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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Influence of environmental factors on spectral characteristic of chromophoric dissolved organic matter (CDOM) in Inner Mongolia Plateau, China" *by* Z. D. Wen et al.

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1. General comments:

This could be an interesting study from a place with rare data, however, the study is out of the scope for HESS. HESS publishes papers which investigate the interactions between hydrological and biogeochemical processes. The paper contains DOC concentration and DOM composition, as well as other chemical and physical data, but lacks any investigation of relationships of this data hydrological process data, since this was not measured. Furthermore it contains many minor to major problems, please see

below for details. Inclusion of catchment hydrology measurements and a sharper focus would strongly improve this manuscript strongly recommend to sharpen the objectives and it would be even better to include testable hypotheses. Until now, the paper lacks focus.

Please check the English language language of the manuscript thoroughly. Several minor mistakes can be found throughout the text, especially for the word tense and wrong prepositions.

Many of your data in Figure 2 do not follow a normal distribution. Please redo the statistics after log-transformation of the data. Otherwise the statistics are not valid, since linear regressions assume normal distributions and homoscedacity. Please check that the data in the PCA follows a normal distribution (as for the linear regressions above). Otherwise please use non-parametric alternatives.

Response to general comments: Thank you for the comment. We have revised throughout the article in order to sharpen the objectives. The study compares water chemical and optical properties of river waters to saline water within the plateau region. The work is valuable as for (1) the analyses of detailed water chemical and optical are rare for the Hulun Buir Plateau. The data allows for future comparison with data from other regions, and is especially suitable for a comparison with data from remote sensing. (2) The information obtained in this study enhances our understanding of CDOM variation with respect to environmental conditions in inland waters in arid and cold plateau region.

We have checked the English language language of the manuscript thoroughly by a professional language consulting agency. Some minor issues have been revised, for example: Page 5914, Line 21, we have corrected a "paddy filed" to"paddy field"; Page 5908, Line 16, delete "obviously"; Page 5899, Line 7 we have corrected a "intwo" to "in two"; Page 5901, Line 6 "The surface water ..": sentence has been rewritten. We have redone the statistics after log-transformation of the data and normal distribution

test (Figure 2).

2. Abstract: Line 4 and in further text: Please substitute the term "terminal waters" with "saline lakes" or similar, since it does not become clear from the abstract that you mean lakes when you write "terminal waters". Terminal waters could also be any other kind of water body in which the rivers end (e.g. another river or an inland delta).

Lines 24 - 25: The vital contribution of the study to the global carbon balance estimation becomes not clear from the abstract. Moreover, please avoid to start a sentence with "And".

Response to comments in abstract: We have substituted the term "terminal waters" with “saline waters”. Lines 24 -25 has been rewritten as follow: “The construction of correlation between DOC and some water quality factors might contribute to derive DOC concentration via alkalinity, EC, TN, and TP in the in plateau region, which would improved carbon storage estimation in water environment.”

3. Introduction: Lines 9 - 10: It is not the sole purpose of DOM to shield biota from UV radiation. It is one of its functions in aquatic ecosystems. Please rephrase the sentence.

Objective 1: You write that have the objective to characterize the DOM "...in plateau rivers and terminal waters in cold and arid regions". Are you investigating more than one region?

Response to comments in introduction: Thank you for the comments and question. We have rephrased the sentence in Lines 9 - 10: CDOM is one of the major light absorbing constituents in natural waters, it could absorb solar radiation in the UV and visible ranges of the light spectrum to shield biota from harmful UV radiation. As a consequence of its optical behavior, CDOM also has largely responsible for the bio-optical properties of natural water, and has the potential effect on the productivity of the water column. Regarding to objective 1, we also performed the related research

in the Tibetan plateau of China, where is also the cold and arid climate. The research results are analyzing in order to support and perfect the findings in this study.

4. Methods: (1) Page 5900, Lines 14 - 18: Please support your climate statements with climate data, e.g. "windy spring" is not an accurate statement.

