DNS of axisymmetric density currents using the equilibrium Eulerian formulation

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Here we consider large-scale high-resolution simulations of density currents generated by a cylindrical region of fluid at a higher density spreading along a rigid bottom into surrounding ambient fluid of lower density. In cases where the density difference is due to differential temperature or salinity the key controlling parameter is the Grashof number. In particle-driven gravity currents the flow is further influenced by particle Stokes number and nondimensional settling velocity. We use the equilibrium Eulerian formalism to follow the particle concentration and fully account for the back effect of particulate phase on the surrounding fluid. We systematically vary the parameters to investigate their influence on key features of the flow such as front velocity, lobe and cleft instability, wall shear stress and sedimentation rate. By comparing the results against the corresponding planar case we illustrate the effect of geometry on density currents.