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±0.23 PgC yr$^{-1}$) is ~26% to ~55% lower than previous estimates while the sink of atmospheric CO2 over continental shelf seas (-0.21±0.36 PgC yr$^{-1}$) is at the low end of the range of previous estimates (-0.22 to -1.00 PgC yr$^{-1}$). The air-sea CO2 flux per surface area over continental shelf seas (-0.7±1.2 molC m$^{-2}$ 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.