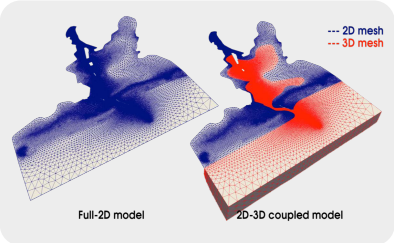
US Army Corps of Engineers
Engineer Research and Development Center

Adaptive Hydraulics Development

Need



High fidelity shallow water, overland flow, ground water and transport models are the cornerstone of environmental quality and storm surge simulation. The Adaptive Hydraulic (AdH) suite was designed as a USACE comprehensive environmental modeling solution for solving the physics necessary in each these regimes.

Current research & development is motivated by increasing the USACE's simulation capabilities in the following areas:

- Hydrodynamic, sediment and salinity impacts of extreme events, hydraulic structure, dredging, etc. on coastal, riverine and estaurine 2D/3D environments
- Hydrologic Impacts of anthropogenic activities, sea-level rise, etc. in coastal groundwater systems
- Ecosystem hydrodynamic and salinity impacts through increasing human development, invasive species, loss of habitat, pollution
- Landslide/subsidence/crust movement generated tidal/reservoir/inland waves

R&D is conducted to apply the most optimal computational tools to advance decision-support technologies to identify risks, potential impacts, and resulting watershed benefits as a function of project-level actions.

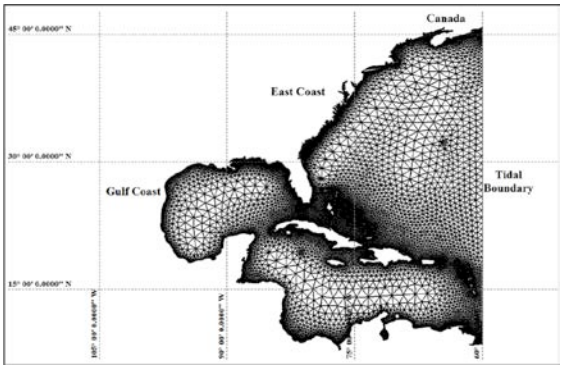
Approach

AdH R&D supports reducing flood & storm risks, increasing project and regional resiliency, developing sustainable infrastructure, all enabled through high fidelity and efficient multi-dimensional numerical simulation. Research supports applications on watershed scales (coastal, estuarine, and riverine), evaluating geotechnical and structural implications, with consideration of environmental processes as well as economic implications. Current development extends the usability and accuracy of the AdH engine via (1) implementation of new grid generation capabilities with new finite elements, (2) internal model coupling options for large-scale multi-physics applications and (3) introducing efficient multi-layer 2D shallow water capabilities for sharply stratified ocean and reservoir simulations.

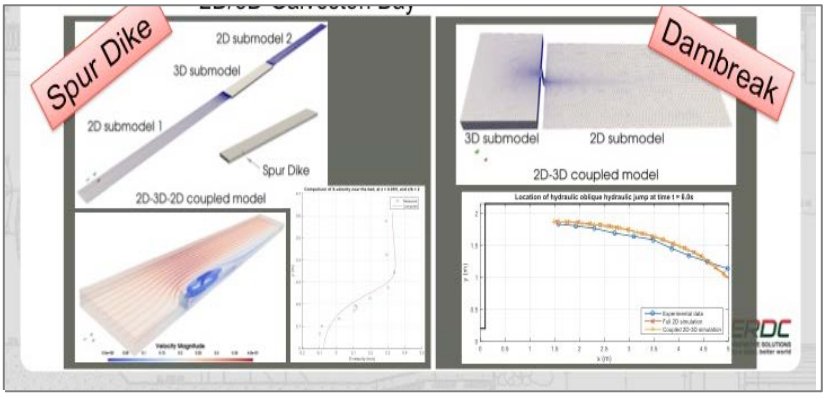
Outcomes

This research and development will provide all AdH users with an updated suite which includes extended inter-suite coupling capabilities for large, complex multi-physics applications, multi-layer 2D shallow water modeling for highly stratified oceans, estuaries and reservoirs and more element and mixed-element options to facilitate grid generation and more accurate simulations.

New research needs are continually submitted by USACE AdH Communities of Practice to focus future research investigations and products. Statements of Need can be submitted by USACE on the R&D Gateway (https://gateway.erdc.dren.mil/son/index.cfm?Cop=Flood&Option=Start).



R&D has advanced AdH to include spherical Coordinate options.



AdH now supports 2D/3D-coupled domains. Shown here are spur dike and dam break multi-physics domains an results.

More Information

POC:
Corey Jason Trahan, Ph.D., 512-518-3662, Corey.J.Trahan@erdc.dren.mil
Gaurav Savant, Ph.D., 601-634-3213, Gaurav.Savant@erdc.dren.mil

For more information on Adaptive Hydraulics R&D, see the ERDC FRM wiki:
https://wiki.erdc.dren.mil/Adaptive_Hydraulics_(AdH)