

## ***Interactive comment on “Review article “Air-sea exchanges of CO<sub>2</sub> in world’s coastal seas”” by C.-T. A. Chen et al.***

**Anonymous Referee #1**

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General Comments:

This paper synthesized the CO<sub>2</sub> fluxes in the world’s estuaries and continental shelves, with new available data in various places. The paper is a good update on what we know about the CO<sub>2</sub> fluxes in these coastal systems. It should have a good impact in coastal carbon research. The paper is reasonably well written, but a careful checkup on the language is necessary. There are a few points I want to make about the paper.

The paper is lack of a method/data analysis section. Although this is a review paper, I think it is useful and important to see how the data were analyzed and upscaled to derive the global estuary and shelf CO<sub>2</sub> fluxes. I don’t see this was well presented in the paper. Related to the last point, it may be better to use different upscale methods to come up with a range of CO<sub>2</sub> fluxes. As authors pointed out, the coastal ocean CO<sub>2</sub>

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fluxes are highly variable in space and time. We don’t have a good handle on how we should upscale the sparse data. Using different methods will help to see what might be the uncertainty these flux estimate may have.

It is also useful to see how the areas without data coverage are treated. Again, different ways of treatment may have different effects on the final estimate, which is worth discussion.

It would be interesting to compare the latest estuary CO<sub>2</sub> flux with other riverine/terrestrial carbon fluxes, such as DOC/POC etc. That may give us some hints on how the organic carbon may be processed in estuaries. In the same token, putting the shelf CO<sub>2</sub> flux in the context of other carbon fluxes would also be useful.

Although different people may prefer different gas transfer velocity constant (k) parameterization, it is generally viewed that open ocean k constants, such as Wanninkhof 1992, cannot simply be applied to estuaries. There are quite a few k parameterizations that can be used for estuaries. I think it is necessary that this is reflected in the estuary flux calculations. For the shelf waters, newer k equations may be more desirable (e.g. Wanninkhof et al. 2009; Ho et al 2011).

Detailed comments:

1. In abstract, p5042 L4, ‘...negative flux indicates that the water is losing CO<sub>2</sub> to the atmosphere’? Looks like the sign of CO<sub>2</sub> flux numbers is the opposite as what defined here. Ocean CO<sub>2</sub> sink usually is defined as the negative flux. This should be consistent throughout the paper.
2. P5046, L1, should be ‘However’.
3. P5046, L4-5, more recent references?
4. P5046, 2nd paragraph. Although global models for coastal CO<sub>2</sub> fluxes are not yet sufficient, but regional models are available, and more successful. This should be acknowledged with some references.

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5. P5048, L12, again, 'negative' sign here?
  6. P5051, L11-13. Please check the numbers. I don't see Arctic estuaries equal the total areas of the estuaries around the Atlantic and Indian Ocean in Fig. 7.
  7. P5052, L12-24. Looks like Fig 11 is referred here? But there is no mention of Fig. 11. Please check.
  8. P5052, L4, This sentence should be moved to the early part of the paper, defining flux signs.
  9. P5054, L18, -0.3 PgC? Or 0.3?
  10. P5054, L21-22, need references here.
  11. P5056, L3, 'warmer' or colder?
  12. P5056, section 5, Future changes in carbon fluxes. This discussion is somewhat weak. I would like to see what different drivers might change CO<sub>2</sub> fluxes. Only temp and weathering are discussed a bit, without much implication. Other factors may also need to be discussed, such as decrease in buffering capacity, changes in biological production, eutrophication, among others.
- Table 3. Please check the sign of the fluxes for consistency.
- Fig. 2. Lack of vertical labels. Why is there a mismatch of n between the upper and lower panel? Should be the same number of observations listed? The caption needs to be improved.
- Figs. 6, 7, 11, 12. Need to define abbreviations.

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