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Interactive comment on "Effects of nitrate and phosphate supply on chromophoric and fluorescent dissolved organic matter in the Eastern Tropical North Atlantic: a mesocosm study" *by* A. N. Loginova et al.

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Autor comments to : Review 2 of the manuscript by A. N. Loginova, C. Borchard, J. Meyer, H. Hauss, R. Kiko, and A. Engel entitled "Effects of nitrate and phosphate supply on chromophoric and fluorescent dissolved organic matter in the Eastern Tropical North Atlantic: a mesocosm study." submitted to Biogeosciences and coded bg-2015-181.

General comments: I think the authors should focus the goals of the manuscript better. Is the goal to test the nutrient influence on CDOM optical properties through stimula-

tion of phytoplankton and/or bacterioplankton? Or by contrast is the goal to compare different models (relationships) with different optical parameters with the mesocosms data? I think that the setup of the mesocosms etc was designed to test specifically the nutrient effects on DOM optical properties. Therefore, I think the comparisons with other models seems to be secondary and I have doubts about if their inclusion in this manuscript have any sense or just makes the paper wordy. For instance, I cannot see the relevance for the comparison with the relationship between a375 and the 320-500 nm spectral slope proposed by Stedmon and Markager (2001) obtained for the Greenland Sea. It is hard to see the usefulness of this comparison that makes the paper longer unnecessary. The comparison, any case, it should be in a natural nutrient gradient in the oceanic waters but not in a particular sea without any reference to mineral nutrients. That is, they can obtain more data from literature covering a wide gradient of nutrients or the authors should just reconsider to include this part of the manuscript. More or less the same comment for the comparison with the Fichot and Benner (2012) ′s model. This model was proposed to related terrigenous DOM with the spectral slope from 275 to 295nm for its use as terrestrial tracer, but not with mineral nutrients, then what is the point of that.

AC: The mineral nutrients influence is indeed the main focus of this paper. The comparison part to models will, therefore, be removed. However, we will keep the equations, found during this study.

Specific comments:

Introduction

Page 6 (line 138)

RC: Please introduce the meaning of OMZ the first time you use these acronyms

AC: The acronym OMZ will be introduced (Page 6 Line 138).

Materials and Methods

Page 8 (lines 163-178)

RC: This paragraph includes too many details and I think could be shortened.

AC: This paragraph will be shortened.

Page 10 (line 229)

RC: The CDOM and FDOM samples were stored at 4°C during 6 months. That is a lot of time storage!!!. Despite the low temperature of conservation and that the 0.45μm filtration will prevent some bacterial growth. It is well known that there are bacteria crossing this filter pore size and, of course, bacteria growth at 4°C particularly under nutrient enrichments. I have my reservations about the time since the samples were collected and analyzed. I recommend including a note on that issue or any kind of control about potential errors.

AC: We agree that 6 month is a long time of storage, therefore we emphasized this duration in the manuscript. However, we agree to the referee that we did not discuss it appropriately. Swan et al. (2009) made tests on open ocean CDOM storage. They demonstrated that the CDOM changes are unappreciable, when the storage of pre-filtered CDOM samples at 4°C does not exceed one year. An although, in our study, CDOM and FDOM samples were passed through filers with larger pore size, than those, used in Swan et al. (2009), the concentrations of all optically active parameters were very similar between treatments up to day 4 of both experiments (e.g. after setting up of the nutrient amendments). Therefore, we believe, if CDOM and FDOM would undergo considerable changes during storage under effect of nutrients, the difference between samples at the beginning stage of experiment, where nutrients were already added would be bigger and significant. Therefore, the error, that could occur, would be systematic and would not influence the CDOM and FDOM development patterns during the study. The note on storage, however, must have been added. Therefore, we will add it to the discussion.

Page 11 (line 271-272)

RC: In the mesocosms, authors have calculated the absorption coefficients at 325 nm (line 267) because is the most common wavelength in the literature. Then, they also calculated coefficients at 355 nm and at 375 nm only for comparative reasons. The information provides by the spectral slopes encompasses the changes among wavelengths within a band. I think the coefficients at 355nm and 375 nm are redundant and I have many concerns about the relevance of the comparisons with the models of this paper (please see the previous comments) that is the 2 ultimate reason for these calculations. I suggest deleting the comparisons and these two absorption coefficients. The paper will be better focused.

AC: The CDOM coefficients at other wavelengths than 325nm will be removed. aCDOM(325) will be used for the model development. The comparison with models of Stedmon and Markager and Fichot and Benner will be removed as well.

Page 11 (line 279-285)

RC: Again, It has no sense for me two calculate three spectral slopes; S275-295; S350-400; S320-500 (SSEMO). Helms et al. (2008) showed that the wavelength band more sensitive to changes is from 275 to 295. Therefore, the calculation of SSEMO is redundant and less precise that S275-295. I suggest deleting these calculations to simplify the paper without losing information.

AC: As comparison to Stedmon and Markager will be removed, SSEMO will also be removed. However, S350-400 is needed for SR calculation.

Page 12 (lines 308-309)

RC: Delete this last sentence of the paragraph.

AC: It will be deleted.

Page 13 (line 324)

RC: Delete “(see Table 1, Fig. 1,2)”.

AC: It will be deleted.

Page 13 (line 329)

RC: Delete “(see Fig. 3,4,5)”.

AC: It will be deleted.

Results

Page 14 (line 363)

RC: Change “abundance” for ”concentration”

AC: It will be replaced.

Figure 3

RC: I suggest deleting this figure and the associated results

AC: As comparison to model of Stedmon and Markager (2001) will be removed from the manuscript, figure 3 will be changed. The SSEMO and aCDOM(375) will be replaced with S275-295 and aCDOM(325). The fit to the data will be reparametrized. The figure will stay in the manuscript, but with no link to the mentioned model.

