# 2012 Special Program in Applied Mathematics and Applied Mechanics

*The dynamics of sediment-laden river outflow on sloping continental shelves*

2012 - 06 - 05 (Tue.)
15:00 - 17:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

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A 3D hydrodynamic model (ROMS) is used to investigate the structure and transport of sediment-laden river outflow across continental shelves. The idealized model consists of a narrow river channel connecting to a constant sloping shelf sea. The configuration is similar to the bathymetric profiles of systems like the Eel River (USA) and Chuoshui River (Taiwan). 3-day flood events with a peak river velocity of 2-4 m/s are simulated, and the riverine sediment concentration of 60 (g/l) is chosen so that the density of sediment-freshwater mixture is denser than the receiving seawater. Shelf slope is varied between 0.001-0.03. For the various slopes considered, it is found that the location of the plunging point is well described by a critical Froude number condition. Seaward of the plunging point, the river outflow dives and moves offshore as an undercurrent. Two flow regimes, which were identified in laboratory experiments, are confirmed at field scales: When the bottom slope is below a critical value, the Reynolds stress generated by the undercurrent is not enough to overcome the sediment settling. The plume loses buoyancy forcing, leading to flow deceleration and sediment deposition (i.e. decelerating regime); In contrast, when the critical slope is reached, the buoyancy forcing is maintained. The undercurrent is self-sustainable and no deposition occurs (autosuspending regime). A simple theory is proposed to estimate the critical slope. Within the decelerating regime, the cross-shelf penetration of the plume is found to scale with advective distance.