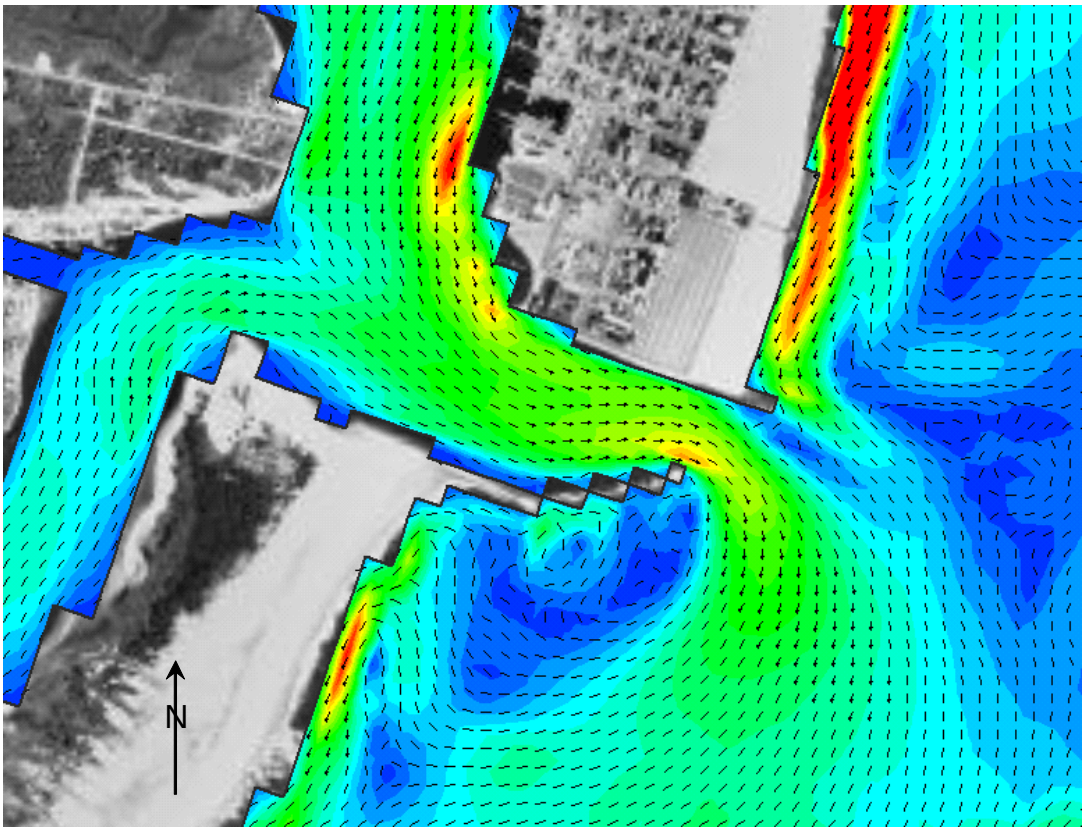
US Army Corps of Engineers®
Engineer Research and Development Center

Coastal Modeling System (CMS)



Coastal Modeling System application at Ocean City Inlet, Maryland

Description of Research

The Coastal Modeling System (CMS), a research area of the Coastal Inlets Research Program (CIRP) at ERDC's Coastal and Hydraulics Laboratory, is a coordinated system of major multidimensional numerical models integrated to simulate waves, currents, water level, sediment transport, and morphology change in the coastal zone. Emphasis is on navigation channel performance and sediment exchanges between the inlet and adjacent beaches and estuaries. The CMS is verified with field and laboratory data and provided within a user-friendly interface running in the Surface-Water Modeling System (SMS).

Problem

Navigation projects involving coastal inlets are designed, operated, and maintained through complex morphologic features. The morphology evolves over time ranging from short-term, as in response to storms, to slow, gradual change caused by waves, currents, and changes in sea level. Because the hydrodynamics, inlet morphology, navigation channel, and longshore sediment transport are connected, navigation project maintenance and natural processes must be estimated to minimize channel dredging and to promote sediment bypassing, either by natural processes or through dredging-related activities. To meet the challenges of channel deepening nationwide and creation of new channels, quantitative predictive models must be available that can calculate navigation channel and

morphology change and connect the processes to the channels, jetties, and adjacent beaches for evaluation of alternatives in a sediment-sharing system.

Expected Products

The CIRP has developed and continues to refine a suite of models that constitute the CMS for calculating hydrodynamics, sediment transport, morphology change, salinity, and temperature at inlets. The typical time frames considered run from several tidal cycles through a series of storms, to several years. The CMS has options for two- and three-dimensional modes as well as explicit and implicit solution schemes for optimization of computational speed and accuracy. Additional features of the CMS include efficient calculation structure, morphologic constraints, and estuarine vegetation constraints. The technology is available for field use through the Surface-Water Modeling System (SMS) interface and annual training workshops.

Potential Users

The CMS through CIRP is producing information and tools to support the U.S. Army Corps of Engineers, private industry, and academia in addressing engineering and science problems at coastal inlets nationwide.

Projected Benefits

Potential benefits and design capability stemming from this work unit include the following:

- Capability and guidance for modeling circulation and water level in and around inlets and associated navigation channels and jetties
- Tools for analysis of natural and anthropogenic modifications to inlets structures, channels, shoals, and beaches and estuary adjacent to inlets
- Realistic representation of a wide range of physical processes encountered in the Corps of Engineers projects, such as tide, wind stress, wave stress, river inflow, advection, flooding and drying, and storm surge
- Capability of integrating the calculation of waves, currents, and sediment transport for inlets, entrances, and navigation channels within a convenient (SMS) interface
- Capability of high-resolution calculations
- CMS and its component models are flexible and applicable to navigation, operation and maintenance, and other coastal engineering problems at inlets
- Example applications include developing the most efficient channel, optimizing channel reliability, optimizing advance dredging practice, prediction and reduction of channel shoaling, determining the best location for dredged-material placement, and objectively evaluating the alternatives for jetty modifications. The CMS has been tested or applied at Shinnecock Inlet, NY; Ocean City, MD; Grays Harbor, WA; Mouth of the Columbia River, OR/WA; Willapa Bay, WA; Humboldt Bay, CA; Ponce de Leon Inlet, FL; Matagorda Ship Channel, TX; Mouth of the Colorado River, TX; and Packery Channel, TX;

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Participating ERDC Laboratories

Coastal and Hydraulics Laboratory (CHL)