Geophysical Research Abstracts,
Vol. 11, EGU2009-11637-1, 2009
EGU General Assembly 2009

Multi-scale modelling of the Scheldt estuary with application to contaminant transport

T. Kärnä (1), B. de Brye (1), A. de Brauwere (1,2), O. Gourgue (1), and E. Deleersnijder (1)

(1) Université catholique de Louvain, Centre for Systems Engineering and Applied Mechanics, Louvain-la-Neuve, Belgium (tuomas.karna@uclouvain.be), (2) Department of Analytical and Environmental Chemistry, Vrije Universiteit Brussel (VUB), Belgium

Modelling coastal areas, estuaries, rivers and adjacent seas is a challenging task due to the various physical length-scales that need to be taken into account. The model should be able to grasp the large scales of open seas but also the small features of coastal areas, such as coastlines, islands and narrow straits. Because it is practically impossible to extend a very fine computational grid over the whole domain, traditionally nested-grid strategies have been used. In recent years, however, unstructured grids have gained attention in coastal modelling due to their intrinsic flexibility: Spatial resolution can be increased locally without constraints and thus the small processes can be resolved with moderate computational cost.

In this work we apply the finite-element unstructured grid model SLIM (Second-generation Louvain-la-Neuve Ice-ocean Model, www.climate.be/SLIM) on the Northwestern European Continental Shelf Sea with focus on the Scheldt estuary in Belgian/Dutch coast. As the tide is a dominant factor in the Scheldt, it is of crucial importance to incorporate a wetting-drying algorithm to take into account the regularly drying sandbanks. Tidal forcing is applied on the shelf break, where reliable data are available from global tide models. In the upstream direction the Scheldt riverine network is followed until the tidal excursion is negligible. This approach leads into a highly multi-scale domain that extends from the shelf sea into rivers of not more than tens of meters in width. Comparing the model results to hydrological data from multiple stations in the estuary shows good agreement in the tidal propagation.

Because the Scheldt is located in a densely populated area with heavy industry it is of high interest to assess the fate of anthropogenic discharges and their impacts on the water ecosystems. Within the framework of the TIMOTHY project (Tracing and Integrated Modeling of Natural and Anthropogenic Effects on Hydrosystems : The Scheldt River basin and adjacent coastal North Sea, www.climate.be/TIMOTHY), we have incorporated a fecal bacteria transport and reaction module in the SLIM model as a first form of anthropogenic contaminant. As measurements on fecal bacteria are typically scarce and expensive to collect, we have also used our model to deduce an optimal sampling strategy such that maximal information is retrieved with minimal number of samples.