(2) Lines 13 - 14: How was made sure that all particles were in suspension?

(3) Lines 21 - 22: 2 days are a long time for microbial processing to occur. Often most of the DOM processing happens in that time frame. How was made sure that the DOM was not processed from sampling until filtration? Have the samples been continuously cooled? At which temperature if yes?

(4) Line 22: Do you mean "within" instead of "with"?

(5) Page 5902, Line 11: How was the fit done? Which program was used? Why was the approach different to the one of Helms 2008?

(6) Page 5902, Line 15: Why was 440 nm used as reference wavelength?

(7) Page 5903, lines 18 - 19: Which regression coefficient is meant here?

(8) Page 5903, line 21: Why was that inflation coefficent chosen?

(9) Page 5903, lines 19 - 25: In which program were the CCA and the MC test conducted?

Response to comments in Methods:

(1) We have added text and reference to support your climate statements. “Based on long-termmeteorological data (1961-2010), the average annual temperature is 0.8°C. The average annual rainfall is 273.9 mm, 70%- 80% of which falls in May- August (Bai et al., 2008).The averageannualwind speed is 3.5 m/s. In this aera, the average annual hours of sunshine is 3000 h. The average annual evaporation is 1615.3 mm, which is fargreater than precipitation, resultingin water scarcity. The soils of the area are

Mollisols, and the topographyconsists of gently rolling hillsand tablelands."

Bai, Y. F., Wu, J. G., Xing, Q., Pan, Q. M., Huang, J. H., Yang, D. L., and Han, X. G.: Primary production and rain use efficiency across a precipitation gradient on the Mongolia plateau, Ecology, 89, 2140-53, doi: 10.1890/07-0992.1, 2008.

Zheng, H., Gao, J., Teng, Y., Feng, C., and Tian, M.: Temporal Variations in Soil Moisture for Three Typical Vegetation Types in Inner Mongolia, Northern China, PLoS One 10, doi: 10.1371/journal.pone.0118964, 2015.

(2) Page 5901, Lines 13 - 14: This method is just measured the suspension particles. In order to suspend all the particles in the collected water, the collected water was stirred with sufficient mixing before the filter programs.

(3) Page 5901, Lines 21 - 22: CDOM was extracted from the collected water samples by filtering through a 0.7 μmmembrane, and then was further filtered through0.22 μm membrane. The whole filtering process wasfinished with 2 days, however, the first filter program alwayshas been fininshed in 24 hours, and the most microbes could be filtered during this process. The results obtained with this method have been proved to be consistent with the results by filterting in wild filed.The samples have been continuously cooled at 4âĎČ.

(4) Page 5901, Line 22: We have substituted "with" with "within".

(5) Page 5902, Line 11: CDOM spectral slopes (S275–295 and S350–400) were both derived from CDOM absorption spectra by fitting the absorption data to the Eq.(2) using Origin 8.0 software. This method was in accord with the one of Helms 2008.

(6) Page 5902, Line 15: This is a recommended value based on many experience data by previous studies (Bricaud et al., 1981). Many researches have been adopted in the studies (Song et al., 2013; Zhou et al., 2015). In coastal and inland waters where the land discharge is important, CDOM can obviously be the predominant factor in shifting the water color. At 440 nm, which is a useful wavelength in remote sensing studies

because it corresponds to the maximal absorption by algal pigments, absorption by these pigments is only of the order of 0.025 m-1 per mgâĂćm-3 of Chl a. Since the corresponding absorption by CDOM varied between 0 and 0.12 m-1 in these waters, CDOM can have an effect on the color variations similar to that of moderate biomass (Bricaud et al., 1981).

Bricaud, A., Morel, A., and Prieur, L.: Absorption by dissolved organic matter of the sea (Yekkow substance) in the UV and visible domains, Limnol. Oceanogr., 26, 43-53, doi, 1981.

