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Engineer Research and
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Research Brief: Multidimensional Sediment Processes Models – Channels and Structures

Issue Department of Defense's *ADaptive Hydraulics* (ADH) framework is a computer code system that allows hydraulic/sediment experts to concentrate on hydraulics/sedimentation without being expert numerical analysts. The users develop a mesh and boundary conditions that represent the problem, and the code adapts the mesh and the time-step to adequately capture the physics. ADH was designed to run quickly and efficiently across many platforms. This trait makes the program one of the few tools available to address regional problems. Currently, no tools are available for simulating noncohesive and cohesive sediment transport algorithms on ADH.

Objective RSM research will produce a state-of-the-art modeling capability to:

- " Perform hydrodynamic and sediment long-term (from several months to 10, 20, 30 years) simulations of rivers, estuaries, reservoirs, and the littoral zone.
- " Perform flow and sedimentation simulations near and in hydraulic structures (dikes, groins, locks, etc.).

This tool will use state-of-the-art processes, which can then be improved by process-based research in the RSM program.

Research/Design The work will be accomplished as follows:

- " Noncohesive sediment transport, including bed load and suspended load, will be produced and added to a sediment module in ADH available for use in the Navier Stokes solver for simulations in and around hydraulic structures as well as the shallow water solver for channels, rivers, estuaries, lakes, and coastal environments under other than RSM research.
- " Under RSM research, cohesive sediment transport algorithms will be produced, including the transport, erosion, deposition, and bed building of cohesive sediments. Testing of the completed sediment transport algorithms (cohesive and noncohesive) and documentation of the results and the user's manual will be produced, benefiting both research areas.
- " Density coupling with hydrodynamics will be implemented in such a way that any number of constituents' effects on the currents can be included. Among routed constituents might be salinity, temperature, sediment concentrations, and others. Thus, ADH may address estuarine environments, lakes, or hyper-concentrated sediment plumes.
- " The interaction and decay of constituents will be invoked through an interaction matrix. Implementation will be through split-operator methods. The RSM proposal includes using a large interaction matrix, and also the testing of the final product, allowing settling and flocculation processes.

Application This work will allow evaluation of flow and sedimentation in channels, rivers, estuaries, and reservoirs as well as in and around hydraulic structures. The shallow water hydrostatic module will be capable of simulations over many years. The nonhydrostatic Navier Stokes module will be capable of addressing months of simulation. This tool will be available quickly and is a tool that can readily incorporate improvements developed via RSM.

Products Links and information will be posted here. View online at <http://rsm.usace.army.mil>.

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