JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

Weekly CEAFM Seminar: Fall 2013

Date: **Friday, October 4, 2013**

Time: 11:00 AM

Location: Gilman 50 (Marjorie M. Fisher Room)

Speaker: **DR. TIAN-JIAN HSU** (University of Delaware)

Title: ***"WAVE-BREAKING-INDUCED TURBULENT COHERENT STRUCTURES AND THEIR INTERACTION WITH THE BED – A 3D NUMERICAL INVESTIGATION"***

Abstract

To better understand the effect of wave-breaking-induced turbulence on sand transport in the nearshore, a 3D Large-Eddy Simulation (LES) study has been carried out. Using a turbulence-resolving approach, our specific objective is to investigate how wave-breaking-induced turbulent coherent structures, known as the obliquely descending eddies (ODEs), may interact with the bed and enhances suspended sediment transport. The numerical model is implemented using an open-source CFD library of solvers, called OpenFOAM, where the incompressible 3D filtered Navier-Stokes equations for the water and the air phases are solved with a finite volume scheme. The evolution of the water-air interfaces are approximated with a volume of fluid method. Using the dynamic Smagorinsky closure, the numerical model has been validate with wave flume experiments of solitary wave breaking over a 1/50 sloping beach (Ting 2006, Coastal Eng., 53, 441-462). The generation and evolution of turbulent coherent structures are shown to be similar to the measured data. More importantly, simulation results show that many turbulent coherent structures are sufficiently intense to reach the bed and enhance the bottom stress by as much as a factor of two. The numerical model has recently been extended with a suspended load module and the numerical simulations are extended to study periodic wave breaking over a slope. Hence, the role of ODEs in determining the direction and amount of suspended sand transport under different breaker types will be investigated in the near future.