

## ***Interactive comment on “Spatial pattern of $K_d(\text{PAR})$ and its relationship with light absorption of optically active components in inland waters across China” by Zhidan Wen et al.***

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Light is an important factor controlling primary production in the water and its measurements have been extensively applied for monitoring water quality in the past centuries. Significant technologic advances have been reached in the past decades with respect to applications for monitoring light through ocean color remote sensing and autonomous in situ sensing. That allowed for a more comprehensive and high spatial- and temporally resolved monitoring of water quality in aquatic environments. The light attenuation, expressed through the diffuse light attenuation coefficient ( $K_d$ ), controls the vertical distribution of plants and phytoplankton over the water column. It is mainly

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governed by the attenuation by the water itself and the concentrations of inherent optical properties (IOPs) of e.g., phytoplankton, inorganic particles and chromophoric dissolved molecules, what makes it an important parameter for eutrophication monitoring. The study by Zhidan Wen and colleagues brings a large dataset from a consistent number of lakes sampled in China. The research topic is relevant and the dataset is of great importance for the bio-optical community as providing a tool for inland water-bodies monitoring. The proposed objectives are reasonable and provide insights into the spatial variability and determining factors of light attenuation over China lakes and reservoirs as well as a model for retrieving  $K_d(\text{PAR})$  from measurements of optically active constituents of water. Although the objectives are sound and can be reached with the dataset used in the study, the manuscript lacks some information and data analysis and it has many rooms for improvement. Therefore, I judge that this current version of the MS is not acceptable for publication in BG and requires extensive reviews prior to re-submission.

GENERAL COMMENTS: - I understand that English might not be the primary language for the authors (the same applies for me), but the manuscript has several grammar and spelling errors and must be revised by a native speaker; - It seems that there is a misuse/misinterpretation of some concepts and terminologies along the manuscript. Some examples on odd use of terminology: phytoplankton pigment particulates, particulate matters, dissolved organic matters. Additionally, authors keep changing the terminology through the MS and that makes it confusing and difficult to follow. There must be a consistency with the terminology adopted throughout the text, and the terminology is expected to follow an updated nomenclature. - Awkward referencing style (e.g. Line 50) and too many old references. I have also found several mistakes in the reference list and citations through the MS, authors must make a thorough review on that. - Abstract: authors do not state their objectives and can be more concise and informative. - Introduction: it is a bit too long and there are some repetitions along the section. Authors can make it more concrete. - Methods: the methodology is not explained in full detail. To my understanding, the major problem of this section is that it does not provide

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enough information for the reader to understand the sampling strategy adopted for this study. Authors say that the lakes vary a lot in size, but do not mention how such a variability influenced, for instance, the decision on the amount of sampling points per lake, etc. Additionally, it is mentioned that 13 field surveys were performed within bit more than two years period. How was the seasonal coverage of those campaigns? Were all the 141 lakes sampled in all of those campaigns? How was the vertical sampling strategy for OACs? How was the bottom depth variability within the lakes and how did the authors deal with that? - Results: are generally well-presented, however, some parts are confusing and difficult to follow. One thing is missing here. . . The authors propose a model for estimating  $K_d(\text{PAR})$  from OACs, but they did not perform any validation exercise. I sincerely expected to see at least a scatter plot with the  $K_d(\text{PAR})$  measured in situ against the  $K_d(\text{PAR})$  obtained with the model presented here. Additionally, results presented in the manuscript could be shortened. Authors present figures with the equations for obtaining  $K_d(\text{PAR})$  from each of the OACs individually, then with all together and finally an equation taking into account all of the OACs (as an individual term of the equation). This can be simplified by only presenting the equation from line 337, which is the most important result here. Since  $k_d$  is a function of all the OACs it does not make sense to show graphs for all the OACs individually. - Discussion: this section is weak. Authors are expected to discuss their results in deep, explain their findings and support them with the literature. However, in this piece of work it is observed rather some comparisons with other studies or only some random sentences scattered along the section, that do not help or add anything to the discussion itself. - Conclusion: the section is short, and it only presents a wrap up of the results instead of a conclusion that highlights the overall importance of the main findings of the study.

SPECIFIC COMMENTS: L 20-22: “absorption coefficient of pigment particulates”, “dissolved organic matters” and “inorganic particulate matters” seems a bit odd. I suggest the authors to adopt “absorption coefficient of phytoplankton, colored dissolved organic matter and inorganic particles”. L 24-25: Need to clarify whether it is considering each of the OACs individually or it takes into account the sum of OACs (i.e., total non-water

