FINEL3D

THREE-DIMENSIONAL NON-HYDROSTATIC FLOW MODEL

FINEL3D is a fully three-dimensional, parallel, non-hydrostatic flow solver based on the Finite Element Method (FEM), suitable for the computation of (shallow) water flow and transport processes in rivers and coastal waters. FINEL3D is based on the complete Navier-Stokes equations; no assumptions are made with respect to the vertical pressure distribution, hence the model is especially suited to compute flows with significant 3D effects.

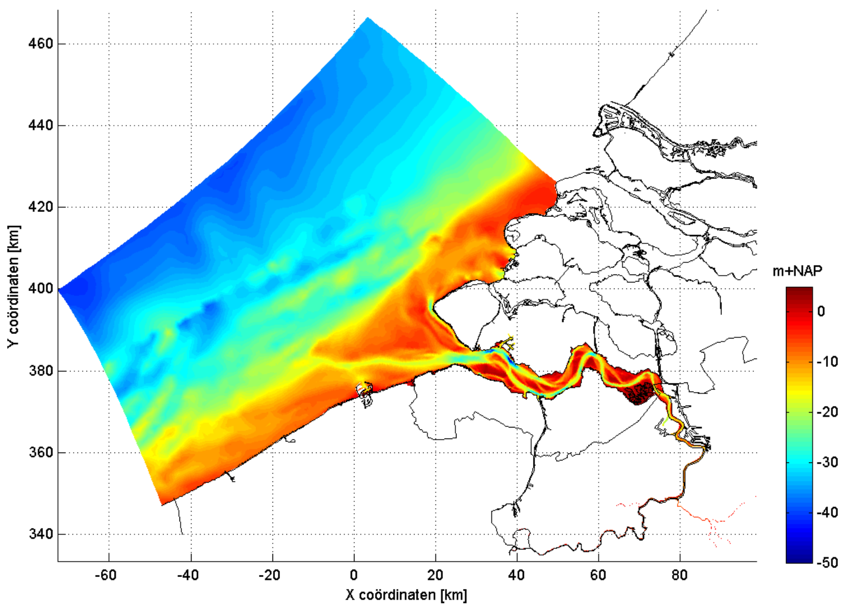
The scientific basis of FINEL3D is given by research work by Labeur (2009) and Labeur & Wells (2012), who have developed a 3D Navier-Stokes solver based on the novel Galerkin Interface Stabilization (GIS) approach within the Finite Element Method. The GIS approach is an advantageous combination of Continuous and Discontinuous Galerkin techniques. FINEL3D is an implementation which applies the scientific concepts by Labeur (2009) and Labeur & Wells (2012), but as the model has been developed in-house Svašek Hydraulics is fully responsible for the quality of the model.

FINEL3D uses computational grids generated by various mesh generators. It is possible to use the same grid as for the 2-dimensional shallow water flow model FINEL2D. This 2D grid can be extended in vertical direction with an arbitrary number of vertical grid points per vertex. This procedure makes the schematisation process flexible and efficient as special features of the area of interest can be easily incorporated in the model.

FINEL3D is also able to compute density currents resulting from cold-warm and salt-fresh interactions, and the combination of both.

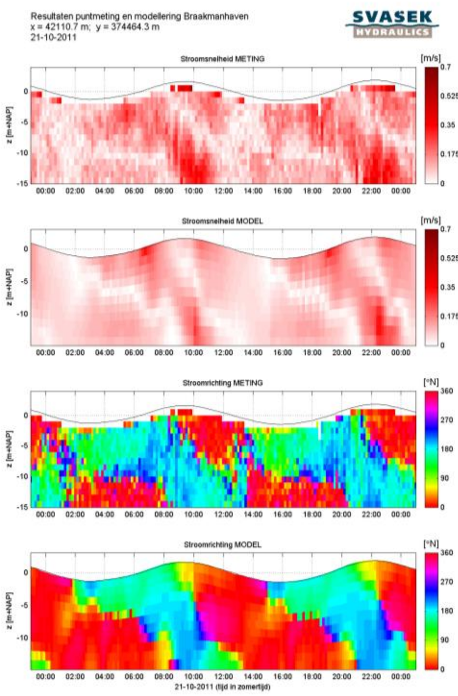
Labeur, R.J., Wells, G.N. (2012). *Energy stable and momentum conservative interface stabilised Finite Element Method for the incompressible Navier-Stokes equations*. SIAM Journal on Scientific Computing, 34(2), A889-A913

Labeur, R.J. (2009). *Finite element modelling of transport and non-hydrostatic flow in environmental fluid mechanics*. Ph.D. Thesis, Delft University of Technology, Delft



MAIN FEATURES

- 3D flow and transport processes in rivers and coastal waters
- Free-surface flow or rigid-lid flow
- Moving mesh in vertical direction
- Density currents
- Wind stress and air pressure
- Coriolis effect
- Bottom friction parameterizations
- Vertical/horizontal turbulence models
- Transport of passive and active scalars (salinity, temperature, silt)
- Drying/wetting algorithm
- Second-order accurate in space and time
- Parallelisation with Message Passing Interface (MPI) library, using automatic domain decomposition



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