<div align="center">**Response to reviewer**</div>

Title: Interactive comment on "Spatial pattern of K_d(PAR) and its relationship with light absorption of optically active components in inland waters across China

Anonymous Referee #1

General comments: Underwater life is markedly influenced by the light field in the water. The spectral composition of light, its total amount, and change with depth are determined by the solar irradiance entering into water as well as by the optical properties of the natural water. Therefore, lake waters can be classified based on their optical properties and the classes indicate certain relationships related to ecological processes in these waters. The research topic is relevant because it enables better understanding optical properties in lakes as well as enhance the development of management strategies to restore and improve the ecological status of lakes In this manuscript, authors describe a new approach to predict K_d(PAR) in turbid inland waters using the absorption characteristics of optically-active components (OACs) in waters. OACs information can be retrieved from widely available satellite images, thus allowing large-scale and high frequency assessment of photosynthetic active radiation and ecological health of lakes. To demonstrate the new approach, they used data collected from 141 lakes and reservoirs over a 3-year period.

The study rationale and objectives are well stated and grounded in existing literature. Methodology is sound and adequately described, and conclusions of the study are supported by the data presented. The manuscript is publishable, but the text requires a great deal of editing. My detailed comments are listed below.

Response: We thank the reviewer for the very instructive and helpful suggestions for revision. We have revised manuscript according to the reviewer's suggestion, and the details are listed as following. Thank you very much again for the positive evaluation and giving us the chance to further improve our manuscript.

1. The abstract doesn't include all important from the paper: for example, the aim of the study was not even mentioned. The abstract should be more concrete too! "This study highlights the……"; "……findings which have application for monitoring K_d(PAR)..."

Response: Thank you for the suggestion, and we have rephrased the abstract as suggested (Page 2, line 17-34).

2. In manuscript, why are you going from OACs to a_{OAC}? Sometimes, you write OAC,

other time you write a_{OACs}. Unless there is a valid reason, it is important to use the same abbreviation throughout the manuscript.

Response: We are very sorry for the inconsistent expression, and we have checked the abbreviations throughout the manuscript. OACs is the abbreviation of optically active components, and a_{OACs} represents the light absorption coefficient of optically active components. These are two different concepts. In our study, we analyzed the relationships between a_{OACs} and K_d(PAR).

3. Line 38 and throughout the manuscript, the citations should be presented as the followed format (First author, et al., year), please do not list all authors in the text.

Response: We completely agree with you, and we have revised them in the manuscript according to your suggestion.

4. Line 43 "optically active compounds" and "optically active components". You need to develop some consistency regarding the use of terms.

Response: Thank you for the suggestion, and we have consistently used "optically active components" in the revised manuscript.

5. Line 61-64 A reference is required here.

Response: Thank you for the suggestion, and we have added the reference "Prieur & Sathyendranath, 1981)" in the revised manuscript (Page 3, line 60).

Prieur, L., Sathyendranath, S.: An optical classification of coastal and oceanic waters based on the specific spectral absorption curves of phytoplankton pigments, dissolved organic matter, and other particulate materials, Limnol. Oceanogr., 26(4), 671-689, 1981.

6. Line 117-137 Condense these sentences. Limit your description to details that would help readers under the context of the study. This section is not your emphasis. You can reduce the length as soon as possible.

Line 138-144 Same thing here. These details are superfluous. Please do not in so much detail.

Response: We have accepted the suggestion, and have rephrased these sentences, thanks for the instructive comments (Page 7, line 106-152).

7. Line 160 I care how long the samples are stored in the field and how to be stored.

Response: The surface water was collected in the acid-washed HDPE bottles, and were placed in a portable refrigerator at 4 ℃ about 1-2 days before they were carried back to the laboratory.

8. Line 211 Has this classification been used before? If so, provide reference. In addition, and more importantly, this is the only time reference is made to CHAID approach in the entire manuscript. There is no reason to list the method, if it is not used in the analysis of data presented in the manuscript.

Response: Thank you for the comment. We have added the related references in the manuscript (Breiman et al., 1984; Hampton et al., 2017) (Page 9, line 185). The result of this analysis showed that the tree had two branches with the boundary of 3.8 mg/L TSM. So the TSM concentration of 3.8 mg/L was used as a threshold to categorize the lakes in the subsequent analysis. Mean K_d(PAR) and standard error of K_d(PAR) were calculated for each branch of the regression trees.

Breiman L, Friedman J, Olshen R (1984) Classification and Regression Trees. Wadsworth International Group, Belmont

Hampton SE et al. (2017) Ecology under lake ice. Ecol Lett 20: 98-111.

9. Line 221 I think, it's more precise to say "point". An entire lake can be viewed as a study site.

Response: We completely agree with you, and we have used "point" in the manuscript.

10. Line 227 That sentence is a repetition of information that has just been provided.

Response: We have deleted the sentence as suggested.

11. Line 234 Sometimes you use trophic status but sometimes trophic state. Please the consistent expression for all the text.

Figure 2 and Figure 8: I could not find in the text how the trophic states were defined.

Response: We have consistently used "trophic status" in the revised manuscript, and added the definition of trophic status. The assessment of the trophic status of lakes was based on the modified Carlson's trophic state index (TSI), using measured *Chla*, TP and SDD data. The TSI value was calculated from TSI(Chla), TSI(SD) and TSI(TP), see Equations 4-7 (Carlson, 1977; Aizaki et al., 1981). The traditional TSI method used numbers (0-100) to express the state of a lake: TSI <30 indicates oligotrophic state, 30 - 50 indicates mesotrophic state, and 50 - 100 indicates eutrophic state. (Page 9, line 189-193).

$$TSI_M(Chla) = 10 \times (2.46 + \frac{\ln Chla}{\ln 2.5}) \tag{1}$$

$$TSI_M(SD) = 10 \times (2.46 + \frac{3.69 - 1.52 \times \ln SD}{\ln 2.5}) \tag{2}$$

$$TSI_M(TP) = 10 \times (2.46 + \frac{6.71 + 1.15 \times \ln(TP)}{\ln 2.5}) \qquad (3)$$

$$TSI = 0.54 \times TSI_M(Chla) + 0.297 \times TSI_M(SD) + 0.163 \times TSI_M(TP) \qquad (4)$$

Aizaki, M., Otsuki, A., Fukushima, T., Kawai, T., Hosomi, M., Muraoka, K. 1981. Application of modified Carlson's trophic state index to Japanese lakes and its relationship to other parameters related to trophic state.

Carlson, R. E.: A trophic state index for lakes, Limnol. Oceanogr., 22(2), 361-369, 1977.

12. Line 314 What is the basis for using a TSM threshold of 3.8 mg/L to categorize the lakes? If that is based on a previous study, list the reference(s). If that is based on the analysis of the data from the present study, indicate where the information is presented.

Response: Thank you for the comment. The TSM concentration of 3.8 mg/L used as a threshold to categorize the lakes is the result of regression tree analysis. We have explained the method in the former comment. The authors really thank for the very instructive comments.