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absorption –  $atw$ ). L 30-32: I cannot see how your results support the affirmation. L 42-45: PAR is also attenuated by the water itself. L 51-52: not clear what it meant with that sentence. L 54-58: How do environmental change (what do you mean by that?) and anthropogenic activity make it challenging to assess  $K_d$  in turbid inland waters? L 58-60: Not only for inland waters, it is actually required to all aquatic environments. L 62-63: “phytoplankton pigment particles (expressed here as the concentration of chlorophyll-a)” – the concentration of Chl-a is an index for the phytoplankton biomass. Absorption by phytoplankton is represented as the absorption coefficient of phytoplankton. L 68-74: authors may want to rephrase this sentence. L 78: “underwater light climate” – I suggest the authors to replace by “underwater light field” L 80-83: those sentences do not make sense to me. Authors may want to rephrase them. L 83-85: it applies for all aquatic systems. L 90: what do the authors mean by plateau waters? And why do they receive such a strong UV radiation? L 91-93: repetition of lines 74-77. Additionally, there is no reference for marine studies. L93-94: this condition is not unique for turbid inland waters. L 96: what do you mean by large spatial variability? Is that intra- or inter waterbodies? L 100: what do the authors mean by “OACs component”? L 105: give salinity intervals. How much is salinity for a lake? L 110: Objective 1 – it is not clear, whether the authors want to compare variability among the regions or if they want to assess the spatial variability in each of the regions. L 111: what do you mean by “optical variables”? Maybe OACs? L 112: what do you mean by “especially in the different types of lakes”? L 113: Objective 3 – provide the model based on what? L 120-121: Awkward phrasing. L 127: What do you mean by “in accordance with the regions and topography”? Are those socio-economic regions? Geomorphologic/Climate regions? Additionally, I did not check for it, but I suspect that there might be other factors other than “regions and topography” behind the division of those regions. Looks a bit simplistic. It is not clear along the MS what kind of regions are those. Authors need to make it clear. L 134: “temporary small lakes” – do you mean perennial ? L 135: Oligotrophic lakes: you use this terminology here and another few times along the MS and then changes to non-eutrophic lakes. It is necessary to have consistency when

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it comes to terminology. L 135-136: this sentence does not make sense. Consider rephrasing it. L 138-141: In what seasons were the surveys carried? All year round? This has great influence on solar radiation. How many stations were performed per lake? Where were the stations located in the lakes? In the borders, in the center? Authors may want to provide such information regarding sampling sites, stations performed, sampling depths, etc. as supplement file to this MS. L 142-143: This sentence is confusing and could be easily removed from the MS. L 144: since there is a great variability in the area of sampling lakes, how was the strategy regarding the number of sampling stations with respect to the area of the lakes? - How were the water samples collected? There is no information on that. Were there only surface samples collected? How confident are the authors by providing a model for light attenuation over the water column based on surface measurements? L 149-156: It is not 100% clear how the PAR measurements were conducted. Was there a surface reference measurement? What was the general vertical resolution of PAR measurements? Was the PAR measurements spectrally resolved, or was provided an averaged PAR value? If spectrally resolved, what are the channels? L 170-172: Not clear whether it was measured directly in water samples or in filters containing the cells. L 179-181: please provide more information on the equipment. Spectral resolution and range? Was it measured with an integrating sphere? L 187-195: what was the spectral resolution and range of the measurements? L 194: why was the 440nm wavelength chosen? L 198: Would not "L" be 0.05? L 198-199: How was the effective area of the deposited particles on the filter was measured? L 205-210: Please provide more information on the calculations of  $K_d$ . How was it obtained? Calculations were made for each wavelength and then averaged (spectrally resolved) or PAR was averaged per depth? L 208:  $r^2$  was obtained based on the relationship of which pair of variables/parameters? L 212: What is SPSS 19.0 ? L 213: How was the trophic status of lakes assessed in this study? L 229: what do you mean by transparency and how was it measured in this study? L 229-230: Again, how was the trophic status assessed? L 231: Please clarify how the transparency was measured. Is that Secchi disc depth? L 234: Missing references.

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L 234-236: Again, how was it measured? What are these results about? What do those numbers mean? L 237: What do you mean by "proportion of eutrophication"? L 238-239: Please, reference accordingly. L 245: "tectonic origins" – Reference for that? L 246-249: Looks like discussion. Question: How was the correlation between transparency and trophic state? And  $k_d$  vs transparency? I suspect there might be a significant correlation between these variables. L 254-255: Sentence needs review. L 257-258: Stick to the abbreviations provided. It is confusing when alternating between calling the regions by name and abbreviation. L 260-264: Confusing and not very informative. Most of the readers have no idea about the locations of the referred lakes. Could be removed from the text. Perhaps authors may want to devote a bit more of effort to describe lakes that have high social-economic impact in the country, instead. L 269: "at all sampling sites" – what do you mean by that? Was the correlation tested for each site individually? It is not clear. L 271: What that the best linear regression, or was a linear regression the best one to describe the correlation? Have you tested for other types of functions? L 279-280: "all the optically active components had impact on  $K_d(\text{PAR})$ " – what do you mean by that? L: 282: what is the standardized coefficient of independent variables? Where are those results presented/discussed in the MS? L 285: The correlation between  $K_d$  and TSM was greater than for  $k_d$  vs aNAP, how do the authors explain that, since they say that aNAP has the most significant impact on  $k_d(\text{PAR})$ ? L 294-295: Any reason/hypothesis why that region had the best performance for predicting  $k_d(\text{PAR})$ ? L 303: those relative contributions are related to what? L 304-308: confusing sentences. The authors may want to rephrase them. L 315: How was the 3.8 mg/L threshold defined? What is the reason for that value? L 318-319: why to combine oligo- and mesotrophic lakes? L 320-322: What about the limnetic regions? Why to use this classification? Any reference for that? Is there any clustering for those stations? In figure 8 the TSM threshold division is further subdivided into non-eutrophy and eutrophy. Authors should state the reason for performing such divisions. L 328-329: Confusing sentence. L 336: what do you mean by "relational expression"? L 338-339: where are those results shown? L 339-340: why was aphy excluded? Au-

