Compressibility effects on Rayleigh-Taylor turbulence

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This paper considers the turbulent stage of the Rayleigh-Taylor problem formed by two compressible miscible fluids. It is shown that the turbulent Mach number, the relevant parameter in the description of intrinsic compressibility effects in the turbulent stage, is limited independently of the density jump at the interface. This upper bound is found to be somewhere between 0.25 and 0.5 depending on the initial mean configuration for the case of an ideal gas, suggesting therefore that intrinsic compressibility effects in that turbulent stage may be relatively small. Large-eddy simulations indeed confirm that the flow is not significantly affected by intrinsic compressibility, and, consequently, key features such as the quadratic time evolution of the mixing depth, the anisotropy of the Reynolds stresses and the mixing parameters compare well with those observed in the incompressible cases reported in the literature.