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LARGE EDDY SIMULATION OF LOCK-EXCHANGE GRAVITY CURRENTS

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Summary. Gravity currents have been studied numerically by many researchers. Despite the accomplishments achieved in those studies, most of them have incorporated the RANS methods, which are essentially unable to see the fine characters of the turbulence field. In the current work we are using the LES scheme (which is inherently more accurate and also more costly) to continue and improve the study of such flows. Use of the LES method gives us the instantaneous velocity fields, velocity correlations of any order and other such turbulence quantities which aren't available in the RANS methods. Gravity currents in a lock-exchange configuration, moving in an straight channel are studied using the large eddy simulation technique. A code is developed for the simulation. The "Cubic root of the volume" delta has been used for filtering and the smaller eddies have been modeled using the Smagorinsky sub-grid scale model. The Van Driest damping function has been used for the near wall simulations, although the first grid point lies well under the $y^+=1$ point. Also the density differences have been considered small enough to use the Boussinesq approximation for the buoyancy term in momentum equation. The accuracy of the code has been tested against the data of other researchers' works. This is done by the comparison of the code results we other LES, RANS and experimental results. The code has been run under the parallel configuration, using the MPI method. Incorporating the mentioned method, the structure of the turbulence has been studied. The evolution of the flow quantities such as the front position, the energy content and the near-wall turbulence structure with time is investigated and the creation of a nearly steady flow has been studied. The effect of the side boundaries and the way that they can lead to 2-D or 3-D current is also investigated. A superior aspect of the current study is that it uses an efficient choice of the parameters and the grid; so it has a much less computational cost relative to the other such LES studied, considering the fact that it also verifies their results both qualitatively and quantitatively.