



A comparative study of carbon dioxide degassing in river- and marine-dominated estuaries

Jiang, Li-Qing, Wei-Jun Cai, Yongchen Wang

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ABSTRACT: The partial pressure of carbon dioxide ($p\text{CO}_2$), concentration of total dissolved inorganic carbon, and total alkalinity were measured at both high tide and low tide in the surface water of three Georgia estuaries from September 2002 to May 2004. Of the three estuaries, Sapelo and Doboy Sounds are marine-dominated estuaries, while Altamaha Sound is a river-dominated estuary. During all sampling months, the three estuaries were supersaturated in CO_2 with respect to the atmosphere (39.5-342.5 Pa, or 390-3380 μatm) because of CO_2 inputs from within the estuarine zone (mainly intertidal marshes) and the river. Overall, $p\text{CO}_2$ in the river-dominated estuary is much higher than that in the marine-dominated estuaries. The calculated annual air-water CO_2 flux in Altamaha Sound (69.3 $\text{mmol m}^{-2} \text{d}^{-1}$) is 2.4 times those of Sapelo and Doboy Sounds (28.7-29.4 $\text{mmol m}^{-2} \text{d}^{-1}$). The higher CO_2 degassing in the river-dominated estuary is fueled largely by CO_2 loading from the river. Because of the substantial differences between river- and marine-dominated estuaries, current estimates of air-water CO_2 fluxes in global estuaries (which are based almost entirely on river-dominated estuaries) could be overestimated.

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