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# Time series of oxygen demand in deltaic sediments obtained by a new benthic station: the Rhône delta (NW Mediterranean Sea)

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Deltas are critical interfaces between the land and sea, buffering organic matter (OM) fluxes which constitute an important link between continent and ocean carbon cycles. Due to the extreme variability of estuaries and coastal areas, on both spatial and temporal scales (hydrology, production-respiration balance, coastal circulation...), the balance between deposition and consumption of OM by the benthic ecosystem is largely unknown. Based on a combination of two in situ techniques, we studied the biogeochemical transformations of particulate inputs in the Rhône River delta and its temporal variability. The Rhône River is the main source of freshwater, sediments and organic matter to the Gulf of Lions.

Oxygen micro-electrodes have long been used in the deep-ocean and the coastal sea in order to study oxygen cycling in sediments and to estimate diffusive oxygen uptake (DOU). This technique has seldom been used for performing time-series measurements of DOU because of several drawbacks linked to the fragile nature of oxygen micro-electrodes, their changing calibration with time, the expected small amplitude of DOU variation over short time-scales and the large natural heterogeneity of the sediment DOU which would prevent small temporal variations of DOU to be distinguished from the "spatial noise".

Here, we present results obtained by two in situ techniques: i) an in situ oxygen micro-profiler ii) a new benthic station equipped with oxygen micro-electrodes and environmental sensors. This new device performs daily measurements of oxygen microprofiles, with a potential for high frequency measurements (4 per day) and uses continuous re-calibration by moored oxygen optodes carried by the benthic station together with turbidity, temperature and salinity sensors. Time series typically encompasses periods of 2-3 months. The lateral heterogeneity of the DOU is assessed by performing a 2D map of oxygen demands at the initial stage of the deployment.

We deployed this benthic station in a deltaic environment at the mouth of the Rhone River together with the oxygen micro-profiler in order to study the fate of particulate organic matter delivered during floods from this Mediterranean River. First results measured during low flow condition and small turbidity showed that the measurement system is stable over time and records a limited lateral heterogeneity allowing temporal variation and floods to be recorded. During the turbidity events of spring 2012, oxygen demand rises by a factor of 3-4. We discuss the importance of flood events in controlling the variability of DOU in this system.

Keywords: oxygen microelectrodes, marine biogeochemistry, coastal zone, River deltas, benthic observatory, mineralization