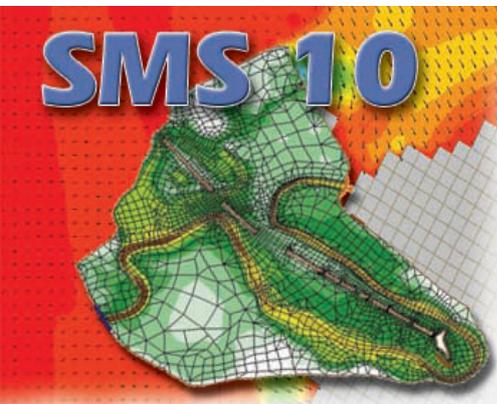


SMS 10.0



Overview

The SMS 10.0 is now available! We are optimistic that the new features and enhancements will make SMS more productive than ever!

The Surface Water Modeling System (SMS) is a comprehensive environment for one-, two-, and three-dimensional hydrodynamic modeling. A pre- and post-processor for surface water modeling and design, SMS includes 2D finite element, 2D finite difference, 3D finite element modeling tools. Supported models include RMA2, RMA4, ADCIRC, CGWAVE, STWAVE, BOUSS2D, CMS Flow &Wave, and GENESIS, models. A comprehensive interface has also been developed for facilitating the use of the FHWA commissioned analysis package FESWMS. The TUFLOW numerical model with powerful flood analysis, wave analysis, and hurricane analysis is now supported. SMS also includes a generic model interface, which can be used to support models which have not been officially incorporated into the system.

The numeric models supported in SMS compute a variety of information applicable to surface water modeling. Primary applications of the models include calculation of water surface elevations and flow velocities for shallow water flow problems, for both steady-state or dynamic conditions. Additional applications include the modeling of contaminant migration, salinity intrusion, sediment transport (scour and deposition), wave energy dispersion, wave properties (directions, magnitudes and amplitudes) and others.

New enhancements and developments continue at the Environmental Modeling Research Laboratory (EMRL) at Brigham Young University in cooperation with the U.S. Army Corps of Engineers Waterways Experiment Station (USACE-WES), and the US Federal Highway Administration (FHWA).

SMS 10.0

Automated Mesh / Grid Generation

SMS can be used to construct 2D and 3D finite element meshes and finite difference grids of rivers, estuaries, bays, or wetland areas. The tools include a sophisticated set of creation and editing tools to handle complex modeling situations with relative ease. Several methods of finite element mesh creation are available, allowing you to create any combination of rectangular and triangular elements needed to represent your model domain. Both cartesian and boundary-fitted grid creation tools are available to allow representation of a model domain for finite difference models. The powerful mesh/grid creation tools, coupled with GIS objects, are what makes SMS such an easy-to-use and accurate modeling system!

There are two main methods for building models in SMS, the direct approach and the conceptual modeling approach. With the direct approach, the first step is to create a mesh or grid. The model parameters, source/sink data, and boundary conditions are assigned directly to the nodestrings, nodes, and elements of the mesh. This approach is only suited for very simple models.

The most efficient approach for building realistic, complex models is the conceptual model approach. With this approach, a conceptual model is created using GIS objects, including points, arcs, and polygons. The conceptual model is constructed independently of a mesh or grid. It is a high-level description of the site including geometric features such as channels and banks, the boundary of the domain to be modeled, flow rates and water surface elevations of boundary conditions, and material zones with material properties such as Manning's n value. Once the conceptual model is complete, a mesh or grid network is automatically constructed to fit the conceptual model, and the model data are converted from the conceptual model to the elements and nodes of the mesh network.



