Carbon dioxide in European coastal waters

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We compiled from literature annually integrated air-water fluxes of carbon dioxide (CO2) computed from field measurements, in 19 coastal European environments that were gathered into 3 main ecosystems: inner estuaries, upwelling continental shelves and non-upwelling continental shelves. Air-water CO2 fluxes were scaled at European regional level and compared to fluxes of atmospheric CO2 in other aquatic and terrestrial compartments. Continental shelves are significant sinks for atmospheric CO2 at an average rate of -1.9 molC/m2/yr that scaled at European level corresponds to an absorption of atmospheric CO2 of -68.1 TgC/yr. This sink is equivalent to the one reported for the terrestrial biosphere of -66.1 TgC/yr, based on carbon-stock change models. Estuaries are significant sources of CO2 to the atmosphere at an average rate of 49.9 molC/m2/yr that is higher than the CO2 emission to the atmosphere from rivers and streams (26.9 molC/m2/yr) and lakes (7.6 molC/m2/yr). The scaled emission of CO2 to the atmosphere from inner estuaries of about 67.0 TgC/yr would almost fully balance the sink of atmospheric CO2 computed for continental shelves, and is higher than the emission of CO2 to the atmosphere from continental aquatic systems of 36.5 TgC/yr. However, the scaled emission of CO2 from estuaries to the atmosphere is inconsistent with the potential emission of CO2 based on the fate of river organic carbon during estuarine transit. This discrepancy is most probably due to the poorly constrained surface area estimate of inner estuaries.