



Evaluation of sinks and sources of CO₂ in the global coastal ocean using a spatially-explicit typology of estuaries and continental shelves

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The exchange of CO₂ between the atmosphere and the global coastal ocean was evaluated from a compilation of air-water CO₂ fluxes scaled using a spatially-explicit global typology of inner estuaries (excluding outer estuaries such as large river deltas) and continental shelves. The computed emission of CO₂ to the atmosphere from estuaries ($+0.27 \pm 0.23 \text{ PgC yr}^{-1}$) is $\sim 26\%$ to $\sim 55\%$ lower than previous estimates while the sink of atmospheric CO₂ over continental shelf seas ($-0.21 \pm 0.36 \text{ PgC yr}^{-1}$) is at the low end of the range of previous estimates (-0.22 to $-1.00 \text{ PgC yr}^{-1}$). The air-sea CO₂ flux per surface area over continental shelf seas ($-0.7 \pm 1.2 \text{ molC m}^{-2} \text{ yr}^{-1}$) is the double of the value in the open ocean based on the most recent CO₂ climatology. The largest uncertainty of scaling approaches remains in the availability of CO₂ data to describe the spatial variability, and to capture relevant temporal scales of variability.