Understanding the biogeochemical interactions of the Scheldt-North Sea river-ocean-continuum through multiscale modelling

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Predicting and understanding the river-estuary-ocean continuum over short and long-time scales are pressing demands for the next decade and beyond [2]. Growth of computing resources had already greatly helped the discipline of coupled land-ocean-atmosphere regional models to evolve over recent years [1]. But many challenges remain to be tackled and land-ocean continuum modelling is one of them. Indeed, the kilometre-scale regional coupled prediction approach, especially when coupled with biogeochemistry, has a lot of progresses to achieve in terms of solving coupled physical-biogeochemical processes in the different components and interactions between them. This project aims to quantify the multi-scale interactions along the river-estuary-ocean-atmosphere continuum from hourly to multi-annual time scales over the Scheldt-North Sea region. In particular, we will assess how the physical and biogeochemical dynamics of the North Western Continental Shelf (NWCS) (i.e. limited by the 200m isobath) and Southern Bight of the North Sea (SBNS) are influenced by the small-scale variability of the Scheldt river-estuary and the atmosphere. For solving the multiscale interactions along the land sea continuum, we propose to develop a modelling framework, coupling unstructured (finite-elements) and structured (finite-differences) grid models for fully resolving in three dimensions the continuum of scales and processes from a few hundreds of meters up to several tens of kilometers. For the atmosphere, we will assess the impact of atmospheric forcing resolution provided by the regional climate model MAR on the quality of ocean prediction over the NWCS. Simulations coupling in 1-way will be done to assess the impact of weather events (e.g. storms, heat wave) on the ocean physics. From a biogeochemical point of view, the modelling system developed will offer an optimal way to quantify the transfer of organic and inorganic materials (e.g. suspended particulate materials, SPM) from the land to the sea and to track pollution events.

References

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Keywords

Scheldt; North Sea; Modelling; Biogeochemical; Finite-Elements Model