

Interactive comment on “Spatial variability of surface-water pCO₂ gas exchange in the world’s largest semi-enclosed estuarine system: St. Lawrence Estuary (Canada)” by Ashley Dinauer and Alfonso Mucci

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Short comment on the paper Spatial variability of surface-water pCO₂ and gas exchange in the world’s largest semi-enclosed estuarine system: St. Lawrence Estuary (Canada), submitted to BIOGEOSCIENCES by Dinauer and Mucci.

The paper reports a very carefully designed study of surface surface water pCO₂ data for the Gulf of St Lawrence, which have been compiled from pH and alkalinity data. The data have been gathered during several years from repeated sampling of the region. The data constitute an important data set, and the paper an important contribution to

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the understanding of the Gulf of St Lawrence system, and to estuarine biogeochemistry overall.

I can offer a few comments to consider for a revision of the paper.

1: In the introduction and later in the paper a further processes may be mentioned regulating the pCO₂ in estuarine systems. This is the relation or ratio of dissolved inorganic carbon and alkalinity (DIC:AT) of the riverine waters, which in essence is controlled by the drainage basin characteristics. This has been shown for example for the Baltic Sea by Thomas and Schneider (1999), or Hudson Bay by Burt et al. (2016). I think this process, or possibly its regional variability within or between drainage basins appears particularly relevant for systems, which span a range of climatic regions such as the Gulf of St Lawrence, being at the boundary between subarctic and temperate regions.

The authors implicitly refer to this point in their section 2.1 (geology of catchment area, as well as its vegetation), and I further think that this is relevant when discussing oxygen vs CO₂ saturation levels (lines 522-536, and their Fig. 8), as well as for section 3.3, which in turn more or less is focused on temperature only rather than on what is implied by equation 9.

2: I appreciate the discussion of the uncertainty associated with the computation of the pCO₂ from alkalinity and pH. I find this - crucial part of the paper – somewhat difficult to follow. I would suggest to add a panel to Figure 3 showing different pCO₂ results themselves, and only then their differences. Also, while I am aware that the authors did not measure pCO₂ directly, possibly a short discussion could be added how the computed values compare to direct measurements, which is actually what the reader would be interested in.

3: Gulf of St Lawrence and another systems. While the river runoff into the Gulf of St Lawrence in North America is only second to the Mississippi system, its runoff is of similar magnitude than the one into the North Sea (300km³ per year, e.g Thomas et

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al., 2005), and about two thirds of the runoff into the Baltic Sea (500km³ per year). I furthermore think, a comparison with the well-studied Baltic Sea would be enlightening here as the Baltic is similarly located at the boundary between subarctic and temperate regions and is a (comparably) similar estuarine system.

References:

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