

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-42

Anonymous Referee #2

Referee comment on "Effects of seasonal and diel variations in thermal stratification on phytoplankton in a regulated river" by Eunsong Jung et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-42-RC2>, 2022

I recommend the authors consider the following comments and develop the manuscript in a global context and perspective.

General comments

This manuscript focuses on river stratification, which was not common in the past but has become frequent due to human river modification and climate changes. The authors traced the causes of stratification and its impact on phytoplankton in the middle of the Nakdong River in South Korea after a river modification. They conducted vertical profiling seasonally and diurnally between 2017 and 2018, and diagnosed the stratification degree using three stratification indices. They also implemented various analyses to reveal the effect of stratification on the river microbial ecology, including associations between different water quality parameters and phytoplankton assemblages. The authors concluded that: 1) The summer stratification in 2018 exceeded the stratification thresholds generally accepted in many aquatic environments, and 2) Diel variations in the stratification intensity and thermocline depth were distinctive from the typical stratification of lakes or dams.

As a reviewer, I concur with the authors in their conclusions. I see several interesting points of the study, which are unfortunately not stressed at the current state of the manuscript. River utilization patterns become complex worldwide, and stratification often occurs in lotic systems. Most importantly, the structure and function of the aquatic ecosystem of the Nakdong River must be shifted to a new phase due to a large-scale river transformation project (as the authors illustrated). I ask the authors to relate the stratification occurrence and the river project; hence the readers may find helpful information comparable to their respective study sites..

The authors provided a lot of analytical results, but they are not well related, nor successfully emphasize their findings. Consequently, the manuscript must be restructured largely. In my reading, I also found several unclear sentences. I have listed some of these under my minor comments. Please ask a native English speaker in the related scientific field to revise the English writing.

I hope that the authors' findings will be successfully conveyed to the readers of the journal Biogeosciences. I believe that an appropriate revision is necessary for this manuscript to meet the goals pursued by the Journal. Please revise the manuscript by carefully reflecting on this general and the following specific comments.

Specific comments

- Title

Title of the manuscript may be reconsidered as the authors revise the manuscript. Please contact your Editor of the journal the possibility.

- Abstract

Line 11. In the discussion part, the authors referenced the researches on diel river stratification and response of phytoplankton. However, in this line they suggested the studies are "lacking". Please revise it.

Lines 23-25. If the authors accept the general comment, the abstract must be rewritten. Especially, please stress your new findings or suggestion in this part.

- Introduction

Lines 40-43. Differentiation of stratification characteristics in rivers from the typical lake stratification would be one of the main conclusions of this study. Moreover, I think these lines must be restructured, in relation to the river project the Nakdong River has experienced.

Lines 44-50. This is more appropriate for the study site description part so please move the sentences. Instead, explain why the Nakdong River stratification problem is import in global context.

- Methods

Line 60. It is strongly recommended the study site establishment strategy: i.e. I hope to understand why the authors set their sites there. In the results section, The different river morphologies or distances from the weirs brought different spatial variations in the stratification indices. This must be also related to the objectives of the study.

Lines 113-139. It is strongly recommended to reformulate this part. I realized that they first examine descriptive characteristics of the study sites, then stratification events were investigated with the application of three indices. Then they applied several multi-variate statistical analyses such as PCA and CCA. Please detail the purpose and differences these analyses to facilitate the readers' understanding. I suggest the authors to reinspect the uses of similar analyses.

Throughout the method part: Please keep methods the authors used in order of the analysis sequence, hence should be linked to the sequence of results exhibition.

- Results

Please revise the Results part as the authors are asked to rewrite the methods part.

Lines 153-160. The authors diagnosed stratification in the river using three stratification indices. They presented much information of seasonal and spatial variation in the stratification for the respective stratification indices into the Figure 2. From reading, it is not clear which information they think the most important and relevant for phytoplankton.

