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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. Response to General Comments: We thank the reviewer for this positive comment and the good suggestionin the detail. We have carefully revised manuscript according the suggestion.

2. Specific Comments:

(A) Please replace "terminal waters" with a well-defined term that best describes your lake type systems.

(B) Please present some more detailed geomorphological and some hydrological data

(metric): estimates of discharge, flow, for the river dataset, river widths, as well as a lake size distribution and some estimates of average lake depths are needed. The data can be rough estimates of means (table or text), but one does need to know the spatial scales of the surface waters addressed in order to use the study.

(C) Please add some basic information on the genesis (formation) and on the dynamics of your surface water network. In specific, are there regular or extreme events (e.g. rainfall events) that alter the geomorphological structure and geometry of your surface water network? Are some of the waters ephemeral?

(D) Carbon balance: Since you argue that plateau lakes play an important role in the global carbon balance, an actual rough estimate of the bulk carbon storage in plateau lakes would help your argument. You do have the carbon concentrations. You could compare a rough estimate to estimates from other regions.

(E) The "vital contribution" (Abstract: P5896-L24), or "potential implications" (Conclusions: P5915-L5) of your study for carbon cycling have to be specified. / Here some specific examples: you show that highest DOC and nutrient levels associate with what you currently refer to as "terminal waters". Based on your data, it seems that a shift towards high DOC and nutrient levels, and potentially also towards high carbon emissions may develop where flow is reduced in the future (e.g. construction of reservoirs, reduced precipitation, irrigation, landuse changes). - Would you agree? Please discuss. I suggest 3-4 sentences in the discussion, not more, since the focus is mainly on CDOM.

(F) Regarding Figure 4 and similar to (E) but with a focus on CDOM: I found your Figure 4 highly informative. Could these patterns change over time? E.g. if the land use or nutrient load changes.

Response to Specific Comments:

(A) We have substitute the term "terminal waters" with "saline waters". The following sentences have been added to “2.1 Study sites”. “A total of 46 surface waters were collected in this study with respect to both watershed characteristics and lake size. Based on the salinity and EC (salinity threshold value = 0.5 PSU, EC threshold value =1000 ms/cm), these waters were divided to 22 river waters and 24 saline waters. Particularly, the saline waters were collected from lakes without outflow or the terminal-flow of rivers.”

(B) The sample numbers for each water body are marked in Fig. 1b. The saline lakes size in this study ranged from 1 km2 to 42.5 km2, with the average depth of 0.4- 2.8 m. The related hydrological data of rivers and freshwater lakes have shown in a Table, including Rivers (or freshwater lakes) names, sampling numbers, basin area, width, Length, max water depth, elevation.

(C) We have added the basic information on our surface water network as above description. We have also added climate information. “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; Zheng et al. 2015).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.” Furthermore, these water samples were all taken in September 2012, it was not in rainy season. The geomorphological structure and geometry of our surface water network remained basically stable. Some of saline waters (area< 1 km2) tend to dry up during the drought.

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.

(D) Thank you very much for the good suggestion. The actual estimate of the bulk carbon storage in plateau lakes would help our argument. If we want to do this work, the general concentrations of POC, DIC, and DOC in plateau surface waters, the river’s flow volume, and the water inventory of lakes are all needed. However, in this study, we just focus on the DOC and CDOM, the related information and data for estimating carbon storage is too little. Yet this suggestion is just consistent with our further research, we have started working on it. Thank you again for the brilliant proposal.

(E) We do agree with your comment. We have substituted the term "terminal waters" with “saline waters”. Saline lakes compose about a fifth of the total Earth’s lake surface, and about 75% of saline lakes are located in endorheic watersheds (Duarte et al., 2008). Studies have indicated that saline waters typically had high dissolved inorganic and organic C concentrations than fresh waters, and played a major role in the global C cycle. The dissolved inorganic C concentrations was about 10-15 times greater than in frshwater lakes (Cole et al., 2011; Duarte et al., 2008; Tranvik et al., 2009).Saline lakes have the potential to emit large amounts of CO2 to the atmosphere(Finlay et al., 2009;Osburn et al., 2011). The average areal CO2 exchange rate with atmosphere of saline lake was about sixfold greater than that reported for freshwater lakes(Duarte et al., 2008; Cole et al., 1994).CO2 flux in lakes is negatively correlated with lake size(Raymond et al., 2013). If the flow and size of saline lakes is reduced by the construction of reservoirs, irrigation, and landuse, the higher carbon emissions may develop.

Cole, J. J., Caraco, N. F., Kling, G. W., and Kratz, T. K.: Carbon dioxide supersaturation in the surface waters of lakes, Science, 265, 1568-70, doi: 10.1126/science.265.5178.1568, 1994.

Cole, J. J., Carpenter, S. R., Kitchell, J., Pace, M. L., Solomon, C. T., and Weidel, B.: Strong evidence for terrestrial support of zooplankton in small lakes based on stable isotopes of carbon, nitrogen, and hydrogen, PNAS 108, 1975-80, doi: 10.1073/pnas.1012807108, 2011.

