mm. << how does this compare to what is said around lines 173?
We revised and added the correct data (35.6%) in the manuscript; thank you. (Line 365)

410-413 repeating the concept in 367-369
We removed the sentence; thank you.

443-445 I would rephrase this. I don't think the words autochthonous or photo biochemical is used efficiently here. (e.g., within lake, primary production, photochemical degradation might be better choices to incorporate)
Thank you for your suggestion. We revised the sentence. (Line 458–460)