Other - CCT Coastal Faculty Candidate

Modeling Oceanic Flows Using Reynolds Averaged Navier-Stokes Model and Large Eddy Simulation Model

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Abstract:

Oceanic flows span a range of scales, with coastal to basin-scale circulations at hundreds to thousands of kilometers scale and the energetic turbulent motions in oceanic boundary layer at meter scale. Simultaneously resolving all those scales in an ocean model is formidable currently and in the near future. Two different types of models, the Reynolds-averaged Navier-Stokes (RANS) model and the large eddy simulation (LES) model, are used respectively for those two types of flows at distinctly different scales. In this talk, I will first present a 26-year hindcast solution (1981 to 2006) of the circulation and ecosystem in the California upwelling system using a RANS-type ocean model -- the regional ocean modeling system (ROMS). I will focus on the evolution of coastal productivity, phytoplankton species, oxygen contents and acidity during that period under a warming climate. I will also present studies on wave-driven boundary layer turbulence and gas bubbles using an LES model for the oceanic boundary layer, and will demonstrate that parameterizations for vertical mixing and air-sea gas flux derived from LES solutions are crucial for the accuracy of RANS-type models. Finally, I will briefly discuss the possible applications and generalization of the two modeling frameworks to study other important marine and coastal processes.

Speaker's Bio:

Liang received a B.Sc. in Engineering Mechanics from Sun Yat-sen University in 2004, an M.Phil. in Civil Engineering from the Hong Kong University of Science and Technology in 2006, and a Ph.D. in Atmospheric and Oceanic Sciences from the University of California, Los Angeles in 2011. He is currently a postdoctoral research associate at the University of Washington.

Liang studies oceanic physical and biogeochemical processes by combining numerical simulations and observations. He has active research efforts in air-sea gas exchange, boundary layer turbulence, marine particles, and eastern boundary upwelling systems. The objective of his research is to better predict future changes in marine environment under a changing climate.

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