

SELFE Cross-Scale Modeling System: new developments and applications

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SELFE is an open-source community-supported modeling system, based on unstructured grids, designed for the effective simulation of 3D baroclinic flows across river-to-ocean scales. It uses a semi-implicit finite-element Eulerian-Lagrangian algorithm to solve the Navier-Stokes equations (in either hydrostatic or non-hydrostatic form), written in MPI FORTRAN90 to realistically address a wide range of physical processes and of atmospheric, ocean and river forcings. The combination of unstructured triangular grids, implicit time stepping and an Eulerian-Lagrangian Method in SELFE leads to flexibility, accuracy, efficiency and robustness.

Here we present new developments of the SELFE modeling system in the areas of tsunamis, internal waves, global circulation, wave-current interaction, and oil spill. Many of these new modules that are fully coupled into SELFE are developed by the user community. Some application cases will be presented to showcase the impressive quantitative skills and cross-scale nature of the SELFE modeling system, from minutes to decade, and from meters to hundreds of kilometers.