REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
24-08-2018	NRL Publication	

4. TITLE AND SUBTITLE
Advanced Coastal Ocean Modeling

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
0602435N

6. AUTHOR(S)
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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER
73-6778-A6-5

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Research Laboratory
Oceanography Division
Stennis Space Center, MS 39529-5004

8. PERFORMING ORGANIZATION REPORT NUMBER
NRL/PU/7320--17-3682

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of Naval Research
One Liberty Center
875 North Randolph Street, Suite 1425
Arlington, VA 22203-1995

10. SPONSOR/MONITOR'S ACRONYM(S)
ONR

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The objectives are to develop and evaluate the capabilities of a finite element-based coastal ocean model applied to riverine environments. The high performance computing work undertaken in FYI 7 has focused on validation of the Advanced Circulation Model, ADCIRC, in its application as a forecast model for the Lower Pearl River Basin (LPRB), a braided river system.

15. SUBJECT TERMS
ocean modeling, ADCIRC,

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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Unclassified	Unclassified	Unclassified	UU	02	19b. TELEPHONE NUMBER *(Include area code)* (228) 688-5450

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CTA: CWO

Computer Resources: IBM iDataPlex [NAVY, MS]

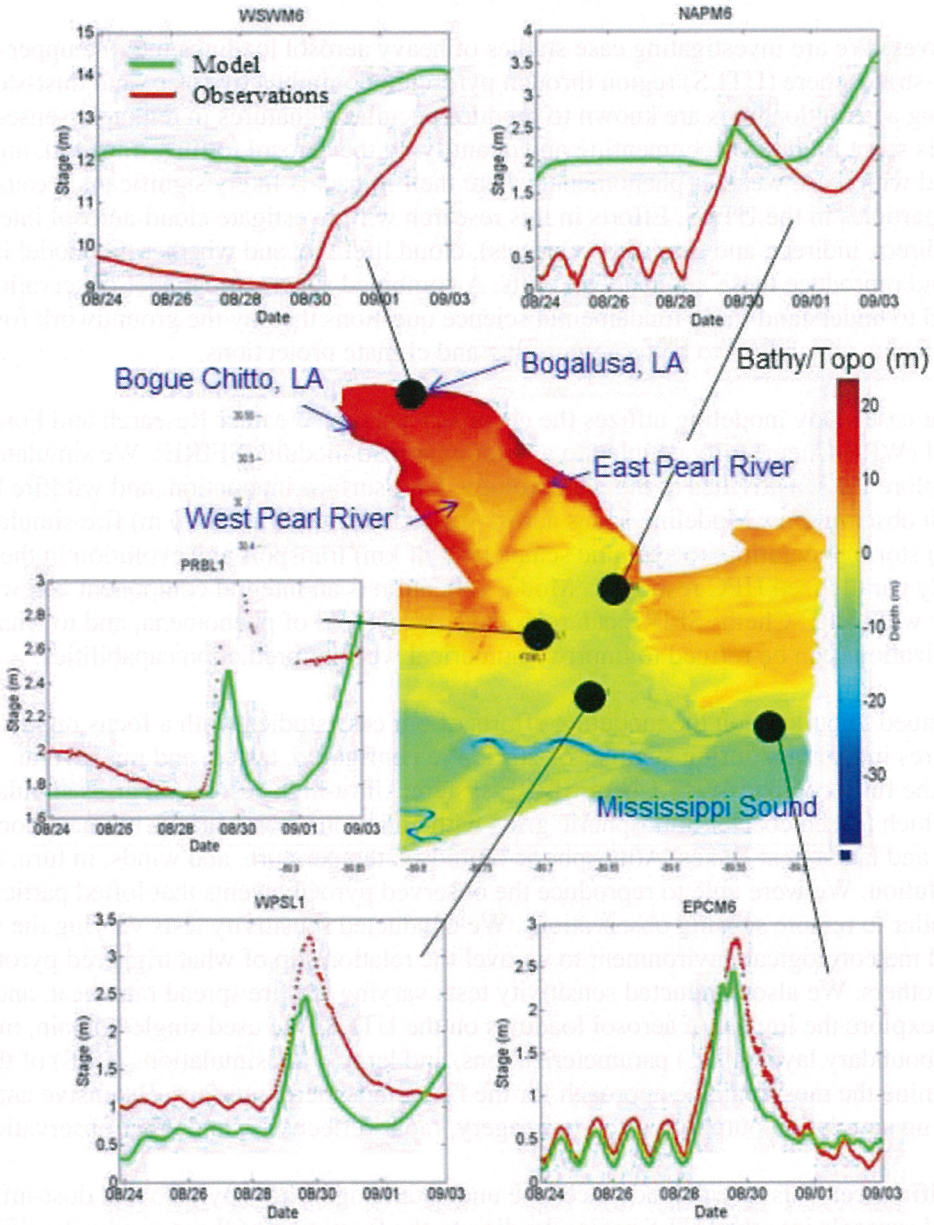
Research Objectives: The objectives are to develop and evaluate the capabilities of a finite element-based coastal ocean model applied to riverine environments. The high performance computing work undertaken in FY17 has focused on validation of the Advanced Circulation Model, ADCIRC, in its application as a forecast model for the Lower Pearl River Basin (LPRB), a braided river system.

