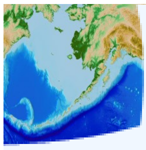

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Presented By:

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Environmental Engineering

Seminar Series

Friday, October 20, 2017

McDonnell Douglas Engineering Auditorium (MDEA)

1:30PM to 2:30PM

The Nonhydrostatic General Curvilinear Coastal Ocean Model (GCCOM) and its Coupling with a Data Assimilation Framework

One of the challenges in the simulation of coastal ocean dynamics is the vast range of length and time scales present. While global- and basin-scale processes and currents can be captured quite well with computationally-inexpensive hydrostatic models, smaller-scale features such as shoaling nonlinear internal waves and bores, coastal fronts, and other convective processes require the use of a nonhydrostatic model to capture dynamics accurately. In this talk we introduce the nonhydrostatic capabilities of the General Curvilinear Coastal Ocean Model (GCCOM) in a stratified environment. GCCOM is a three-dimensional, nonhydrostatic Large Eddy Simulation (LES) model that can run in a fully three-dimensional general curvilinear coordinate system. While this model was validated for unstratified flows, we present on recent advances of the model to simulate stratified flows. In particular, a suite of test cases widely used as benchmarks for assessing the nonhydrostatic capabilities for gravity -driven flows: the classic lock release and gravity current experiment and internal seiche in a flat bottom tank. These validation experiments demonstrate that GCCOM can resolve complex nonhydrostatic phenomena in stratified flows with numerical accuracy and mass and energy conservation. The second part of the talk presents the integration of a data assimilation framework for GCCOM with the aim to study of sub-mesoscale processes. When provided with the proper data, mesoscale phenomena have been modeled with a certain level of accuracy; however, many sub-mesoscale features are still poorly modeled, causing them to remain largely unpredictable. 3D nonhydrostatic models are required to accurately capture these key dynamics. Although this implementation is essential for the successful development of physical ocean models, a major challenge posed by this approach is the high computational cost incurred by high-resolution numerical models with three-dimensional data assimilation schemes within complicated, stratified systems. However, by interfacing GCCOM with NCAR's Data Assimilation Research Testbed (DART), we enable GCCOM to integrate observations into its system. This research included observation system simulation experiments (OSSEs) for test cases using very steep seamounts. Results demonstrated that the DART-GCCOM model can assimilate high-resolution observations using as few as 30 ensemble members .

Mariangel Garcia Ph.D. is a Research Associate at the Computational Science Research Center and the Project Manager of the Coastal Ocean Dynamics Group at San Diego State University. Her concentration is Data Assimilation in Ocean Modeling. Her focus is on simulating coastal hydrodynamics; applications include Tsunamis Simulation and Oil Spill tracking. Mariangel has studies on ENSO Index using spatial statistic analysis and Data Mining techniques and experience working in oil industry, research centers, teaching and conducting multidisciplinary groups. The results of her research were acknowledged with awards in 2015: The Dean's Award for Research, College of Sciences for Best Oral Presentation and the ACSESS Industry Award for Best Poster Presentation in 2012.