

Interactive comment on “Revisiting the disappearance of terrestrial dissolved organic matter in the ocean: a $\delta^{13}\text{C}$ study” by K. Lalonde et al.

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bg-2013-512 Revisiting the disappearance of terrestrial dissolved organic matter in the ocean: a $\delta^{13}\text{C}$ study K. Lalonde, A. V. Vähätalo, and Y. Gélinas

General comments

The authors present an experimental approach to quantify the impact of photobleaching on stable carbon isotope composition of terrestrial organic matter dissolved in river waters. The point is of prime importance to evaluate terrestrial contributions to the dissolved organic carbon (DOC) pool present in ocean water. Experimental and worldwide sampling of riverine waters used in this study appear well appropriate with regard

C7257

to the objectives. Output data are original and give a relatively large worldwide basis for a re-evaluation of the recalcitrant terrestrial DOC pool in ocean. By considering $\approx +1.5\text{‰}$ fractionation on $\delta^{13}\text{C}_{\text{DOC}}$ values of non labile terrestrial DOC due to the residual-enrichment effect of photobleaching, the authors calculate a terrestrial DOC contribution in ocean multiplied by about 1.22 (as a whole). Although experimental is convincing, application to direct calculation of terrestrial DOC percentages present in oceanic total DOC using a unique two end-member isotopic mixing system may sound exaggerated. The choice of a unique value for the pure algal marine DOC end-member, i. e. -20‰ looks as an over simplification, may be not applicable everywhere in the ocean? Likewise, unaltered (-28.11‰ or photobleached (-26.63‰ $\delta^{13}\text{C}_{\text{DOC}}$ end-members values for riverine contribution which are average values may fail to compute significantly local mixing percentages. The authors should prefer to stress the 20% increase of DOC terrestrial contribution in ocean which is calculated if photobleaching is taken into account (according to their data) than to proposed absolute values of that contribution like in Table 2. Calculated riverine contribution for literatures values would be taken more as an example to illustrate the photobleaching effect on that evaluation. A welcome improvement of the manuscript should to reorganise the Results and Discussion section by first presenting the results.

Specific comments

The assumption that mineralization of labile photoproducts was not associated to an isotopic shift is balanced by the data found for the Parana River (and Congo River), that is 2 out of 5! You should also comment the -1‰ found for the dark control in Fig 3A (and precise from which river the sample came from?). R-DOC should be introduced in this section (3.3).

In Figure 5 B, extrapolation of $\delta^{13}\text{C}_{\text{DOC}}$ values to fraction 0 or 1 seem perhaps unnecessary (since not used later) if any correct if a sigmoid function is considered instead a straight line. Anyway the sense of the -32.35 and -20.04‰ values respectively calculated for the pure mineralized and the pure R-DOC fractions should be discussed.

C7258

How is calculated the fraction of R-DOC comprised in the NL-DOC could be specified.

Technical corrections (suggestions)

Line 27: less depleted should be preferred to more enriched.

Line 54: Hedges 2002 is missing in the list of references.

Line 146: one set irradiated + one dark control make not a duplicate?

Line 158: reference? (Chu and Liu 2009?).

Line 223: Amazon? Black or White waters or mix? Put here information given in Table 1 caption.

Line 232: sentence starting by L-DOC was not... should be placed at the end of the §line238.

Line 241: this statement cannot apply in case of mixing of different sources of DOC with different biodegradability.

Line 259: light absorption.

Line 272: please put references at the end of the sentence or move backward the sentence. Lines 288-291 "Naturally ...".

Line 290, rephrase to avoid double brackets.

Line 308: "data not shown" really not shown or in Fig 3B?

Lines 315-317: average data are not available on last column in Table1? The shift seems quite large for Parana River: -2.5‰ in Table 1, comment please. In Fig 3A dark control recorded a 1‰ shift during the microbial degradation step following photo-oxidation, is this significant? Comment please. Also in Fig 3 caption, you mention data from "a representative riverine sample" but you should indicate which River?

Line 318: new subtitle? 3.4?

C7259

Line 320: rephrase.

Lines 321-323: 14C..., do you mean young material or mass dependant 14C enriched material? This section is not clear and not at its right place in the text.

Line 323-325: move to next paragraph.

Line 329: prefer (R-DOC is less 13C-depleted).

Line 330: what is "model II" ?

Line 332: do not repeat (R-DOC).

Line 340: References?

Line 341-343: move before line 321. Results are not sufficiently exposed before to be discussed.

Line 343: avoid excessive bracketing.

Lines 343-346: Where are the data you comment? Which are the Rivers you are talking about?

Line 349: plant materials.

Line 350: less depleted.

Line 355: new subtitle? 3.5?

Line 369: do not repeat (R-DOC).

Line 385: no useful data could be taken from phytoplankton?

Lines 388-394: too long, rephrase.

Line 397: which $\delta^{13}\text{C}_{\text{DOC}}$ end-members values are used?

Line 407: 22%? data from Table 2?

C7260

Line 413: which are the "others".

Are lines 415 to 427 the Conclusion?

Lines 415-419: not at their place, move to Introduction?

Lines 424: which "new proxies, methods and ..." ? References?

Line 444: actualise reference data.

Table captions

Table 1

Total and 2 NL-DOC ... instead of "various". Do not repeat information concerning L-DOC removal and move to the plain text information concerning Amazon River sampling. In Table 1, last column, does % of microbial degradation are also "% loss"?

Table 2

Why unaltered or photobleached CDOC end-members values taken for calculation (respectively -28.11 and -26.63‰ differ from average values in Table 1 (respectively -28.07 and -26.57‰)? less depleted instead of "most enriched" line 3

Figure captions

Figure 1

put (a) and (b) at the beginning of the sentence sections

Figure 3

Y-axis Fig 3b : NL-DOC (mg/L); Fig3a: NL-DOC $\delta^{13}C$

Figure 5

(A) and (B) have been inverted in the text of the caption precise NL-DOC $\delta^{13}C$ Y-axis Fig4B Congo plot mark in Fig5A should be in black as in fig5B rearrange X-axis label

C7261

END

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C7262