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Statistics of Vortical Structures in Variable-Density Turbulent Mixing Layers JON BALTZER, DANIEL LIVESCU, Los Alamos National Laboratory — Direct Numerical Simulations are performed of temporal incompressible shear-driven planar mixing layers between two miscible streams of fluids with different densities. The simulations begin from thin disturbed interfaces and develop into self-similar states. We use very large domain sizes, corresponding to grids of up to 6144 x 2048 x 1536 points, to produce high-quality statistics and allow natural growth of turbulent structures. A wide range of Atwood numbers are explored, ranging from nearly constant density to A=0.87 (or a density ratio of 14). At high Atwood numbers, a variety of statistics show that variable-density effects produce significant asymmetries. Here we focus on the differences in vortical structure of the light and heavy fluid streams and the importance of non-Boussinesq effects as Atwood number increases. Detailed budgets of vorticity moments are examined in conjunction with the alignments of vorticity relative to other flow quantities. The results display the variable density effects due to compositional variations, a distinctly different mechanism from the density variations associated with compressibility in high-speed flows.

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