

Salinity in the Belgian coastal zone

Vanlede Joris¹, Gert Leyssen² and Boudewijn Decrop²

¹ Flanders Hydraulics Research, Berchemlei 115, B-2140 Antwerp, Belgium

E-mail: joris.vanlede@mow.vlaanderen.be

² International Marine and Dredging Consultants (IMDC), Coveliersstraat 15, B-2600 Berchem, Belgium

Ecological and morphological studies in the Scheldt Estuary rely on correct salinity distributions within the estuary, and thus an accurate description of the salinity in the coastal zone is needed. The distribution and variability of the salinity of the Belgian coastal waters is influenced by the freshwater discharges of the major European rivers discharging in the Southern North Sea, and the circulation in the North Sea. The importance of the major rivers (Scheldt, Rhine/Meuse and the Thames) is investigated with passive tracers in the CSM (Continental Shelf Model) and ZUNO (ZUIDelijke NOordzeemodel) models (RWS-Waterdienst & Deltares). Furthermore the reaction of the salinity distribution to storms and large freshwater discharge events is evaluated.

Flanders Hydraulics operates a series of nested models for research purposes (hindcast) in the North Sea. The models run on the parallelized SIMONA WAQUA shallow water flow solver (SIMONA, 2009). CSMv5 has a Cartesian grid in spherical coordinates with a resolution of 1/8° longitude (9.3-6.5km) and 1/12° latitude (9.25km). The astronomical boundary conditions consist of 11 tidal components. ZUNO has a curvilinear grid with a resolution of 1-4km in the Belgian coastal zone. The models are linked with water level boundaries.

Passive tracers allow the identification of the water masses in front of the Belgian Coast. The water originates mainly from the Channel (+96.6%) with freshwater input from the Rhine/Meuse river system (+2.6%) and the Scheldt (+0.5%). This is in agreement with the residual transport in the North Sea and previous research of Lacroix (2004). A region of fresh water influence is formed in front of the Belgian and Dutch coast. This mass of brackish water can expand or shrink and move under the influence of the surrounding hydrodynamics and the varying input of fresh water. The model data is validated with a salinity dataset of 2009 (Meetnet Vlaamse Banken and HMCZ). The effect of wind events and river discharge is investigated in 4 simulations of the year 2009. Four different combinations of wind (HIRLAM/residual field) and discharge (static/dynamic) are applied in these simulations.

A period with a large discharge of fresh water results in a slow decrease of salinity in front of the Belgian coast whereas wind events have a much faster effect. Certain wind events can generate large jumps in salinity of several ppt in the Belgian coastal zone. These jumps are also observed in the measurement data. A wind event can move the entire brackish water mass or compress it much closer to the coast.

This study has contributed to the knowledge of the factors influencing the salinity distribution in the Belgian coastal zone. This knowledge is important to create adequate boundary conditions for the models of morphology, ecology and sediment transport in the Scheldt Estuary.

References

Lacroix G., K. Ruddick, J. Ozer and C. Lancelot. 2004. Modelling the impact of the Scheldt and Rhine/Meuse plumes on the salinity distribution in Belgian waters (southern North Sea). *J. Sea Res.* 52(3):149-163.

Leyssen G., J. Vanlede, B. Decrop and F. Mostaert. 2011a. Modellentrein CSM-ZUNO. Deelrapport2: Validatie. (in preparation).

Leyssen G., J. Vanlede and F. Mostaert. 2011b. Modellentrein CSM-ZUNO. Deelrapport1: Opzet en gevoeligheidsanalyse. WL2011R753_12rev2_0, I/RA/11313/11.087/GLE.

SIMONA. 2009. Waqua/Triwaq- two- and three dimensional shallow water flow model: technical documentation. Simona report 99-01.