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Turbulent structures on gravity currents fronts MARIANO CANTERO, University of Illinois, S. BALACHANDAR, University of Florida, MARCELO GARCIA, University of Illinois — Gravity currents are flows driven by horizontal pressure gradients generated due to the action of gravity over two fluids with density difference. This work presents highly resolved simulations of planar and cylindrical gravity currents for Reynolds numbers ranging from about 1000 to about 10000. Soon after release the interface between light and heavy fluids rolls up forming Kelvin-Helmholtz vortices. This process continues only during the slumping and inertial phases. The coherent Kelvin-Helmholtz vortices undergo spanwise or azimuthal instabilities and eventually breakdown into small scale turbulence. In the case of planar currents this turbulent region extends over the entire body of the current and it is populated with hairpin vortices. Also during the early stage of the flow development, incipient lobes and clefts start to form at the lower frontal region. These instabilities grow in size and extend to the upper part of the front. Lobes and clefts continuously merge and split and, thus result in a complex pattern that dynamically evolves. In this work we show the relation between the flow structures mentioned above and the local flow patterns and bottom shear stress patterns. For the case of the cylindrical current, laboratory experiments have been performed at the higher Reynolds numbers and the results have been compared to the simulation results. The agreement between numerical results and experimental observations is good.

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