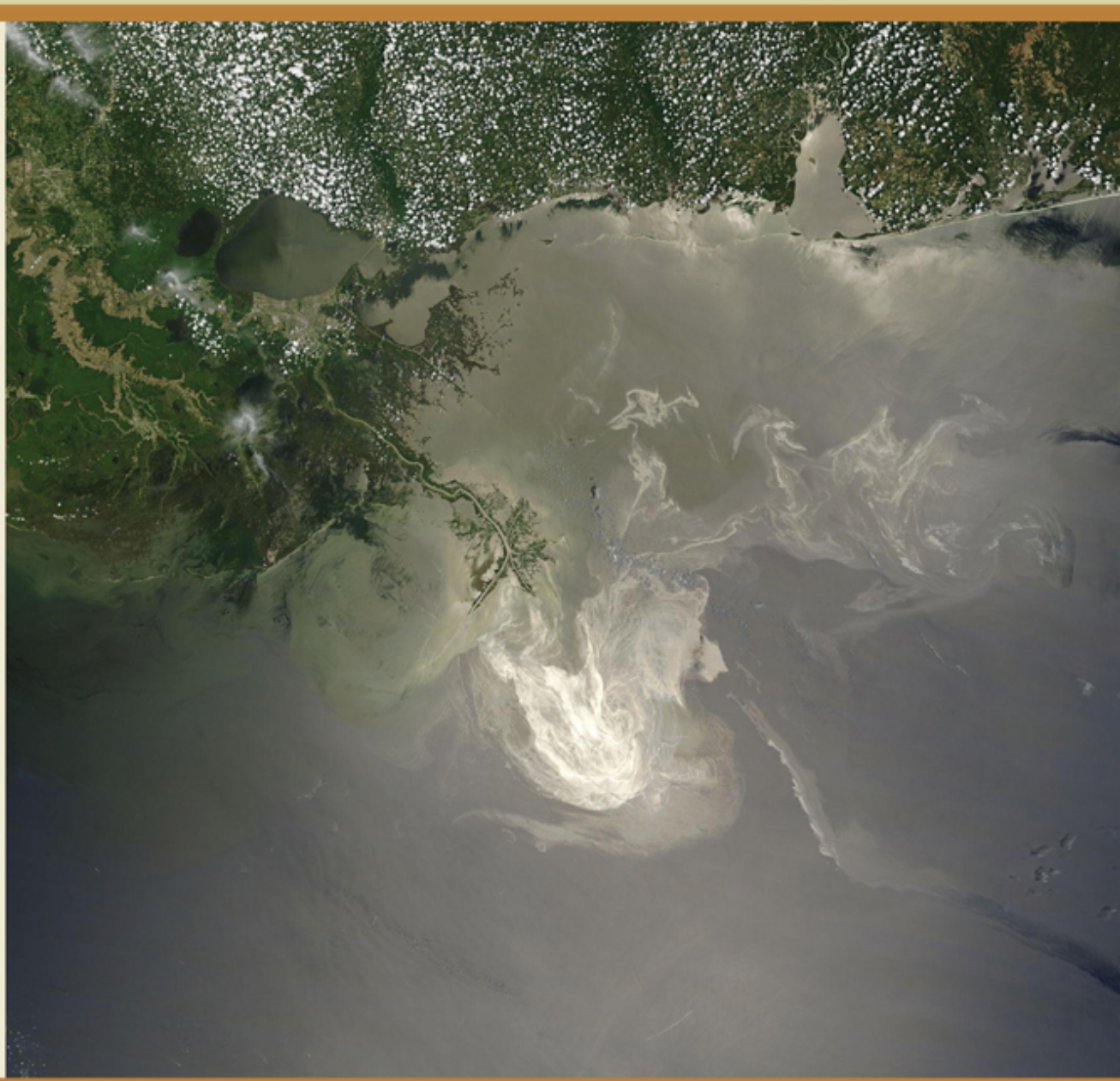
Estuarine and Coastal Modeling



Proceedings of the Twelfth International Conference

ASCE

Edited by
Malcolm L. Spaulding, Ph.D., P.E.

