Special Program in Applied Mathematics and Applied Mechanics

Understanding critical fine sediment transport mechanisms in sediment source to sink – A turbulence-resolving numerical study

2015 - 03 - 31 (Tue.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

One of the most intriguing issues in fine sediment (mud) transport, including turbidity currents, wave-current driven resuspension, is that the presence of sediments may significantly attenuate flow turbulence. Depending on the level of turbulence suppression, it may lead to the formation of lutocline (a sharp negative gradient of sediment concentration) which further encourages offshore directed gravity flow; or it may cause catastrophic collapse of turbulence and deposition. These are critical controls of the resuspension stage of sediment source to sink. Due to very small Stokes number associated with fine sediment, equilibrium approximation is used to simplify the Eulerian two-phase flow equations. Through idealized turbulence-resolving simulations with fine sediment load prescribed in the domain, our recent studies reveal that the transition of these flow modes also exist in the wave bottom boundary layer. This talk further reports our most recent investigation on how the resuspension/deposition mechanisms, specifically the critical shear stress of erosion can dictate the transport mode. Another crucial mechanism in sediment source to sink is the initial deposition, which is dictated by the effective settling rate and river plume processes. Toward the end of the talk, the speaker will also discuss ongoing study to simulate field scale river plume using a non-hydrostatic coastal modeling system.


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