Nutrient fluxes (C, N, P) across the sediment-water interface in a macrotidal estuarian mudflat using a coupled experimental in-situ – modelling approach

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Estuarian mudflats play a major feature in the nutrient dynamics owing to their position as interfaces between a river and an ocean. These ecosystems are subject to strong hydrodynamic processes that concentrate organic particles. Those particles are degraded throughout burial by bacteria. Subsequently to its degradation nutrients are released enriching porous media within the sediment creating strong chemical gradients between the sediment and the overlying water which results in nutrient fluxes at the interface. Thus, the sediment-water interface plays an important role in the nutrient dynamics by being alternatively sink or source of nutrients. This interface can be studied by using in-situ methods which allow to obtain concentration profiles in the sediment. The exchanges between the sediment compartment and the water column can be also numerically modelled considering hydrodynamic and chemical forcings.

The purpose of this study is to couple in-situ experimental and numerical approaches to estimate the nutrient fluxes at the sediment-water interface in a macrotidal estuarian mudflat. First, we deployed in-situ methods such as dialyzer porewater samplers (DPS) and Diffusive Equilibration in Thin-Films (DET) to obtain the depth-dependence concentration of nutrients during several tide cycles at a millimetre resolution. Secondly, we applied a numerical model to assess relative significance of different forcings (physical, chemical, biological, etc.) on nutrient benthic fluxes.

Our preliminary results show that hydrodynamic forcings and more particularly advection have a major impact on the nutrient concentration distribution at the sediment-water interface in a macrotidal estuary by enhancing the nutrient exchanges The final goal is to improve our understanding of the influence of the hydrodynamic forcing on nutrients cycling in the Seine Estuary.