Song, K. S., Zang, S. Y., Zhao, Y., Li, L., Du, J., Zhang, N. N., Wang, X. D., Shao, T. T., Guan, Y., and Liu, L.: Spatiotemporal characterization of dissolved carbon for inland waters in semi-humid/semi-arid region, China, Hydrol. Earth Syst. Sci. , 17, 4269-81, doi: 10.5194/hess-17-4269-2013, 2013.

Zhou, Y., Zhang, Y., Shi, K., Niu, C., Liu, X., and Duan, H.: Lake Taihu, a large, shallow and eutrophic aquatic ecosystem in China serves as a sink for chromophoric dissolved organic matter, J. Great Lakes Res., 41, 597-606, doi: http://dx.doi.org/10.1016/j.jglr.2015.03.027, 2015.

(7) Page 5903, lines 18 - 19: Pearson Correlation Coefficient (rp) is here.

(8) Page 5903, line 21: We chose the inflation coefficent according to the following guide book of CANOCO software. Leps, J., and Smilauer, P.: Multivariate Analysis of Ecological Data using CANOCO, First ed., Cambridge University Press, 2003.

(9) Page 5903, lines 19 - 25: The CCA and the MC test were conducted by CANOCO 4.5 for Windows.

5. Discussion:

(1) Page 5908, Line: Please explain, how higher alkalinity may explain the inversed pattern.

(2) Page 5908, Line 15: You cite only a small selection of case studies. Please support this statement with more and more general publications. Check out for example (in the supplement of this paper a large collection of DOC concentrations in streams and rivers is given): Alvarez-Cobelas M., Angeler D., Sánchez-Carrillo S. & Almendros G. (2012) A worldwide view of organic carbon export from catchments. Biogeochemistry 107, 275–293.

(3) Page 5908, Line 16: Please delete "obviously".

(4) Page 5908, Lines 18 - 25: Please support these statements with literature.

(5) Page 5908, Line 26: You probably mean decreasing acid deposition. Please rephrase the sentence.

Response to comments in Discussion:

(1) Page 5908, Line 9. This sentence in here was not to indicate that how higher alkalinity could explain the inversed pattern, there was no rigorous answer. We speculated that the inversed pattern might be related to the higher alkalinity and EC in the terminal waters compared with river waters. Because that the sodicity of water could increase DOM solubility. The increasing EC (salt concentration) would result in decreased osmotic potential, which has negative effects on microbial activity. DOM along with other nutrients come from soil via run and leaching, and can accumulate in terminal waters due to lower microbial activity.

(2) We have added more publications into the references to support this statement, includingAlvarez-Cobelas et al. 2012,Evans et al. 2005, Findlay and Sinsabaugh2003, and Worrall and Burt, 2004.

Alvarez-Cobelas, M., Angeler, D. G., Sanchez-Carrillo, S., and Almendros, G.: A worldwide view of organic carbon export from catchments, Biogeochemistry, 107, 275-93, doi: 10.1007/s10533-010-9553-z, 2012.

Evans, C. D., Monteith, D. T., and Cooper, D. M.: Long-term increases in surface water

dissolved organic carbon: Observations, possible causes and environmental impacts, Environ. Pollut., 137, 55-71, doi: 10.1016/j.envpol.2004.12.031, 2005.

Findlay, S. E. G., and Sinsabaugh, R. L.: Aquatic Ecosystems Interactivity of Dissolved Organic Matter, Academic press, Elsevier Science USA, 2003.

Worrall, F., and Burt, T.: Time series analysis of long-term river dissolved organic carbon records, Hydrol. Processes 18, 893-911, doi: 10.1002/hyp.1321, 2004.

(3) Page 5908, Line 16: We have deleted "obviously".

(4) Page 5908, Lines 18 - 25: We have added the following references to the manuscript: Alvarez-Cobelas et al., 2012; Bai et al., 2008; Hao et al., 2007; and Zheng et al., 2015.

