Biogeosciences

Discussions

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Interactive comment on "High-frequency variability of CO_2 in Grand Passage, Bay of Fundy, Nova Scotia" *by* Rachel M. Horwitz et al.

Anonymous Referee #1

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1. General Comments: Tides are often viewed as symmetric with respect to volume flow, so the effects of tidal pumping are misunderstood or ignored. Given the discrepancy of biogeochemical estimates to determine whether this region is a net source or sink of CO_2 to the atmosphere, this study gives essential insight to the contribution of high-frequency variability to the carbon cycle, specifically carbon transport via tidal pumping. However, I am not yet convinced that air-sea flux has been given full consideration. The relationship between DIC_{ex} and air-sea flux is still unclear to me even after reading through the appendix. With respect to data presentation, I recommend the abandonment of the rainbow colormap and the adoption of color schemes more true to the data and accessible to colorblind readers.

2. Specific Comments:

- P3, l15: The tidally-estimated salinity has a much lower range than the measured salinity. How sensitive are your downstream calculations, especially DIC_{ex}, to this reduction in variability in salinity and hence alkalinity?

- P3, l23 - 25: Alkalinity samples were taken only during the daytime. I presume they spanned the entire tidal range?

- P4, l28 - 29: While the full equation is not necessary, it would be helpful to enumerate what measurements were used to calculate DIC and pH.

- P5, l6 - 7 and Fig 2a, b: Generally, I would expect any gas to decrease in the summer and increase in the winter due to solubility. Is there something special about CO_2 that I am missing here?

- P6, l6: Air-sea exchange is very difficult to calculate, especially in a dynamic system such as this one. How is it treated in CO2SYS? Is it the Wanninkhoff parameterization shown in the discussion? Should the reader refer to the appendix at this point?

- P6 l14 - 21: There seems to be abrupt changes in the nature of the DIC_{ex} data around days 265 and 290. Any explanations?

- P6 l26 - 28 and Fig 5: In addition to the 24-hr and M2, there are two peaks. From the x-scale, it is difficult to tell whether they are important or merely harmonics of the predominant frequencies.

- P7 l19: By "lower growth," do you mean lower primary production or photosynthesis? Growth can also be heterotrophic.

- P7 l24 - P8 l10: Provide units of the variables given to aid dimensional analysis.

- P9 l27 - 29: Did you finish your thought here? Do you have an estimate of advection? There's no period.

- P12 l7: Given the spatial variability in pCO$_2$, S, and T, can you assume spatially-uniform air-sea flux?

- Fig 3: There is a tail of low DIC in the tidally-predicted salinity points. Are these anomalous?

- Fig 4: I appreciate how differently a) and b) portray the exact same data. I would recommend not using a rainbow colormap for 4a. It is good that it wraps around, but the data are not represented linearly (green spans 6 hours) and it is not accessible for readers who are colorblind. Take a look at other cyclic color maps. I understand why you might want to put the winter 2016 data at the front of the figure, but there is nothing significant about January 1st with respect to solar or lunar cycles. It's better to arrange the data chronologically and smoothly.

- Fig 6: These plots are extremely informative, but again, rainbow colormaps are ineffective at communicating data. For a) and b), use the parula colormap used in Fig 4b. For c) and d), try a diverging map (blue - white - red, for example).

3. Technical Corrections:

- P2, l1: Transpose "of" and "understanding."
- P2, l20: Remove the redundant "of."
- P3, l5 - 11: Descriptions of sampling frequency alternate between s and Hz. Choose one for consistency.
- P4, l3 - 4: Double check this link. I got a 404 error.
- P4, l18 - 19: Generally the past tense is preferred here. Feel free to use the first person.
- P5, l17: Eliminate the space in "relation ship."

- P5, l9 - 20: These two sentences make it sound as if air-sea flux was a biological process.
- P5, l30: What software is used to run CO2SYS?
- P7, l9 - 12: Use past tense.
- Fig 6a: Should axis should read "Salinity" rather than "salt?"