COPRI
COASTS, OCEANS, PORTS AND RIVERS INSTITUTE

ESTUARINE AND COASTAL MODELING

PROCEEDINGS OF THE TWELFTH INTERNATIONAL CONFERENCE

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Preface

This conference represents the 12 th in a biennial series to explore the development, testing, application, calibration, validation, and visualization of predictions from estuarine and coastal models. Application of models to problems in hydrodynamics, water quality, and sediment transport were presented. There were a substantial number of papers highlighting the advancement of modeling capabilities for storm surge and coastal inundation and now/forecasting. Attendance at the meeting was 120 and included representatives from both the US and many foreign countries. Participants were predominantly government and academic engineers and scientist, but also included a significant number of industry professionals.

As for the earlier conferences in the series, the goal of the present conference was to bring together a diverse group of model developers, users, and evaluators to exchange information on new directions in the field and the current state-of-the-art and practice in marine environmental modeling. The primary focus was on development of new models and the application of models to bays, sounds, lagoons, estuaries, embayments, bights, and coastal seas. The models were addressed at solving engineering and environmental impact assessment problems and also at better understanding circulation and pollutant transport in near shore waters. Model applications to address regulatory requirements for facility sighting and operation were also presented.

The conference included 20 oral sessions and 1 poster session, held over the two and one half day meeting period. Papers from both poster and oral sessions are included in the conference proceedings. Each paper in the proceedings was presented at the meeting, subjected to at least three external peer reviews, and accepted, if appropriate and after revision, by the proceedings editor.

The enthusiastic support and assistance of the Organizing and Advisory committees, whose names are listed below, are acknowledged. We welcome new Organizing Committee members Michael Piasecki and Nickitas Georgas and thank outgoing member Alan Blumberg. Rich Signell will be chairing ECM 13. Joseph Pittle, University of Rhode Island Conference and Special Programs Development Office, managed the conference and contributed greatly to its success. Thanks are also extended to the many other individuals who generously served as session chairs and reviewers.

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Nonlinear Tidal Dynamics in Florida Coastal Waters

Zizang Yang[1] and Richard Patchen[1]

Abstract

This study investigated the dynamics of nonlinear tidal constituents, i.e., compound and shallow-water (C&S) tides, in Florida coastal waters. We simulated barotropic tides and depth-averaged tidal currents using a high-resolution, two-dimensional version of the Advanced Circulation (ADCIRC –2DDI) model. The model domain includes both the eastern Gulf of Mexico and the South Atlantic Bight. The model grid consists of 353,718 nodes and 622,367 triangular elements, with spatial resolutions ranging from 16 m to 41 km.

We focused on analyzing two major compound tides M_4 and M_6 of M_2 and two shallow-water tides MS_4 and MK_3. For each tidal constituent, we derived co-tidal charts, co-range charts, and atlases of tidal current ellipses, energy fluxes, and dissipation rates.

We identified energy flux pathways of various C&S tides. We found that their energy fluxes follow different pathways than those of the astronomical constituents. The differences are attributed to differing genesis mechanisms. The astronomical tide originates from the deep-ocean equilibrium tide potential, while the C&S tides are predominantly generated in near-shore shallow waters due to nonlinear tidal interactions.

Nonlinear tidal interactions were most intense in near-shore areas of the eastern Straits of Florida, the Big Bend and Florida Bay along the west Florida coast, and Biscayne Bay along the east Florida coast. In these areas, C&S energies are generated nearly equally by two mechanisms: local nonlinear interactions and energy influxes from far fields. In addition, coastline geometry exerts appreciable influence on tidal energetics. For instance, in Florida Bay a funneling effect from the convergence of opposite shorelines overwhelms the damping effect of bottom friction and enhances the local tidal range.

This study provides insight into the nonlinear tidal dynamics and energetics of Florida coastal waters.

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