Alvarez-Cobelas, M., Angeler, D. G., Sanchez-Carrillo, S., and Almendros, G.: A worldwide view of organic carbon export from catchments, Biogeochemistry, 107, 275-93, doi: 10.1007/s10533-010-9553-z, 2012.

Bai, Y. F., Wu, J. G., Xing, Q., Pan, Q. M., Huang, J. H., Yang, D. L., and Han, X. G.: Primary production and rain use efficiency across a precipitation gradient on the Mongolia plateau, Ecology, 89, 2140-53, doi: 10.1890/07-0992.1, 2008.

Hao, Y., Wang, Y., Huang, X., Cui, X., Zhou, X., Wang, S., Niu, H., and Jiang, G.: Seasonal and interannual variation in water vapor and energy exchange over a typical steppe in Inner Mongolia, China, Agric. For. Meteorol., 146, 57-69, doi: 10.1016/j.agrformet.2007.05.005, 2007.

Zheng, H., Gao, J., Teng, Y., Feng, C., and Tian, M.: Temporal Variations in Soil Moisture for Three Typical Vegetation Types in Inner Mongolia, Northern China, PLoS One 10, doi: 10.1371/journal.pone.0118964, 2015.

(5) Page 5908, Line 26: We have rephrased the sentence.

6. Conclusions: Page 5915, Line 5: This snapshot study is not an intensive study.

Spatial and temporal resolution are too small. Please rephrase.

Response to comments in Conclusions: “An intensive study” has been substituted with " A preliminary study”.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 5895, 2015.

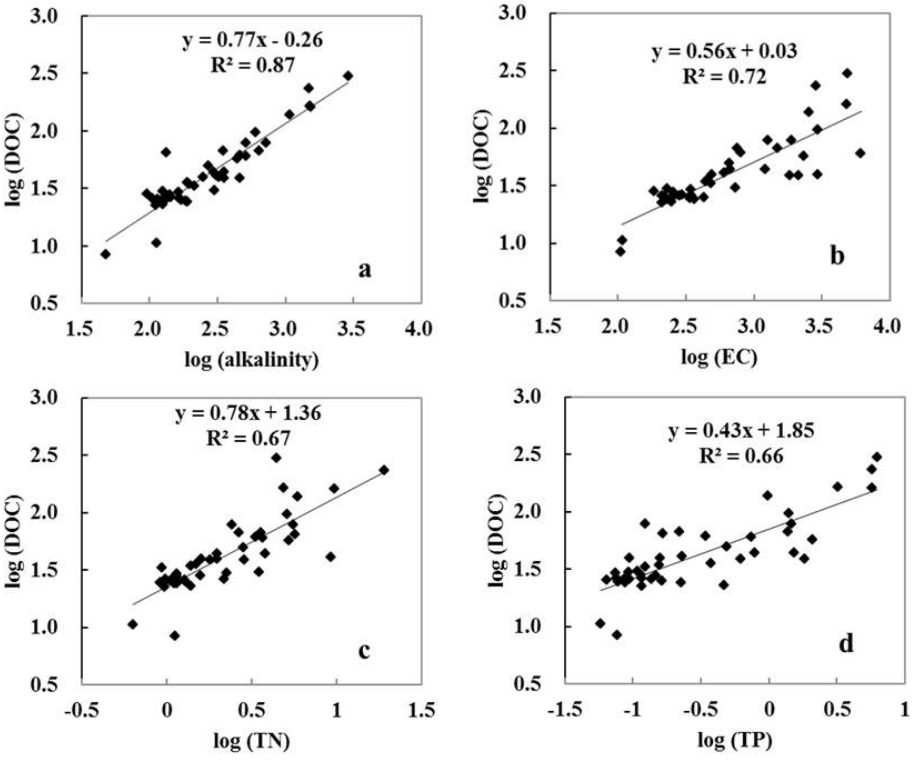

Fig. 1.