

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-42

Anonymous Referee #1

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-RC1>, 2022

General comments

The authors present an interesting manuscript about the different effects of seasonal and diel variations in a river's thermal stratification on phytoplankton community. This work is timely given the recent intensification of interest in global temperature increase and helps predicting its short/long term consequences in freshwater ecosystems. I am pleased that the authors made a valuable contribution to the field with the high-frequency data of phytoplankton community rarely seen in other studies. The authors hypothesized that river stratification would have different environmental drivers and effects on phytoplankton in the two different time scales then analyzed them separately. Interestingly, the authors found that the seasonal shifts in phytoplankton community structure were either insensitive and showed a limited response to the stratification indices. Summer cyanobacterial bloom intensity, here cell abundance and accumulation into the surface water, was positively affected by the diel variations in the stratification indices and thermocline. Based on the environmental drivers of stratification, the authors discuss the generalization of stratification events for the river system and the implementation strategy for flow management to mitigate cyanobacterial blooms. Overall, the manuscript has interesting research questions and the data collection/analysis/interpretation seem sound. However, the manuscript needs to be revised before publication. I hope the comments below can help the authors improve their manuscript.

Specific comments

Section 2.2: the used thermal stability indices are all based on the vertical temperature difference (potential energy), but their calculations lack the concept of vertical mixing

(mixing energy) that against the formed stratification. Prandtl number, Richardson number, or Lake number could be additionally considered when appropriate (Kirillin and Shatwell, 2016).

Section 2.3: It would improve the readability of the materials and methods section, if the different data analyses were more clearly linked with specific hypotheses which already stated in the results section.

Section 3.1: temporal variations in the stratification indices are investigated, but why are the authors interested in the scales of variation? What do they expect? This is one of many examples, where the formulation of a hypothesis would improve the storyline. Are the authors expecting that short-term stratification will have a different ecological mechanism or consequence from lake stratification which persists longer?

Fig 4: why are the authors presenting additional information on the thermoclines and their vertical variations? It would be easier to read if the authors formulated a hypothesis about how the diel variation of the thermoclines affect the vertical distribution of phytoplankton cell in Fig 8 and then investigate these.

Section 3.2: the first paragraph summarizes the changes over seasons and sites in the multiple parameters which were later analyzed against the stratification indices. From reading, it is not clear why all this information (and with the standard error of detail) is presented. Parts of the paragraph are trivial and the text could easily be reduced substantially (e.g. the two first sentences could be removed).

Section 3.3, relationships between phytoplankton assemblage and multiple environmental factors including the stratification indices are investigated. It is described that the diel CCA showed a positive relationship between air temperature and cyanobacterial density. The authors must draw a conclusion by combining the PCA results, which showed a strong relationship between chlorophyll a and the stratification indices.

Fig 8. I suggest the authors to present cyanobacterial cell density, which was used in the CCA analyses in Fig 7. This may give a reason for the different stratification-phytoplankton relationships between the PCA and CCA.

Section 4.2: 'The PCA ordinations revealed that thermal stratification is one of the most important drivers of water environments in the Nakdong River, largely accounting for their seasonal and diel variations'. What do the authors mean by this?

Reference

Kirillin, G., & Shatwell, T. (2016). Generalized scaling of seasonal thermal stratification in lakes. *Earth-Science Reviews*, 161, 179-190.