2D Hydrodynamic Modelling of a Tidal Inlet using TELEMAC
Case Study of *'De IJzermonding'*

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Introduction

The Flemish Government (AMINAL) is working at the restoration of an important coastal wetland in the IJzer estuary at Nieuwpoort: *'De IJzermonding'* natural reserve. The study of the hydrodynamic processes is an important component of this project, being as well the principal objective of the present thesis work.

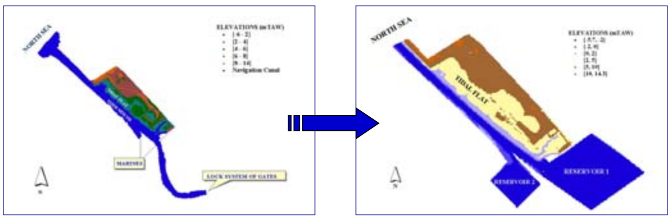
Objective

Model the hydrodynamics of the IJzer estuary at 'De IJzermonding' reserve, applying TELEMAC-2D, a two dimensional numerical modelling system and using ADCP measurements from a field campaign in 2003 to validate the model results.

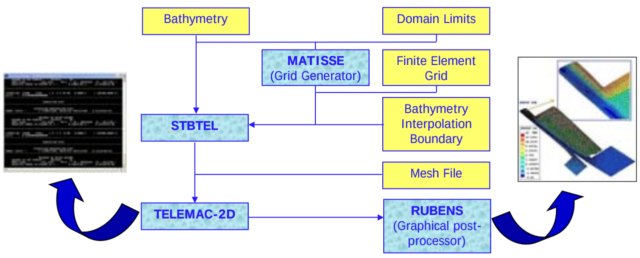
Methods

At first, a number of theoretical cases for different canal geometry and idealised tidal sign imposed at the canal mouth have been implemented to become familiar with the modelling software and to calibrate the model parameters.

The modelling area of 'De Ijzermonding' has been simplified, replacing the upper part of the canal (the canal area up to the lock system of gates, including two marines) by two reservoirs containing the same water volume; closing in this way the fresh water input to the system and modelling it as a tidal inlet.

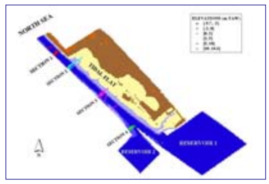


MATISSE, the TELEMAC finite element grid generator, was used for the mesh building. The Bathymetry and DEM data files were input to generate the mesh and to set the boundary sides of the model area.



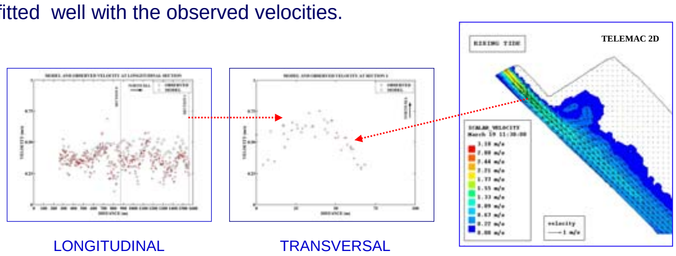
TELEMAC 2D runs in a DOS environment, in function of the Steering file settings (initial, boundary and numerical options). The geometry, boundary and liquid boundary (Water Level) files are defined inside the Steering file to be read by TELEMAC 2D. The model results are processed in RUBENS, the postprocessor, to compare them with observed velocities and calibrate the model.

The observed velocities for model comparison were measured in a field campaign on march 19th, 2003, during Spring tide, covering the ebb and part of the rising phase (transversal and longitudinal sections).



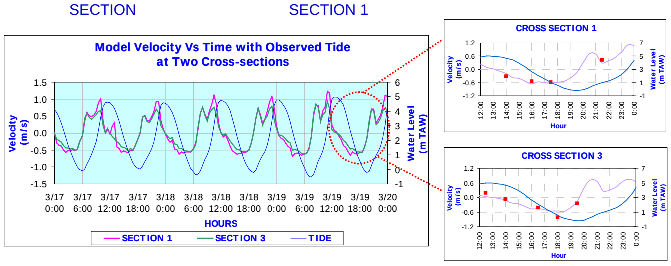
Results

The hydrodynamic numerical model results showed a good performance with the observed velocities. The spatial distribution of the velocity represented successfully eddies on the right bank. Flooding and drying events on the tidal flats were well represented. The model velocity, magnitude and direction, fitted well with the observed velocities.



LONGITUDINAL SECTION

TRANSVERSAL SECTION 1



Discussion

The magnitude and directions of model velocities at the navigation canal fit well with observed values during the Ebb tidal phase. The natural pattern of velocities influenced by tides when the change in tidal phase occurs is well followed by the model results, as well as the parabolic velocity distribution along the cross section. The deviation of the model results from reality may arise from uncertainty in measurements (observed water levels imposed at the canal mouth) and parameter estimation (Chezy's and viscosity coefficient mainly).

Limited amount of data during rising tide do not allow complete analysis of the model performance. The double peaks of velocity during the rising tide might be due to combined effect of tidal flat topography and imposed water level at spring tide.

"Modeling is an effective tool for management if is used being awarded of its limitations"

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