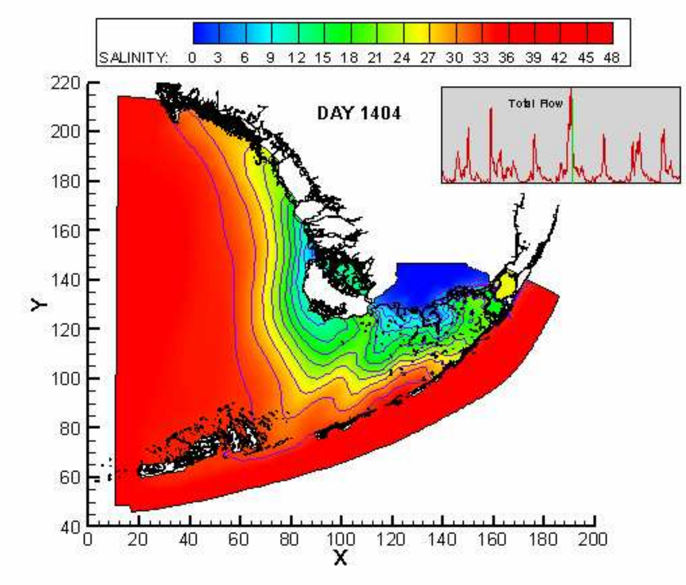
ENVIRONMENTAL FLUID DYNAMICS CODE (EFDC)

Background: EFDC is a multifunctional surface water modeling system, which includes hydrodynamic, sediment-contaminant, and eutrophication components. The public domain EFDC model was originally developed at the Virginia Institute of Marine Science and is currently maintained by Tetra Tech, Inc. with support from the US EPA. EFDC has been used for more than 80 modeling studies of rivers, lakes, estuaries, coastal regions and wetlands in the US and abroad.

Spatial Resolution: The EFDC model is capable of 1, 2, and 3D spatial resolution. The model employees a curvilinear-orthogonal horizontal grid and a sigma terrain following vertical grid. For 1-D applications, an optional HEC type cross section description can be used. Two horizontal grid generation and preprocessing tools, GEFDC (GridEFDC) and VOGG (Visual Orthogonal Grid Generator) are available.

Hydrodynamic Capabilities: The EFDC model's hydrodynamic component employees a semi-implicit, conservative finite volume solution scheme for the hydrostatic primitive equations with either two or three level time stepping. Salinity and temperature transport are dynamically coupled which a choice of high accuracy advection schemes including MPDATA and COSMIC. Additional hydrodynamic component features include, simulation of drying and wetting, representation of hydraulic control structures, vegetation resistance, wave-current boundary layers and wave induced currents. An embedded single port buoyant jet module is included for coupled near and far field mixing analysis.



Florida Bay EFDC application

Sediment Transport Capabilities: The EFDC model allows the simulation of multiple size classes of cohesive and noncohesive sediment. A sediment processes function library allows the model user to choose from a wide range of currently accepted parameterizations for settling, deposition, resuspension and bed load transport. The sediment bed is represented by multiple layers and includes a number of armoring representations for noncohesive sediment and a finite strain consolidation formulation for dynamic prediction of bed layer thickness, void ratio and pore water advection. The sediment transport component can operate in a morphological mode with full coupling with the hydrodynamic component to represent dynamic evolution of bed topography.

***Contaminant Transport Capabilities*:** The EFDC model can represent the transport and fate of an arbitrary number of contaminants, including metals and hydrophobic organics, sorbed to any of the sediment classes and dissolved and particulate organic carbon using a three-phase equilibrium partitioning formulation. Dissolved and particulate organic carbon can be represented as independent state variables or POC can be fractionally assigned to any of the sediment classes. A contaminant processes function library allows the representation of various degradation and transformation processes.

***Eutrophication Capabilites*:** The EFDC model includes a variable configuration eutrophication component for simulation of aquatic carbon, nitrogen and phosphorous cycles. The full configuration of state variables is based on the CE-QUAL-ICM model including sediment diagenesis. The configuration can be readily reduced to WASP equivalent configurations. In addition to the internal eutrophication model, EFDC can create hydrodynamic transport files formatted for WASP and CE-QUAL-ICM.

***Model Validation*:** The EFDC model has been validated using analytical solutions, simulations of laboratory experiments and verified prototype applications. An extensive bibliography of referred journal and conference proceedings articles exist.

Auxiliary Tools: In addition to the grid generation tools, a windows based model interface, EFDCView, incorporating grid generation, pre-processing and post-processing tools is available. A number of currently available post-processing tools support various graphics packages such as IDL, TECPLOT and MATLAB.