



CO₂ air-sea fluxes across the Portuguese estuaries Tagus and Sado

AP Oliveira, G Cabeçadas, and M Nogueira

INRB - IPIMAR, U-AMB, Lisbon, Portugal (aoliveira@ipimar.pt)

Generally, estuaries and proximal shelves under the direct influence of river runoff and large inputs of organic matter are mostly heterotrophic and, therefore, act as a carbon source. In this context the CO₂ dynamics in Tagus and Sado estuaries (SW Portugal) was studied under two different climate and hydrological situations. These moderately productive mesotidal coastal-plain lagoon-type estuaries, localised in the center of Portugal and distant 30-40 km apart, present quite different freshwater inflows, surface areas and water residence times.

A study performed in 2001 revealed that the magnitude of CO₂ fluxes in the two estuarine systems varied seasonally. CO₂ emissions during the huge rainfall winter were similar in both estuaries, reaching a mean value of $\sim 50 \text{ mmol m}^{-2} \text{ d}^{-1}$, while in spring emissions from Sado were ~ 6 times higher than Tagus ones, attaining a mean value of $62 \text{ mmol m}^{-2} \text{ d}^{-1}$. Nevertheless, in both sampling periods, Sado estuary showed, within the upper estuary (salinity < 15), a decrease of CO₂ associated with a decrease of suspended particulate matter. Mainly in spring, the observed CO₂ fluxes decrease occurred right in the turbidity maximum (salinity 0-10) being found out positive relationships between the respective fluxes and suspended particulate matter and chlorophyll *a*, simultaneously with the occurrence of a decline in values of dissolved oxygen. These features point out to mineralisation processes possible being responsible for the elevated CO₂ emissions in the upper estuary by that time. For salinities above 20, biological activity (namely photosynthesis) seemed to be the main process regulating the relatively low CO₂ emissions. By contrast, Tagus estuary does not display a marked maximum of turbidity, being CO₂ dynamics, during the productive period, apparently governed by biological mechanisms, in particular photosynthesis.

Despite different hydrology and processes responsible for the CO₂ dynamics, Tagus and Sado estuaries follow the general tendency of acting as carbon sources. At an annual basis, Tagus and Sado CO₂ emissions in 2001 were, respectively, 13 and 21 mol m^{-2} . Comparing to other European estuaries these two studied estuaries function as moderate CO₂ sources to the atmosphere.