

The contribution of chemical fluxes across the sediment-water interface to carbon cycling in estuarine regions: A case study at the Rhône River mouth (NW Mediterranean)

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Despite their small surface compared to the global oceans, continental shelf regions play a significant role in the global carbon cycle. Whereas shelf regions are seen as a sink for atmospheric CO₂, estuarine regions are seen as a source. These regions are characterized by the export of allochthonous terrigenous organic matter (OM) and the production of autochthonous marine organic carbon. An important fraction of this OM is mineralized in the sediments close to the river mouth. As a result, high exchange fluxes of dissolved inorganic carbon (DIC), total alkalinity (TA), oxygen and nutrients cross the sediment-water interface (SWI) and cause acidification of the bottom waters. Potentially, primary production in the water column is enhanced by these fluxes. Therefore, OM mineralisation in estuarine regions plays a key role in the carbon cycle as a direct producer of DIC and as a potential control factor for primary production. This work aims to quantify chemical fluxes through the SWI at the prodelta of the Rhone River (Mediterranean). In September 2015, a benthic chamber has been deployed at several stations in the prodelta to measure directly (in situ) fluxes of DIC, TA, ammonium and dissolved calcium at the SWI. At the same stations, in situ microprofiles of oxygen and pH have been recorded and sediment cores were taken for pore water extraction and analysis (DIC, TA, NH₄⁺ and Ca²⁺). The results show a strong decrease of the fluxes in offshore direction indicating a strong variation of respiration rates in this direction. From pore water profiles, diffusive fluxes have been calculated and compared with the fluxes measured by the benthic chamber. This comparison enables us to include pore water profiles from previous investigations to calculate a carbon mass budget of this region.