

Interactive comment on “Dissolved organic matter composition and bioavailability reflect ecosystem productivity in the Western Arctic Ocean” by Y. Shen et al.

Anonymous Referee #2

Received and published: 25 September 2012

This manuscript investigates the DOC bioavailability in two contrasting systems (Chukchi and Beaufort Seas) in the Western Arctic Ocean. The authors use data from various cruises and show that the DOM bioavailability is different in the two systems. An accumulation and export of bioavailable DOC is furthermore suggested, proposing an uncoupling between biological production and decay.

The manuscript is definitely of interest for the readers of Biogeosciences, but there are some issues the authors need to deal with before publication. I would therefore recommend publication after minor revision.

General comments

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1. Do you have any chlorophyll and inorganic nutrient data from the cruises? If so please present them in both table 1 and the results section.
2. It is mentioned that TDAA yields followed chlorophyll concentrations and productivity, can this “relation” be describe by a function (e.g. linear relation)?
3. TDN values are shown in table 1, but they are currently not discussed in the manuscript (which they should be). Could these values be used to calculate DON (DON + TDN-DIN)? If so, please also calculate the “DON TDAA % yields” and “DI”.
4. Bioavailable DOM accumulations has been found before in various other systems (e.g. Søndergaard et al. 2000, Thingstad et al.1997, Williams 1995). This has to be acknowledged (cited) and discussed in more detail in the manuscript.
5. Concentrations of different amino acids were measured (page 9576 line 15-20). Could these measurements be used to test if the DOM composition was different between years, stations and with depth?

Detailed comments:

Introduction

Describe DOM in more detail in the introduction. Define what is labile, semi-labile and refractory DOM.

Page 9574: Please rewrite “It is therefore interesting to consider how the bioavailability of DOM differs between the two regions.”

Material and methods

Page 9575

Line 15: Use “combusted” instead of “cleaned”

Line 16: Were the 60 ml bottles cleaned before use?

Line 17: Were the DOC samples only frozen? Or was acid also added at this point?

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Line 27: At which depth was the chlorophyll max?

Page 9576

Line 5-8: Which concentrations did you obtain for the Deep sea reference samples?

Line 16-20: What is the error (\pm) of the amino acid measurements? Different amino acids are measured and it would improve the manuscript if these values were used to indicate changes in the DOM composition.

Line 21: I guess you normalized "Amino-acid carbon" to DOC, or?

Line 21-26: Add more detail on the DI values. How are they calculated? and how should we understand these values?

Page 9577:

Line 1: Introduce the terms labile, semi-labile and refractory in the introduction.

Results

Page 9578

Line 14: How do you see that the TDAA is more variable than DOC? TDAA concentrations are in C, right?

Line 25-26: What is the \pm SD of the average DOC normalized TDAA yields?

Page 9579

Line 10: Any indications of a difference in DOM composition from your amino acids?

Line 10-15: Please explain in more detail why the DI values and TDAA are not related.

Line 16: Can 2002/2004 and 2008/2009 really be combined? In other parts you say that the yearly variation was high, please justify.

Discussion

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The DI values are not mentioned in the discussion, is this because they did not relate with the TDAA yields? Please justify.

Page 9581:

Line 1-3: Did you find any correlation between PP and DOC/TDAA?

Line 8-10: How can a "minor spatial variation" lead to a "substantial supply"? Page 9582

Line 12-14: Which processes? Please specify.

Line 20: What do you mean by net change in DOC? The DOC concentration decreased with ~ 300 μmol over the salinity gradient.

Page 9584

Line 1-2: What is meant by "due to differences in sampling years"?

Line 23: Please change "It is interesting to consider".

Page 9585

Line 8: Delete "sharp"

Line 14: "resulted in the production of DOM that is rich in amino acids", is this not the case for both systems?

Line 18: Please change "clearly imprinted"

Line 27: What about viral lysis and phytoplankton extracellular release? Do they not produce DOM?

Line 29: What do you mean by "indicators"? TDAA?

Page 9586

Line 8-22: This part needs improvement. Please see the articles below and discuss

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your findings in relation to them.

Line 18: "indicate deficiencies in the metabolic diversity of the microbial community for the added substrates"; Has this been shown before? What about grazing pressure and nutrient limitation would that not impact this finding?

Table 1: Could the DI of DON be calculated and included? What about DOC:DON ratios?

Figure 2a: Is there a line and equation for the R2 value?

References:

Søndergaard et al. (2000) Net accumulation and flux of dissolved organic carbon and dissolved organic nitrogen in marine plankton communities. *Limnol. Ocean* 45:1097-1111

Thingstad et al. (1997) Accumulation of degradable DOC in surface waters: Is it caused by a malfunctioning microbial loop? *Limnol. Ocean.* 42:398-404

Williams (1995) Evidence for the seasonal accumulation of carbon-rich dissolved organic material, its scale in comparison with changes in particulate material and the consequential effect on net C/N assimilation ratios. *Mar Chem* 51:17-29

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