

Interactive comment on “Spatio-temporal variability of the CO₂ system on the Scotian Shelf” by E. H. Shadwick et al.

Anonymous Referee #2

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Overall quality of the discussion paper

1. A paper prepared to a low standard with respect to the reader being able to make their own judgement on the data.
2. A paper which is not sufficiently quantitative in its approach.
3. A paper which does not consider the hydrographic setting in sufficient depth.

Specific comments

1. Does the paper address relevant scientific questions within the scope of BG?

Yes. The magnitude of the impact of shelf sea systems on the global carbon cycle is still an open question because of the lack of measurements over most of the globe.

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2. Does the paper present novel concepts, ideas, tools, or data?

The data is novel but poorly described. The data set is partial because it does not include the appropriate nutrient and chlorophyll or oxygen data. The tools used to derive budget are poorly described. The concepts and ideas included in the conclusions provide nothing new relative to assertions made in the introduction.

3. Are substantial conclusions reached?

No new conclusions are reached.

4. Are the scientific methods and assumptions valid and clearly outlined?

No. See below.

5. Are the results sufficient to support the interpretations and conclusions?

No. The paper is weak on clearly describing the annual hydrographic cycle in the waters being studied.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

No. The way the data is presented in the form of contour diagrams makes the data difficult to assimilate quantitatively. The data should be presented as simple x/y depth versus property plots. Throughout, the data is described as being “high” or “low” and rarely are any numbers provided for the reader to judge what is meant by “high” or “low”.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes. But one has the feeling that the group could have produced better papers if the number were less.

8. Does the title clearly reflect the contents of the paper?

C6063

No. It should mention the assessment of export.

9. Does the abstract provide a concise and complete summary?

No. It contains no quantitative information.

10. Is the overall presentation well structured and clear?

No.

(1) A section of say 300 words giving information on the hydrographic setting and seasonal changes is required. Questions such as:- How well homogenised is the water at the end of winter on and off shelf? What is the direction of the flow of the St Lawrence plume? How much does the flow change seasonally in terms of volume?

(2) Thought should be given as to how the differences between the hydrographic sections could be more clearly presented. This would allow section 3.2 to be substantially shortened and make it more useful and informative.

(3) A problem this paper probably suffers from is that the first April cruise should have actually sailed and sampled before the spring bloom. Page 12019 line 3 states "In April ... representative of winter conditions" but the bloom was well underway by the time they had sailed. I would have expected that they would have tried to examine their profiles to identify winter mixed water containing pre-bloom concentrations of DIC. Was this not possible?

(4) I find the section on the estimation of net community production confusing. At the top of page 12028 mention is made of nitrate data for the first time (but it is "not shown"). Given the wealth of historical nitrate data I would have thought must exist for this region, could not the early season production be estimated from difference between their observed April values and winter nitrates from a climatically comparable year? This would solve the problem they admit to around line 25 on page 12028, that substantial production had occurred before their April cruise.

C6064

(5) Section 4.2 on the budget seems a bit of jumble to me. What is needed is simple step by step description how each of the numbers appearing in Figure 14 is arrived at.

(6) Other points

What is the carbonate concentration in the St Lawrence? How does the carbonate content change with flow? This important information is not presented. (Cai et al (2010) *J. Geophys. Res.* 115: C08014, doi:10.1029/2009JC005482. Raymond and Cole (2003) *Science* 301: 88–91; give some indication it would be worth a mention).

They followed the Friis normalisation method but where did they get the appropriate end member from?

Having made case that normalising DIC is of value then changes in DIC would be easier to see in the diagrams if nDIC were plotted.

11. Is the language fluent and precise?

The language is fluent but the paper is poorly structured and long winded. Substantial editing and restructuring are required.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

In sufficient such information is given.

For example the Friss adjustment equation and factor and source of the fresh water factor should be given. Presentation of the equations may help explain the working used to derive Figure 13.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

Figure 12 is unnecessary given Table 1. It could however be merged with Figure 1 and flow lines indicating the major currents could be added.

C6065

Thought needs to be given to Figures 3 to 7 and 9. I think the information would be clearer as X/Y depth property plots. They should be grouped by property rather than the section. Plotting the normalised values for DIC and TA may be more appropriate than the simple concentrations. The contour diagrams in this submission could be retained in the supplementary data.

14. Are the number and quality of references appropriate?

No. Better information is needed on the background hydrography and the seasonal cycle in productivity in the region based on nutrient and other studies.

15. Is the amount and quality of supplementary material appropriate?

The data set is sufficiently small it could be included in the supplementary information. This should also include the nutrient data. It is possible that examination of the nutrient ratios may also help distinguish the boundary between river influenced and ocean waters.

The continuous records from the ship's CTD temperature and salinity profiles may help distinguish the position and depth of the winter mixed layer and hence pre-bloom concentrations of DIC.

Interactive comment on Biogeosciences Discuss., 8, 12013, 2011.