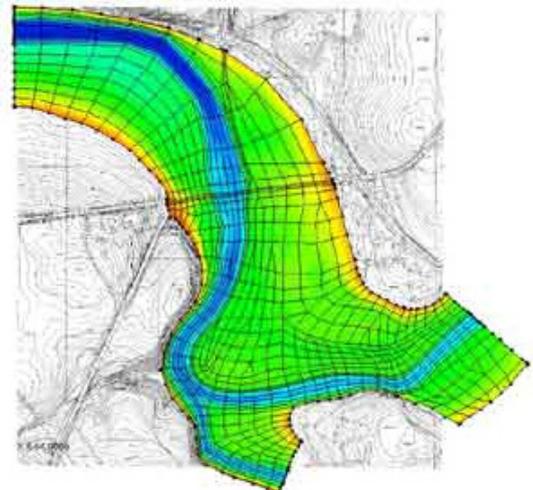
Automated Mesh Generation

SMS 10.0

GIS Tools

SMS will allow you to take advantage of all types of GIS data available for hydraulic modeling. The Map module of SMS includes a complete set of tools for importing, creating, and manipulating GIS vector and raster data. ArcGIS/ArcView is not a required component of the SMS software! You will find that SMS can work with your GIS data effectively with or without ArcGIS. A few of the powerful tools in SMS include:

- ◆ Robust algorithms have been developed to allow you to handle large data sets (such as bathymetry data collected by LIDAR survey) with speed and accuracy.
- ◆ Images (TIFF, JPEG) can be geo-referenced, joined, and clipped.
- ◆ Use TIFF or JPEG images to guide on-screen digitizing and to enhance presentation.
- ◆ Boundary conditions and material properties from data layers can be assigned to your model using GIS overlay operations.
- ◆ Coordinate System Conversions – Convert data between geographic and planar coordinate systems.
- ◆ Control mesh/grid density and type by assigning properties to simple GIS objects. Create observation points/cross sections for review and calibration of your model output.



Model Coupling / Steering

Many of the tasks performed as part of a numerical simulation are repetitious and time consuming. The main objectives of the Steering Module are to:

- ◆ Simplify data sharing between models
- ◆ Monitor model runs
- ◆ Save time by automating repetitive user tasks
- ◆ Achieve more accurate results from models

SMS 10.0

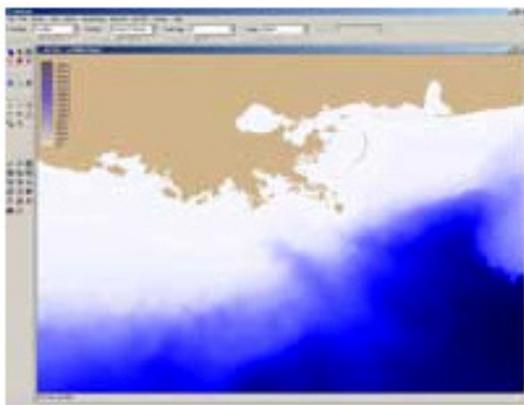
The tasks the steering module performs can be classified in two main groups. These include single model control, and multiple model coupling. The control channels currently available in the Steering Module are:

- ◆ RMA2 Spin Down
- ◆ FESWMS Spin Down
- ◆ ADCIRC \leftrightarrow STWAVE Interaction
- ◆ M2D \leftrightarrow STWAVE Interaction
- ◆ RMA2 \leftrightarrow SED2D Interaction

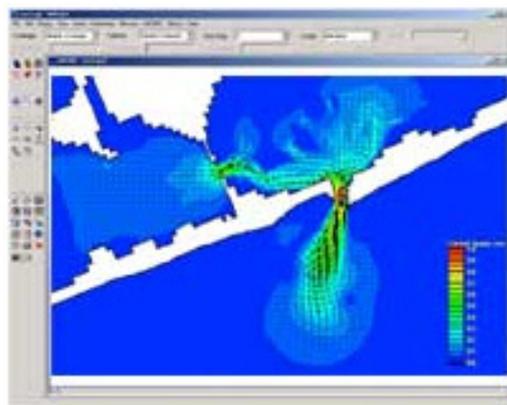
Coastal Circulation / Wave Modeling

SMS supports coastal circulation modeling with advanced finite-element and finite-difference models. You can choose which is better for your needs:

