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# *Interactive comment on* "Bioavailability of riverine dissolved organic matter in three Baltic Sea estuaries and the effect of catchment land-use" *by* E. Asmala et al.

**Anonymous Referee #1**

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This manuscript compares bioavailable DOC and DON between 3 estuaries and discusses the effects of DOM quality on bacterial growth efficiency (BGE), which is further linked to the estimation of CO2 emissions from estuaries. Differences in bioavailable DOM between estuaries were observed and attributed to the contrasting land use. CDOM, fluorescent DOM, and DOM molecular weight were used as DOM quality parameters and were concluded to be the major drivers of BGE. Daily bacterial CO2-emissions from estuaries were estimated and discussed.

Overall, this manuscript presents interesting data and can be of interest for the readers of Biogeosciences. Generally the scientific significance, scientific quality and presentation quality are fair to good. There are some points needing reworking. I would recom-



mend publication if the following comments are addressed in the revised manuscript.

General comments:

1). The introduction gives a review on DOM. But it is too long and the significance of the study is missing from the introduction. It will be better to present a more concise introduction that is developed to reveal the necessary for conducting this study. The revision will also help reduce the number of references, which are too many from my point of view.

2). The discussion about the effects of land use on DOM degradation needs to be strengthened. For instance, lines 5-21 on page 9837, which actually should be in the result sections, are too descriptive and the discussion is insufficient. Why significant differences in bioavailable DOM are observed between estuaries? What role does the land use play in leading to the differences and how?

3). What are the concentrations of total dissolved nitrogen (TDN)? Oxidation efficiency for TDN are reported to be >90%, which still leaves up to 10% for errors. Concentrations of bioavailable DON (BDON) are only a few $\mu$mol/L and have relatively large deviations. It is possible that the differences in BDON between estuaries were largely due to the errors of TDN measurement.

4). Is the incubation time the same in every experiment unit? If not, the concentrations of bioavailable DOC and DON between experiment units are not directly comparable.

5). BGE is shown to be significantly different between estuaries and is later shown to be affected by DOM qualities by using the whole dataset from 3 estuaries (section 4.4). But still it is not clear how the distinct BGE value is explained by DOM quality in each estuary. For instance, how can the DOM quality in KY estuary cause the lowest BGE value in that region?

6). As stated in the 2nd paragraph on page 9842, DOM properties that affect BGE are linked to humic substances (line 15), which are resistant to biodegradation (line 20).

Given that, those DOM quality indicators (molecular weight, spectral slope, florescence properties) are then very insensitive to biotransformation. So how can they be used to explain the variation in BGE? I feel the conclusion about the drivers of BGE (page 9820, lines 17-20) is somewhat overstated.

Specific comments:

Introduction

Page 9822

Line 3: Give the definition for “BDOM”.

Methods

Page 9826

Line 28: The full name of “SEC” should be given when it first appears here.

Page 9827

Lines 15-25: How is SUVA254 calculated?

Line 23: You mention “the quality of the CDOM”, please specify what “quality” means here.

Results

Page 9831

Lines 10-13: Please explain how the “source” and “sink” of DOM are assessed using the two end members.

Line 20, 23: What do “DOM quality parameters” refer to?

Page 9832

Lines 1-5: I suggest placing this paragraph in the discussion section.



Line 8: I think you meant “significant differences” rather than “differences”.

Page 9833

Lines 5-6: BDOC in Kiiminkijoki is 64.1 $\mu$mol L-1, which is not the lowest (Table 3)

Page 9835

Line 16: “absorption” should be “absorbance”.

Line 18: The word “drivers” should be used very carefully. Those quality parameters influence BGE but I don’t think they are the drivers of BGE. Please rephrase the sentence.

Discussion

Page 9836

Lines 14: The use of “seawater” can be misleading here, as you only investigate low-salinity waters, not real seawater.

Line 17: I suggest replacing “importance” by “influence” or “effect”.

Page 9837

Line 4: Is “seasonality” discussed in the section 4.2?

Page 9838

Lines 11-12: Why increasing agricultural land would increase BDON, but not BDOC?

Page 9839

Line 21: Previous studies have observed the production of CDOM by microbes (e.g., Nelson et al. Mar. Chem. 89, 273-287, 2004) and can be used here to underline the statement.

Lines 22-28: What is the main point of this paragraph? The higher riverine SUVA254

value in summer could be simply due to larger inputs of plant-derived DOM at that time and is not a robust diagenetic indicator of DOM. In the last sentence of this paragraph (page 9840, line 3), I would suggest to replace “utilized” by “altered” as it is not clear whether CDOM is utilized or removed during the incubation, as stated in the first sentence (page 9839, lines 22-24).

Page 9840

Lines 23-25: Any references?

Line 26: The title for section 4.4 should be revised. This section discusses the effects of water sources (river vs. sea end-members), seasonality, substrate concentrations and DOM quality on BGE, but not how BGE is used as a proxy for DOM quality.

Page 9841

Line 1: Please specify what kind of DOM quality leads to “faster degradation of DOM and higher BGE”.

Lines 5-6: Why those transformative forces (e.g., photo-oxidation, microbial activity) occurring in the sea end-member do not cause DOM to be more refractory?

Lines 10-11: Is the effect of seasonality on BGE described in the result section?

Page 9842

Line 2: “Fig. 7” should be “Fig. 8”.

Line 25: Replace “proxies” by “parameters”.

Table 2

Remove the unit of the third SUVA254.

Figure 1

The map has insufficient labels. Estuary information (e.g., abbreviation, land use, etc.)



can be included.

Figure 6

In the figure legend, “P < 0.001.” should be “P < 0.001”

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Interactive comment on Biogeosciences Discuss., 10, 9819, 2013.