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Turbulent structures and vortex dynamics on gravity currents MARIANO CANTERO, University of Illinois at Urbana-Champaign / University of Florida, S. BALACHANDAR, University of Florida, GARY PARKER, MARCELO GARCIA, University of Illinois at Urbana-Champaign — Highly resolved three-dimensional simulations are presented for planar and cylindrical gravity currents. The Navier-Stoke equations are solved for Reynolds numbers $Re = 15000$ and $Re = 8950$ with 131 and 1340 millions grid-point resolution for the planar and cylindrical cases, respectively. The work is oriented to visualize and describe the turbulence structures present in the flow. The near-front region is composed of a boundary layer at the bottom and a shear layer at the top. The shear layer undergoes instabilities and the formation of Kelvin-Helmholtz vortices which decay to smaller scale turbulence populating the rear part of the front of the current with hairpin vortices oriented in the direction opposite to the flow. On the other hand, the near-bottom boundary-layer-like region is populated with hairpin vortices oriented in the direction of the flow. The body of the current is characterized by the interaction of these turbulent structures. The decay of Kelvin-Helmholtz vortices and their complex dynamics induce large pressure recovery by homogenization of the flow which modifies substantially the front velocity, which shows the importance of three-dimensional effect on the spreading rate.

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