Biogeosciences Discuss., 11, C4973–C4976, 2014
www.biogeosciences-discuss.net/11/C4973/2014/

Biogeosciences
Discussions
Open Access

Interactive comment on "Seasonal response of air-water CO_2 exchange along the land-ocean aquatic continuum of the North East American coast" *by* G. G. Laruelle et al.

Z. Wang (Referee)

zawang@whoi.edu

Received and published: 7 September 2014

The study quantified the air-water CO2 exchange rates in rivers, estuaries, and continental shelves of the US Northeast region using existing data and various interpolation and extrapolation techniques. These CO2 flux estimates are very useful to construct the regional C budget. The seasonality and spatial variability in CO2 fluxes in the region, especially in rivers, are particularly interesting. In general, the paper is well written, but there are a few concerns/comments that I would like to share with the authors:

Riverine pCO2 calculation – The pCO2 values in the paper were calculated from pH

and alkalinity (alk) measurements. It is known that non-carbonate alkalinity (non-calk) can introduce large calculation uncertainty in pH-alk calculation of pCO2, most likely overestimate of pCO2. The study in Maine rivers (Hunt et al.) show the calculation can be 10 – >60% over estimate. I think the uncertainty may be even higher than this, as that particular study only focused on the main stems near river mouths, and upper streams of the rivers may be even more organic rich and their water may contain more non-calk. I won't be surprised in some places calculated pCO2 may be >100% off the real value. This issue was not dealt with in the paper, not even mentioned. I think the strategy here may be to find some existing data, where three of the 4 CO2 parameters are available to give an estimate of calculation errors or better yet try to minimize the overestimate in flux calculation.

Abstract: '. . .estuarine surface area are identified as important . . .factors. . .'. It is a bit confusing. Surface area is one factor of many in estuaries that can affect CO2 flux. As the authors mentioned, decomposition of terrestrial C in estuaries is one very important factor, at least as important as surface area.

I am not an expert of the language, but is 'North East' should be one word? This applies to the whole paper.

P11988, L16, COSCAT 827 first appeared in the paper. Should give the full name and give some description on what is it. Many people are not familiar with the term. There are other acronyms in the paper that authors did not first describe and give the full names. May want to give a thorough check and add descriptions if necessary.

Figure 1. The boundary of the North-South region is not clearly labeled and showed, and no legend for it.

P11989, last paragraph, It would be useful and more clear to list the equations of Aeff or have a table to show how it is defined. The equations of Raymond et al. 2012, 2013 may also be useful to show here. I found it is a bit difficult to follow the text.

Why did the authors choose -4.8C as the ice cover temp? Is there a logic/reason here, reference?

P11990, 2nd paragraph, I think it would be very useful to list how k is calculated in equations. The k constant is a key parameter for CO2 flux calculation. I don't see what k-parameterization (reference) was used here. A more careful discussion is needed here. Also in this paragraph, it mentioned that only annual averages for V and k600 could be calculated, then how can monthly k be calculated? P11990, last line, what is the inverse distance weighted interpolation? More description would be useful.

P11991, L9, '. . .relative to the terrestrial surface area per. . .'. Not sure how this has been done and what meaning it has. Please clarify.

P11991, L11, Is there any justification why the equations of Raymond et al. 2012 and 2013 can be used for the estimate of the uncertainty?

P11991, 2nd paragraph, Again, what k-parameterization was used for estuarine CO2 flux calculations? It would be very useful to list key equations and have some discussion of k errors.

P11992, 2nd paragraph, it there any extrapolation that has been done to cover non-sampled grid cells? Please clarify. 'Monthly FCO2 for the North and South. . .water surface area and weighted rate for each cell,. . .' It is not very clear how this has been done, may want to list some equations and have more description.

Results and Discussion, I like the estuarine filter discussion. But other mechanical drivers of CO2 fluxes along this continuum are not very well discussed. It would be useful to strengthen the discussion by examining the fluxes calculated from this study.

P11993, 1st paragraph, it would be good to separate this paragraph to two, one for river, one for shelf.

P11994, 1st line, '. . .in DOC and CO2, combined to increasing . . .respiration. . .' CO2 can't increase respiration.

P11994, 1st paragraph, 'a close mirror behavior', I think it is not a very close mirror here.

P11994, L25, '. . .one order of magnitude larger. . .' I don't see it is one order of magnitude larger here. Which number vs. which number?

P11995, 2nd paragraph. Is there an explanation why rivers in the North have a higher areal rate of CO2 degassing than in the South in general? Also in this paragraph, it would be clearer to make two paragraphs, one for rivers and one for shelf.

P11995, 2nd paragraph. It says that the shallowest depth interval is a CO2 source for the shelf, but Table 1 shows the South shelf S1 is a sink? Please check and change the discussion accordingly. It is a bit surprise that S1 is a sink? Do DeGrandpre and Signorini papers show nearshore CO2 sink in the MAB?

P11997, 1st paragraph. Although estuarine filters may be a reason that can explain the north-south difference, there may be other reasons as well. For example, the Gulf of Maine is a semi-closed system, which may promote shelf-derived OC decomposition. In the Scotia shelf, there is riverine influence from the St. Lawrence River, I think (please check). So careful discussion and wording here are necessary.

- Aleck Wang

Interactive comment on Biogeosciences Discuss., 11, 11985, 2014.