Temporal variability of carbon recycling in deltaic sediments at different time scales: An example from the Rhône River delta

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Temporal variability of the carbon cycle in estuaries and deltas is known to be very large and is the main issue for quantifying the carbon cycle in this active zone of the Earth System. Indeed, this variability combines hydrological variation from the river (floods, droughts) and the hydrology of the coastal seas (storms, coastal circulation, upwelling) which are both influential on biogeochemistry. This gives rise to short timescale variability of biogeochemical fluxes (typically hours to days) which has been poorly documented. The connexion with long term effects has been so far overlooked. Using *in situ* oxygen microprofiling devices, we have collected a new dataset on organic matter recycling in the Rhone prodelta and shelf sediments (Northwestern Mediterranean Sea) which covers a wide range of timescales: from hours to decades. The hourly variation is collected using a new benthic station deployed on the sediments and specially adapted to monitor short-term variations such as flood or storm events. Water column sensors (Turbidity, Temperature and Salinity) can trigger more frequent sampling by an oxygen micro-profiler to provide time-series of oxygen microprofiles over a few days during resuspension or flood events, before returning to its nominal frequency, i.e. one set of profiles per day for a couple of months. The seasonal to decadal timescale is constituted by a set of oxygen micro-profiles measured on an array of stations in the Rhône prodelta and shelf by an *in situ* microprofiler during seasonal cruises over 10 years.

The results show extensive variations of oxygen demand related to organic matter remineralization in Rhône prodelta sediments at all time scales, largely driven by deposition of riverine material during floods. Resuspension during storms increases the oxygen demand over short time scales, but its long-term effect is not apparent in our dataset. The relationship between the variability observed at these two timescales is still being sought and a modelling effort is underway to try and unravel the long term effect of short timescale variation in deltaic systems.