Coast to Cosmos Lecture Series

A Field and Numerical Modeling Study at New River Inlet, North Carolina

Jia-Lin Chen, Woods Hole Oceanographic Institute

Postdoctoral Investigator

Digital Media Center 1034
February 29, 2016 - 12:00 pm

Abstract:

Coastal inlet hydrodynamics are critical to ecosystems and many engineering applications such as coastal inundation, dredging, land reclamation, and scalar (e.g. pollutant, nutrient and sediment) transport. Due to complex interactions among tidal currents, waves, and bathymetry, highly variable flows (spatially and temporally) can be generated in a coastal inlet system. Understanding these nonlinear processes and the resulting morphological evolution can be challenging. In conjunction with a multi-institutional field experimental campaign, a numerical investigation on wave-current-bathymetry interactions at New River Inlet, NC, is carried out using the Nearshore Community Model (NearCoM) System. The wave model SWAN is coupled with a TVD-type scheme of circulation model SHORECIRC. When modeling many coastal processes with abrupt changes or discontinuities, such as tidal bore propagation, breaker zones, and moving shorelines, conventional finite-difference schemes may produce unphysical oscillations. The TVD type finite volume scheme allows for robust treatment of discontinuities through the shock capturing mechanism. The model is validated with observations of waves and currents at 30 locations, including in a recently dredged navigation channel and a shallower channel, and on the ebb tidal delta, for a range of flow and offshore wave conditions during May 2012. A comprehensive model skill assessment at various sections of the inlet system is presented for both significant wave height and circulation velocities. Model skills for flow velocity and wave height are high in the channels. The numerical model also captures the sharp transition between wave-dominated and tide-dominated flows near the ebb tidal deltas. Model results demonstrate that wave intensity plays an important role in circulation (vortex) generation near inlet entrances. The simulated nearshore circulation patterns are also validated to the study of the bottom boundary layer (BBL) parameterization using Automonous Underwater Vehicle (AUV) measurements.

Speaker's Bio:

Jia-Lin Chen's research has been focused on understanding the hydrodynamic and transport mechanism in estuaries and coasts. She is currently working on Coastal SEES and Hurricane Sandy Coastal Resiliency projects in Woods Hole Oceanographic Institute. She obtained her PhD degree in Civil and Environmental Engineering from University of Delaware in 2014. Before moving to US, she obtained her Master degree from the European Joint Master Program, Hydroinformatic and Water Management in 2007, and practiced as a modeling engineer/project manager in DHI China and Singapore for two years.

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957