Lines 166-174. Same comment. In the Discussion, it is explained that frequency of destratification and timing of the maximum stratification are important for cyanobacterial proliferation. Timing of the maximum stratification and depth of the thermocline were investigated. However how would they affect phytoplankton was not rigorously discussed in the Discussion.

Section 3.3. I concur with many comments already made by Referee #1. In addition to and supporting suggestions by Referee #1, I would recommend that the authors to identify the roles of diel variation in stratification and thermocline depth using the figure 7 and 8 for the novelty of the study.

Lines 225-236. Phytoplankton distribution seems well responded to the stratification event (only by Figure 6); however, its corresponding text does not clearly explain. Please rewrite this part.

Lines 242-249. Relationships between phytoplankton assemblage and environmental variables including several stratification indices were analyzed. In interpreting the results, do they assume the response of phytoplankton in an "assemblage-scale" or a linear relationship in an individual phytoplankton phylum? Also, please highlight and distinguish these finding from the similar researches in the Discussion section.

- Discussion

Subsection 4.1. They entitled this part as "the characteristics of the Nakdong River," however the Nakdong River circumstance was not well discussed. The spatial difference of the stratification indices were found between the study sites. They should explain how the different river morphologies or distances from the weirs brought these consequences. For example, the authors may relate future mitigation strategy for cyanobacterial proliferation to stratification patterns.

Moreover, they only stressed that the river had different stratification characteristics than the typical lake system by comparing the stratification indices and behaviors of stratification to referenced lakes. Finally, they concluded that these characteristics are important in shaping the aquatic ecosystem. Please relate the results in the manuscript to the storyline. Please suggest how unique or general the stratification in the Nakdong river is by comparing to other river stratifications.

Section 4.2. They expect that summer stratification would become more intensive in the Nakdong river based on the dependence of the stratification indices on the meteorological variables. It would be more persuasive if evidences were provided properly. For example, they can show the highest record of air temperature of the study site in 2018 or extended years then compare it with the air temperature at the date of surveys. This will tell how much the stratification would further intensify as it reaches the middle of summer and how the stratification would be recurrent in every summer.

Section 4.3. The authors are asked to discuss their results with the references shown in the texts. If the authors accept my suggestion shown above, the texts in this section must be largely restructured.

- Conclusion

Is there really a need for a concluding section? This section is basically a summary and not a terse concluding paragraph. It needs to be shorter and highlight the novelties of the study. If this cannot be done, then it is not needed.

Technical comments

Lines 57-62. As aforementioned, the sentences of Nakdong River explanation may be merged to this part. Please do not forget to clarify the Nakdong River characteristics, comparable to other rivers in the world.

Line 70. Please explain your diel monitoring strategy in detail.

Line 76. The authors examined phytoplankton species data from their diel monitoring, but here they did not explain how they monitored, identified, and enumerated.

Figure 1 (the map). Please add a small map showing the East Asian region to understand

where the river is located.

Lines 97, 102. I don't think the in-line equations are necessary, because the authors already showed them in Table 1. Please consult the journal style.

Line 103. Acceleration due to gravity $\ddot{\square}$ gravitational acceleration

Table 1. Please check whether the authors used those threshold values as the meaning of a magnitude or intensity that must be exceeded for stratification. Why they provided two values for the respective indices? In my reading, the terms "low- and high-threshold" could be misunderstood to mean the lowest and the highest values of each of the indices reported previously.

Also, the authors did not provide equation of "Maximum temperature gradient" in the table, and what is "many" right after the name of this index?

Line 148. Please show the version numbers for respective R packages the authors used.

Lines 155-157. Different results between the stratification indices were explained. Please move it to the Discussion section.

Lines 181-190. I think this descriptive part may appear in the first part of the results.

Table 3. This would be appropriate for supplementary materials.

Lines 259-267. Please move this paragraph to the previous diel pattern explanation part, and concentrate on Microcystis distribution. Also, please explain what data were used to calculate each average value.

6. Figure 8. Please check the parentheses.