US Army Corps of Engineers®
Engineer Research and Development Center

Improved Numerical Modeling of Vessel Hydrodynamics and Sedimentation Effects on Waterways

Description

The Corps is charged with assessing environmental quality on its navigation projects. Moving vessels create currents, drawdown, and potentially bed scour that may need to be quantified and mitigated.

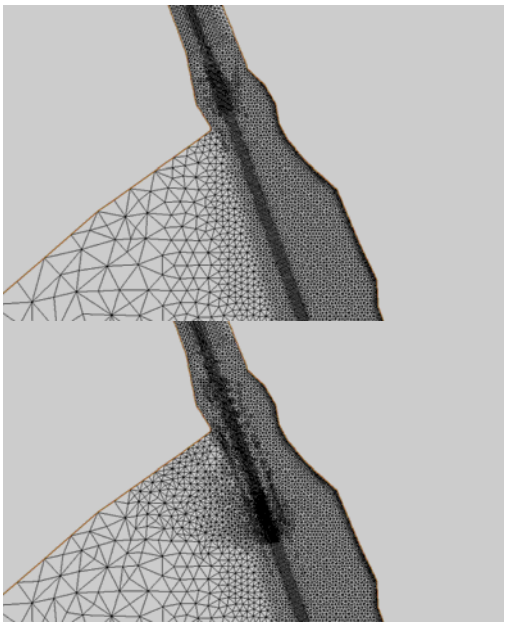
Issue

Corps investigators presently calculate the effects of a vessel sailing through a waterway using a numerical program, HIVEL2D. However, this model is computationally limited due to longer setup and computing times than are now necessary. Also, the numerical program does not directly include sedimentation effects. This work will move the concept of a moving pressure field, currently in HIVEL2D, into the modern ADH (Adaptive Hydraulic) program. The sediment entrainment due to the return currents and drawdown as well as the vessel propeller will be incorporated.

Users

Researchers and district engineers will use this software for various navigation studies.

Products



In previous work on this project, the Coastal and Hydraulics Laboratory developed a vessel movement library that can track several vessels within a numerical water body. This library can be used with many other shallow water models. This vessel library has been combined with the ADaptive Hydraulics shallow water model, thus allowing accurate grids to be automatically produced as vessels move along a waterway. Since the ADH code refines the mesh near the vessel (and unrefines when the vessel effects have passed) the setup time for the user is minimal. The figure shows two views of the same area as a vessel moves into a bay from a confined channel. The top graphic contains the grid while the vessel is above the bay while the second shows the grid as the vessel enters the bay. The mesh has automatically refined where necessary, to accurately capture the hydrodynamics associated with the vessel. Entrainment regions around the vessel and the propeller are delineated in the vessel library. These entrainment conditions then feed the sediment calculations within ADH to predict scour and deposition effects from the vessel.

Benefits

This work will make the vessel movement algorithm available to all shallow water models. It will cut the cost and time of studies for the impact of vessels in confined waterways.

Corps Program

Navigation Systems Research Program, Mr. James Clausner, Program Manger.

Point of Contact Dr. Richard Stockstill, US Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180; (601) 634-4251, email (Richard.L.Stockstill@usace.army.mil), or Mr. James Clausner, (601) 634-2009, email (James.E.Clausner@usace.army.mil).

Partners Coastal & Hydraulics Laboratory