Coast to Cosmos Lecture Series

Simulations of Coastal and Estuarine Circulations Using Finite-Volume Coastal Ocean Model (FVCOM)

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Digital Media Center 1034
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Abstract:

FVCOM is a prognostic, unstructured-grid, finite-volume, free-surface, 3-D coastal ocean circulation model. It solves the governing equations in integral form by computing fluxes between non-overlapping horizontal triangular control volumes. A sigma coordinate is used in the vertical to follow bottom topography. This numerical approach provides a better representation of mass, momentum, salt, and heat conservation. The conservative nature plus its great grid flexibility make FVCOM ideally suited for interdisciplinary application in the coastal ocean.

In this presentation three idealized validation experiments with known analytic solutions are used to assess FVCOM simulation accuracy. Applications of FVCOM to conduct physical and coupled physical-biological studies in coastal oceans, bays, and estuaries are reported using examples from Corpus Christi Bay (Texas), Bayou Boeuf (Louisiana), and Breton Sound Estuary (Louisiana). It is shown that FVCOM is capable of simulating wind-, tidal-, and buoyancy-driven circulations with satisfactory outcomes. Material transport trajectory and residence time can also be estimated by employing the Lagrangian particle tracking module in FVCOM. A case study is presented in which FVCOM is coupled with a fish movement model to study the impact of pulsed re-introduction of Mississippi River freshwater into the deltaic plain on displacement and salinity stress of commercially and recreationally important fish species.

Speaker's Bio:

Haosheng Huang is an associate professor in the Department of Oceanography and Coastal Sciences, Louisiana State University. He received his B.S. degree in Applied Mechanics from Fudan University, a M.S. in Physical Oceanography from First Institute of Oceanography, and a Ph.D. in Physical Oceanography from Florida State University.

Dr. Huang's research focuses on the development and application of computer models for the study of coastal hydrodynamics, regional physical oceanography, wave-current interaction, estuarine circulation, and physical-biogeochemical interaction. He has participated in the development of the unstructured grid, finite-volume coastal ocean model (FVCOM), specifically in model validation case study, addition of new open boundary condition, and development of spherical coordinate FVCOM. He has developed a FVCOM hydrodynamic model in the Breton Sound Estuary and coupled it to an individual-based model for fish behavioral movement to study the impact of physical processes on fish spatial displacement and salinity stress. He is now working on applying FVCOM to simulate hydrodynamics and wave dynamics, and their impacts on sediment erosion, transportation, and deposition in various coastal restoration projects along the Louisiana-Texas continental shelf, the Mississippi River Delta, and many Louisiana coastal estuaries and bays. He has been participating in several GoMRI funded oil spill impact research initiatives.

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