

Modelling of the historical and current hydrodynamics of the Scheldt estuary

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The Scheldt estuary, the part of the Scheldt river subject to tides, ranges from the mouth up to the city of Ghent, over a length of 180 km. Numerous human interventions have been performed in the Scheldt estuary over the last century, ranging from impolderings, deepening of the fairway to harbor extensions. This, together with external forcings as sea-level-rise, resulted in a change of the horizontal (velocities, fluxes) and vertical (water levels) tide in the estuary over the last century.

The water levels have been measured at several measurement locations since the end of the 19th century. Although long recordings exist of the water levels, almost no historical information is available of the horizontal tide or water velocities. Therefore, it is not clear in what extent the change of water levels has influenced the currents.

Both for the year 2009, the current situation including all human modifications to the estuary, and for 1954, a reference year before the main deepening works and harbor extensions, a hydrodynamic model is set up using the SIMONA software. The model grid ranges from the North Sea to the most upstream parts of the Scheldt estuary, including the main side rivers. Both for 1954 and 2009, a bathymetry is interpolated onto the grid based on depth soundings. The model is calibrated in previous work (Vanlede *et al.*, 2015). Roughness calibration was accounted for by specifying regions with different values of Manning coefficient across the domain. The model is validated for both situations and compared with water level measurements, to assess the model accuracy. Comparing the results of both models gives more insight in the major changes in the horizontal and vertical tide, the amplitude and phase of the important harmonic components and the residual fluxes due to morphological changes in the estuary.