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On the viscosity stratification in temporal mixing layer[1] LUMINITA DANAILA, NOUREDDINE TAGUELMIMT, ABDELLAH HADJADJ, CORIA UMR6614, University of Rouen & INSA Rouen, TURBULENCE TEAM —
We assess the effects of viscosity variations in low-speed temporally-evolving turbulent mixing layer. The two streams are density-matched, but the slow fluid is Rv times more viscous than the rapid stream. Direct Numerical Simulations (DNS) are performed for several viscosity ratios, Rv varying between 1 and 9. The space-time evolution of Variable-Viscosity Flow (VVF) is compared with that of the Constant-Viscosity Flow (CVF). The velocity fluctuations occur earlier and are more enhanced for VVF. In particular, the kinetic energy peaks earlier and is up to three times larger for VVF than for CVF at the earliest stages of the flow. Over the first stages of the flow, the temporal growth rate of the fluctuations kinetic energy is exponential, in full agreement with linear stability theory. The transport equation for the fluctuations kinetic energy is favourably compared with simulations data. The enhanced kinetic energy for VVF is mainly due to an increased production at the interface between the two fluids, in tight correlation with enlarged values of mean velocity gradient at the inflection point of the mean velocity profile. The transport equations of the one-and two-point kinetic energy show that self-preservation cannot be complete in variable-viscosity flows.

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