How do salinity and SPM structure in the Lower Sea Scheldt influence the maintenance dredging volumes in Deurganckdock ?

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Introduction:
The construction of the Deurganckdok (DGD) tidal dock in the Lower Sea Scheldt has necessitated the Flemish Government to commission a series of field surveys to assess the hydrodynamic, suspended solids, salinity and temperature structure of reaches of the Lower Sea Scheldt in and around the DGD. Short-lived and long-term phenomena were measured intensively by a wide range of stationary and mobile surveys.
Mobile survey techniques were applied - intensively and repeatedly using a range of instruments - to measure through-tide variations in suspended solids and temperature, salinity and hydrodynamics. In addition the sedimentation pattern in the dock was assessed during 2 years in order to analyse the seasonal fluctuations and the relationship with the fresh water input in the Scheldt estuary from the tributaries.
This record will be considered by the authorities as the basis to compare the sedimentation in the future situation after the construction of a "tidal" current deflecting wall.

Methodology & Approaches:
Following measurements (2 years) have been carried out during the course of the project: Monitoring salinity and sediment concentration in the Lower Sea Scheldt; long term measurement of salinity distribution and sediment concentration in DGD; monitoring near-bed processes in the central trench in the dock, near the entrance as well as near the landward end: near-bed turbidity, near-bed current velocity and bed elevation variations are measured from a fixed frame placed on the dock's bed; measurement of current, salinity and sediment transport at the entrance of DGD (ADCP, Sediview, SiltProfiler) ; through tide measurements of vertical sediment concentration profiles - including near bed highly concentrated suspensions- with the SiltProfiler equipment, near the entrance of DGD; monitoring dredging activities at entrance channels towards the Kallo, Zandvliet and Berendrecht locks and monitoring dredging and dumping activities in the Lower Sea Scheldt.

The first part of the study aims at determining a sediment balance of DGD and the net influx of sediment. The sediment balance comprises a number of sediment transport modes: deposition, influx from capital dredging works, internal replacement and removal of sediments due to maintenance dredging.

A net deposition can be calculated from a comparison with a chosen initial condition. The mass of deposited sediment is determined from the integration of bed density profiles recorded at grid points covering the dock.

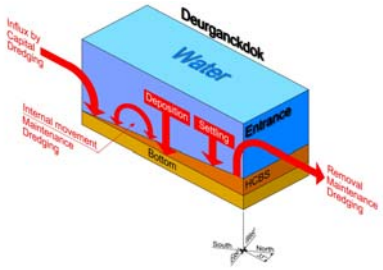

Fig. 1 Elements of the sediment balance

The main purpose of the second part of the study is to gain insight in the mechanisms causing siltation in Deurganckdok. The following mechanisms will be aimed at in this part of the study:

- Tidal prism, i.e. the extra volume in a water body due to high tide;
- Eddy circulation due to passing tidal current;
- Density currents due to salinity gradient between the Scheldt river and the dock;
- Density currents due to highly concentrated benthic suspensions.

Results & Discussion:
The paper will describe the results of the main measurement campaigns. It will highlight the sedimentation pattern in the DGD as well as the seasonal variability of the sedimentation pattern. The estimated long term sedimentation rate from an analytical model are compared to detailed 3D numerical model results of the anticipated mud deposition and finally the model results are compared to the measured siltation rate in the dock and the overall maintenance dredging volumes.