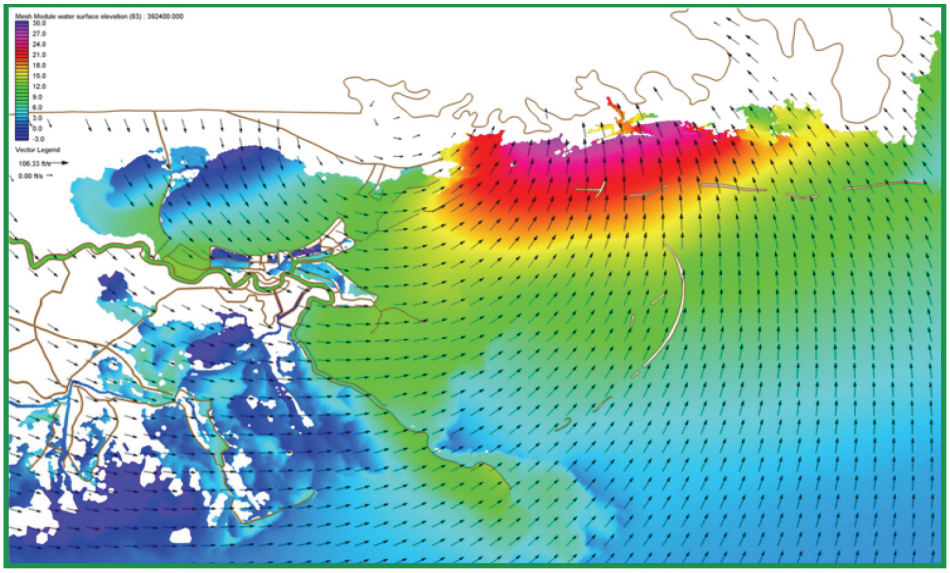
System-Wide Water Resources Program
SWWRP

Advanced Circulation Model (ADCIRC)

Description: The Advanced Circulation Model (ADCIRC) is a hydrodynamic circulation numerical model that simulates water level and current over an unstructured gridded domain. Run as a two-dimensional or three-dimensional (2-D or 3-D) model, ADCIRC is used for modeling tidally driven and wind and wave driven circulation in coastal waters; forecasting hurricane storm surge and flooding; and for modeling inlet sediment transport/morphology change studies, and dredging/material disposal studies.

Applications: ADCIRC applications have included: modeling tides and wind driven circulation; analysis of hurricane storm surge and flooding; dredging feasibility and material disposal studies; larval transport studies; and nearshore marine operations. ADCIRC has been certified by FEMA for use in performing storm surge analyses. In addition to USACE projects, it is used by Laboratorio Nacional de Engenharia Civil (LNEC), the National Oceanic and Atmospheric Administration (NOAA), and the Naval Research Laboratory (NRL). Currently, ADCIRC is being applied under the Interagency Performance Evaluation Task Force (IPET) study to evaluate the wave and water level impacts on the levees and floodwalls in southeastern Louisiana and Lake Pontchartrain. This study requires efficient, high-resolution surge modeling of complex geometries/bathymetries over extensive areas. ADCIRC is linked to STWAVE to calculate wave-induced setup, in addition to the wind-induced setup. It is also being applied for 16 hypothetical hurricanes for the entire coasts of Louisiana, Mississippi, and Alabama to provide preliminary design input to improve the level of hurricane protection in these areas. In the next phase, ADCIRC will also be used to evaluate ecosystem restoration alternatives in southern Louisiana.



Water surface elevation with respect to the NGVD 29 (ft) with boundary layer adjusted wind velocity vectors (knots) during Hurricane Katrina on August 29, 2005 at 1600UTC (IPET Report 2)

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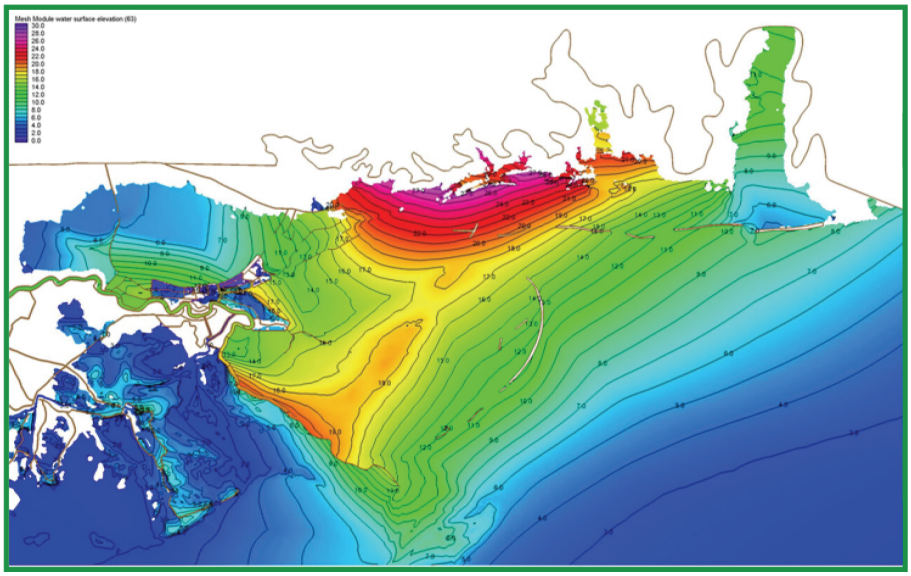
Benefits: By simulating tidal circulation and storm surge propagation over large computational domains, ADCIRC eliminates the need for imposing approximate open-water boundary conditions that can create inaccuracies in model results, while providing high resolution in areas of complex shoreline and bathymetry. Its predictive capabilities support activities to minimize dredging, maintain channel reliability, manage inlet and adjacent beach sediment, and predict navigation project performance. Its prediction of potential storm water levels is critical in the design of flood and storm damage reduction projects, protection of facilities and infrastructure, and to planning and evacuation procedures. ADCIRC is ideal for system-wide applications because resolution can be varied to reflect the fidelity of solution required in each area of the system.



Hurricane Katrina event modeled peak storm surge elevation in eastern Louisiana to Alabama (ft) relative to NGVD 29 (IPET Report 2)

Future Capabilities: Planned enhancements include modeling salinity, contaminant transport, 3-D sediment transport/morphology change in shallow water, additional sediment transport algorithms, and continued development of the mass conserving, Discontinuous Galerkin version of ADCIRC. New and improved linkages to morphology change, wave, and ecosystem models are planned.

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