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thors have to state the reason for that. Results – suggestion: I have the impression that the authors wanted to include all their results in the MS. However, some of those results could be omitted without changing the concept of the manuscript and it would make it easier to present, write and follow. Authors should rethink what results are worth it to be presented in the manuscript. L 349-351: Based on what could you infer that? Are there any thresholds? Please, provide reference. L 357-359: Please provide a reference for that statement. L 361-363: please provide reference. L 363-365: please provide reference. L 371-372: Do you mean wind-induced waves? What about the establishment of the seasonal thermocline? What about the allochthonous input of TSM? What can you say about it? L 379-381: The sentence does not add information to the discussion. Consider removing it or developing it more in depth. L 386: where are those similar inland bodies? Please develop more the discussion instead of making comparisons. L 401-404: CDOM photobleaching and photodegradation: how can the authors infer that based on their results? If the information is from other study, please, include the reference. L 410-412: How can the authors infer that from their results? Have you measured phytoplankton biomass prior to the “overbloom”? L 414-415: Not clear what the authors want to say in that sentence. L 415-416: Many studies and only one reference? L 425: Awkward phrasing. L 428: Figure 5 only shows TSM results. L 428-429: What was the overall absorption budget for the studied regions? I think that your results would be clearer if you present a ternary plot for the absorption of OACs (CDOM x phytoplankton x NAP) for each of the regions. L 431-432: Not clear what the authors want to say in that sentence. L 439: “Chla” – is not it the contribution of phytoplankton, which is expressed by means of Chla concentration? L 438-442: where are those results presented in the manuscript? L 442-444: that classification was made for oceanic waters. Additionally, the terminology presented in the manuscript is out of date. L 444-449: what can the authors discuss/add/conclude about that information? How does it help the interpretation of their results? L 449-455: those sentences can be deleted without changing the interpretation of results and discussion of this manuscript. L 461-463: This sentence does not add to the discussion given that the authors do not

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mention calcite particles in their study. L 469: are you assuming Chla as a proxy for trophic status? L 470-476: Not clear what the authors want to say in that sentence. Additionally, the authors start the sentence with the word “Studies” and present only a single reference. L 475-478: how do the results suggest that? It is not clear to me. L 484-487: Where is this shown along the MS? How do your results support such an affirmation? L 488-490: How do your results support that affirmation? How was the scattering contribution in this study? L 490-496: Not clear how those sentences would help/add to the discussion. L 498: I would suggest an AC-S instead, given the much better spectral resolution. L 501: The sentence does not make sense. L 506: when presenting the given, please indicate at what wavelength the absorption coefficients should be considered. L 511-512: Sentence does not add to the conclusions. I suggest to remove it.

FIGURES AND TABLES: Captions provide a poor description of figure contents. Authors should put more effort on that. Figure in general are well presented and I have some specific comments/suggestions below: Figure 1. Very poor resolution and it is almost impossible to read the text and see the inset figure in each panel. In (a) there is no reference for the limnetic region definitions. What do the red dots mean? What is presented in the inset graph? Additionally, the  $K_d(\text{PAR})$  values presented in panel (b) are not described. Where was that data from? Figure 2: Provide more information in the caption. Figure 3: Have you tested for the differences among regions? It seems that there is no significant difference between ER and MXR. Figure 4. Please indicate the selected wavelength for absorption coefficients. It is mandatory to provide such an information. Table 1. What do you mean by adjusted  $r^2$ ? How did you get to that? Figure 5. How is that possible to have a  $n=788$ , when you mention that only 741 samples were taken? Figure 7. How were the  $K$  values for each OACs obtained? How was the  $K_{\text{water}}$  obtained? I suggest you to make ternary plots instead. It gives more information on the absorption budget and you can split it into different seasons/years to see how it varies over time. Finally, given that the authors present a model to retrieve  $K_d(\text{PAR})$ , I expected to see a figure where calculated  $K_d$  was plotted against in situ

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observed  $K_d$ .

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