Building a High Fidelity Model for Turbidity Currents

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Numerical models can help to push forward the knowledge about complex dynamic physical systems. The modern approach for doing that involves detailed high-fidelity mathematical models. Turbidity currents are a kind of particle-laden flows that are a very complex natural phenomenon. In a simple way, they are turbulent driven flows generated between fluids with small density differences carrying particles. They also are one mechanism responsible for the deposition of sediments on the seabed. A detailed understanding of this phenomenon, including uncertainties, may offer new insight to help geologists to understand reservoirs formation, a strategic knowledge in oil exploration. We present a finite element Residual-based Variational Multiscale formulation applied to the numerical simulation of particle-laden flows in a Eulerian-Eulerian framework. Thus, the mathematical model results from the incompressible Navier-Stokes equation combined with an advection-diffusion transport equation. When sediment concentrations are high enough, rheological empirical laws close the model, describing how sediment concentration influence the mixture viscosity. The aim of this work is to investigate the effects on the flow dynamics of some of these empirical laws.