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Numerical Investigations of Turbidity Currents

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Turbidity currents are particle-laden, geophysical flows driven by gravity. Within the global sediment cycle, they represent the primary mechanism by which sediment is transported from the continental shelves into the deep ocean, with transport distances ranging up to O(1,000) km. They furthermore influence the formation of an important class of hydrocarbon reservoirs. As turbidity currents propagate along the sea floor, they can trigger the formation of a variety of topographical features through the processes of deposition and erosion, such as channels, levees and sediment waves. The talk will review high-resolution, two- and three-dimensional Navier-Stokes simulations of turbidity currents, along with related linear instability mechanisms, that have advanced our understanding of these phenomena. For the mathematical description, we assume that the particles have negligible inertia and are much smaller than the smallest length scales of the buoyancy-induced fluid motion. Under these conditions, we can employ an Eulerian approach for the description of the particulate phase. Results will be shown regarding the unsteady interaction of turbidity currents with channels, pipelines and local seamounts. We will also address currents in stratified ambient, as well as reversing buoyancy currents.