- ◆ ADCIRC – ADCIRC (ADvanced CIRCulation Multi-dimensional Hydrodynamic Model) is a latest-generation multidimensional model based on the solution of the generalized wave equation formulation of the governing equations on a highly flexible unstructured grid.
- ◆ M2D – The hydrodynamic circulation model M2D is a two-dimensional, finite-difference numerical approximation of the depth-integrated continuity and momentum equations.
- ◆ TUFLOW – TUFLOW is a computational engine that provides two-dimensional (2D) and one-dimensional(1D) solutions of the free-surface flow equations to simulate flood and tidal wave propagation.



ADCIRC Model



M2D Model

SMS 10.0

Wave modeling is also supported by SMS. Once again, finite-difference or finite-element models are available. These models can analyze wave action to predict wave height and velocity:

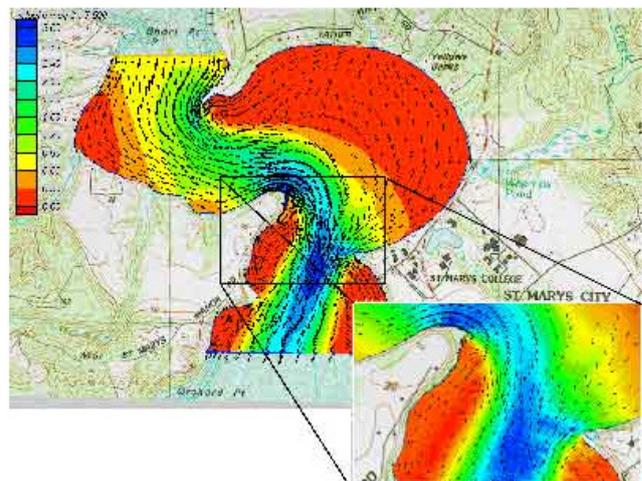
- ◆ STWAVE – STWAVE (STeady State Irregular WAVE Model) is a model that is computationally efficient steady state spectral wave energy propagation model.
- ◆ CGWAVE – CGWAVE models harbor response taking into account outside sea state, harbor shape and man-made structures (i.e., piers, breakwaters, naval vessels). It is a forecasting and nowcasting tool used in coastal and military planning and civil engineering.
- ◆ BOUSS2D – BOUSS-2D is a comprehensive numerical model for simulating the propagation and transformation of waves in coastal regions and harbors based on a time-domain solution of Boussinesq-type equations.
- ◆ WABED – Wave-Action Balance Equation with Diffraction model. The WABED model is a nearshore wave transformation model capable of representing wave diffraction and reflection.

Interaction between waves and currents can be modeled using the Steering Module described above to couple a wave model with a circulation model. The most popular combination is ADCIRC – STWAVE coupling. This allows you to run the models together and find out how waves are affecting circulation!

River Modeling

River hydrodynamics can be modeled with SMS using one of several 2D models, including FESWMS, RMA2, HIVE2D. The TUFLOW model engine is capable of representing a river system as 1D and 2D domains within SMS too!

River models will allow you predict water depth and velocity in complex waterways including bays, estuaries, and river reaches. Natural and man-made conditions can be simulated in unprecedented detail using the SMS pre and post processing tools



SMS 10.0

Water Quality / Sediment Transport Modeling

In addition to hydrodynamics, you will often need to analyze pollutant and/or sediment transport in your waterway system. There are 2 models supported in SMS that couple with RMA2 to add the capability you will need:

- ◆ SED2D – A sediment transport numerical model that has the ability to compute sediment loadings and bed elevation changes when supplied with a hydrodynamic solution computed by RMA2.
- ◆ RMA4 – A constituent migration modeling code that has the ability to compute constituent concentrations and dispersion when supplied with a hydrodynamic solution computed by RMA2.