Duarte, C. M., Prairie, Y. T., Montes, C., Cole, J. J., Striegl, R., Melack, J., and Downing, J. A.: CO2 emissions from saline lakes: A global estimate of a surprisingly large flux, J. Geophys. Res. - Biogeosci., 113, doi: 10.1029/2007jg000637, 2008.

Finlay, K., Leavitt, P. R., Wissel, B., and Prairie, Y. T.: Regulation of spatial and temporal variability of carbon flux in six hard-water lakes of the northern Great Plains, Limnol. Oceanogr., 54, 2553-64, doi: 10.4319/lo.2009.54.6_part_2.2553, 2009.

Osburn, C. L., Wigdahl, C. R., Fritz, S. C., and Saros, J. E.: Dissolved organic matter composition and photoreactivity in prairie lakes of the U.S. Great Plains, Limnol. Oceanogr., 56, 2371-90, doi: 10.4319/lo.2011.56.6.2371, 2011.

Raymond, P. A., Hartmann, J., Lauerwald, R., Sobek, S., McDonald, C., Hoover, M., Butman, D., Striegl, R., Mayorga, E., Humborg, C., Kortelainen, P., Duerr, H., Meybeck, M., Ciais, P., and Guth, P.: Global carbon dioxide emissions from inland waters, Nature, 503, 355-59, doi: 10.1038/nature12760, 2013.

Tranvik, L. J., Downing, J. A., Cotner, J. B.,et al.: Lakes and reservoirs as regulators of carbon cycling and climate, Limnol. Oceanogr., 54, 2298-314.

(F) This is always an issue worthy of discussion. The light absorption of optically active compounds (OACs) determines the inherent optical properties of waters. In our opinion, the pattern showed in Fig.4 is not invariable, and it may change with season and some extreme climate events. Increasing nutrient load could promote algal growth, resulting in increase of light absorption by phytoplankton. The change of land use may influence the constituent of DOM, thus affecting CDOM absorption through terrigenous input. Many factors could affect the OACs, the relative contributions of CDOM, phytoplankton and non-algal particles to total non-water light absorption should discussed upon the environment.

3. Technical Corrections:

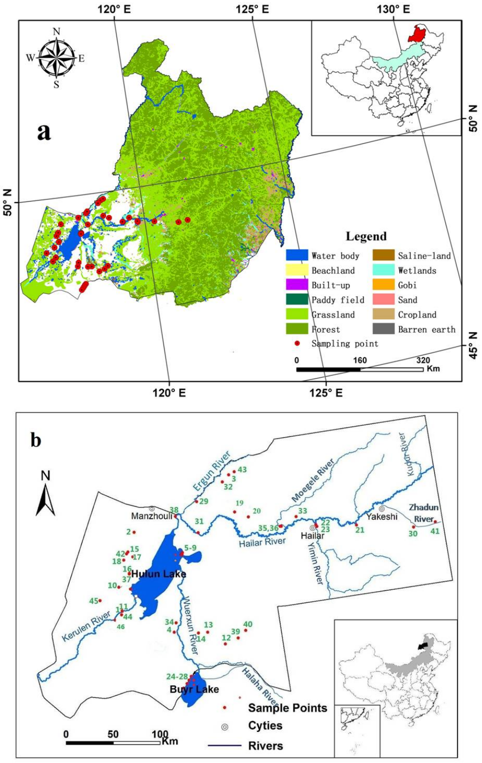
(1) 5997/18 Please introduce all abbreviations. 5899/7 "in_two",5901/2-3 Please check transition: “Because .., the water samples..” 5901/6 "The surface water ..": sentence needs to be rewritten (grammar) .5901/22 “within two days”. 5901/22 Consider to write integers out from one to nine (one, two, three, ..), and indicate higher integers as arabic numbers (10, 11, ..). Throughout the manuscript. 5902/20 Either “.. by a UV spectrophotometer ..”, or ".. by UV spectrophotometry .." .5904/8 “A positive relationship..” 5908/26 “potentially due to recovery from acid deposition”. 5907/2 This is about CDOM absorption data and environmental data. Please consider to replace or remove the very generic term “species”. Alternatively, please define what you mean with "species". 5914/21 “paddy field

(2) 5904/8 Are the "Hulun Buir Plateau waters" your entire dataset? Is this correct? Please specify, it is somewhat unclear as you discuss differences between terminal and river waters in both the previous as well as precedent sentences.

Response to Comments in Technical Corrections: (1) Thank you very much for the patient and detailed comments. We have revised the misnomer and ambiguous expression based on the above suggestions.

(2) 5904/8 The "Hulun Buir Plateau waters" is the entire dataet. The differences between terminal and river waters was introduced as the follow: “A total of 46 surface waters were collected in this study with respect to both watershed characteristics and lake size. Based on the salinity and EC (salinity threshold value = 0.5 PSU, EC threshold value =1000 ms/cm), these waters were divided to 22 river waters and 24 saline waters. Particularly, the saline waters were collected from lakes without outflow or the terminal-flow of rivers.”

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


120° E
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Water body
Beachland
Built-up
Paddy field
Grassland
Forest
Sampling point
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Wetlands
Gobi
Sand
Cropland
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Moegele River
Kuduer River
Manzhouli
Hailar River
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Hulun Lake
Kerulen River
Wuerxun River
Halaha River
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Fig. 1.