Figure 5

RC: I suggest deleting the figure e. Even although the molar absorption coefficient at 355 nm (a355/DOC) could be considered as a surrogate of terrigenous DOM (dissolved lignin), the parameter determined in the Fichot and Benner (2012) in river-influenced oceanic waters, I cannot see the connection between the influence of mineral nutrients (N and P) using waters from the Eastern Tropical North Atlantic with this molar absorption coefficient at 355 nm and the spectral slopes S275-295 in the mesocosms. Sorry, but I cannot see the meaning of this figure.

AC: As comparison to model of Fichot and Benner (2012) will be removed from the manuscript, figure 3 will be changed. The aCDOM(355) will be replaced with aCDOM(325). The fit to the data will be reparametrized. The figure will stay in the manuscript, but with no link to the mentioned model.

Table 2

RC: Units of the spectral slopes are wrong just nm-1 not d-1nm-1

AC: Units d-1nm-1 will be changed to nm-1 d-1. These units were used, as they refer to the linear trend in change of S over time. We agree that symbol we used in the table is confusing; therefore, S will be changed to dS.

Page 18 (line 489)

RC: Change “In order to access” for ” to assess”

AC: It will be changed.

Discussion

Page 21 (lines 534-548)

RC: This first paragraph seems an introduction. Please delete from line 546 to 548, these are the goals that should appear at the end of the introduction section.

AC: This paragraph will be removed.

RC: In general, discussion section needs to be polished and I missed references to key papers on this topic. It needs more focus and structure. For instance, some missing (not all) references. Biers et al. 2007. The role of nitrogen in chromophoric and fluorescent dissolved organic matter formation. Mar. Chem. 103: 46–60. Kramer & Herndl. 2004. Photo- and bioreactivity of chromophoric dissolved organic matter produced by marine bacterioplankton. Aquat. Microb. Ecol. 36: 239–246. Ortega-Retuerta, E., et al. 2009. Biogeneration of chromophoric disolved organic matter by bacteria and

krill in the Southern Ocean. Limnol. Oceanogr. 54:1941–1950. Romera-Castillo et al. 2011. Net Production and Consumption of Fluorescent Colored Dissolved Organic Matter by Natural Bacterial Assemblages Growing on Marine Phytoplankton Exudates. AEM doi:10.1128/AEM.00200-11

AC: The suggested papers were reviewed, Biers et al. (2007) and Kramer & Herndl (2004) will be added to both introduction and discussion and Romera-Castillo et al. (2011) will be added to discussion. We will revise the discussion in order to gain it better focused and structured.

Interactive comment on Biogeosciences Discuss., 12, 7209, 2015.

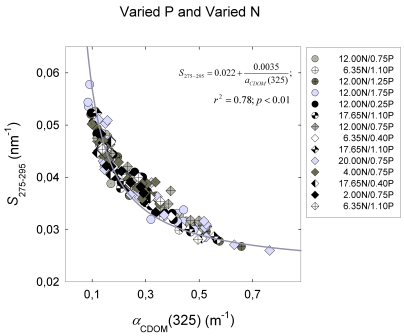

Fig. 1.

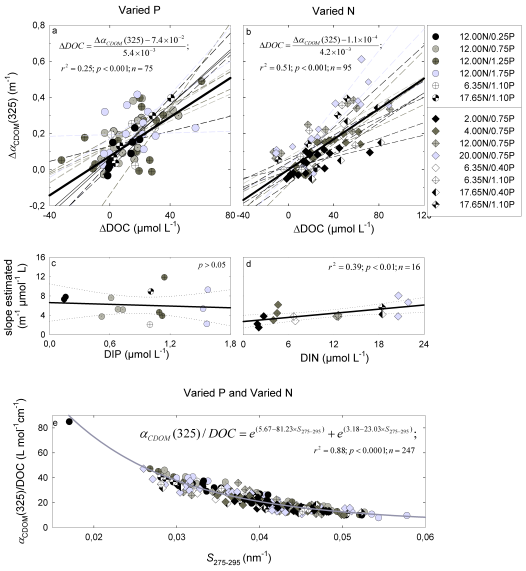
Varied P
Varied N
a
b
c
d
e
$\Delta DOC = \frac{\Delta\alpha_{CDOM}(325) - 7.4\times10^{-2}}{5.4\times10^{-3}}$;
$r^2 = 0.25$; $p < 0.001$; $n = 75$
$\Delta DOC = \frac{\Delta\alpha_{CDOM}(325) - 1.1\times10^{-4}}{4.2\times10^{-3}}$;
$r^2 = 0.51$; $p < 0.001$; $n = 95$
$\Delta\alpha_{CDOM}(325)$ (m^{-1})
ΔDOC (µmol L^{-1})
12.00N/0.25P
12.00N/0.75P
12.00N/1.25P
12.00N/1.75P
6.35N/1.10P
17.65N/1.10P
2.00N/0.75P
4.00N/0.75P
12.00N/0.75P
20.00N/0.75P
6.35N/0.40P
6.35N/1.10P
17.65N/0.40P
17.65N/1.10P
slope estimated (m^2 µmol L^{-1})
$p > 0.05$
$r^2 = 0.39$; $p < 0.01$; $n = 16$
DIP (µmol L^{-1})
DIN (µmol L^{-1})
Varied P and Varied N
$\alpha_{CDOM}(325) / DOC = e^{(5.67-81.23\times S_{275-295})} + e^{(3.18-23.03\times S_{275-295})}$;
$r^2 = 0.88$; $p < 0.0001$; $n = 247$
$\alpha_{CDOM}(325)$/DOC (L mol^{-1} cm^{-1})
$S_{275-295}$ (nm^{-1})

Fig. 2.