Methodology: The ADCIRC model for the Lower Pearl River Basin represents the East and West Pearl Rivers, including its complex braided channels, and surrounding floodplain. The north-south extent of the domain spans from just downstream of Bogalusa, LA to a boundary just beyond the Mississippi Sound in the open waters of the Gulf of Mexico. The western extent of the domain allows for the incoming Bogue Chitto tributary. At the present time, the model does not include contributions from the East and West Hobolochitto tributaries originating in Mississippi. Spatial resolution ranges from 3 m to 1.4 km, with the highest resolution reserved for river channels; the mesh itself contains 422K nodes and 843K elements. The test case selected to evaluate the model comes from Hurricane Issac (August, 2012) conditions which brought both extreme rainfall and surge to the lower Pearl River Basin. NOAA's best available reanalysis h*Wind product was processed and applied to the Louisiana Coastal Protection and Restoration Authority surge and inundation mesh. LPRB offshore water level forcing is extracted from this large domain simulation of H. Isaac. Upstream hydrographs are processed from NOAA discharge station data at Bogalousa, LA, and Bogue Chitto, LA. Five hydrographic stations for which water level observations are available are used to evaluate the performance of the model at three temporal stages of the Hurricane Isaac event, pre-storm, peak-storm, and post-storm.

Results: Overall model-data comparisons (Fig. 1) indicate that error is minimal at station EPCM6 (CSX Railroad near Claiborne), near the outlet of the East Pearl River to the Mississippi Sound. The timing of peak surge is also well represented at all stations, including WSWM6 (Walkiah Bluff near Industrial MS), whose peak water levels on September 2 are largely a result of rainfall. Non-coincidentally, each of these stations lie along the East Pearl River where river depth values in the model agree well with available measurements. All modeled peak flood stages are within 0.5 m of the measured flood stage. However, prior to the storm, (i.e. Aug. 26), simulated water levels exhibit larger discrepancies along the West Pearl channel indicating that river depths in the model are not representing actual depths at the station locations. A transition plan is being developed for the LPRB model with transition partners: St. Tammany Parish, LA, NOAA NWS-Lower Mississippi River Forecast Center, and the targeted operational venue at the LSU Center for Coastal Resiliency, Coastal Emergency Risk Assessment office.

DoD Impact/Significance: An operational strategy of applying high resolution finite element coastal models to challenging river-floodplain environments results in the fine scale prediction of rivers, tides, currents and water elevation that impact coastal missions related to Special Warfare, Mine Warfare and amphibious operations. The technology developed is capable of high resolution water level predictions under extreme surge, tide and rainfall conditions and will be a targeted application for observations collected by NASA's Shallow Water Ocean Topography (SWOT) satellite mission.

Hurricane Isaac Simulation using the Lower Pearl River Basin Model



Water level comparisons during Hurricane Isaac, Aug. 24 – Sep 03, 2012 at 5 hydrograph locations.