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Compressibility effects on turbulent mixing[1] JOHN PANICKACHERIL JOHN, DIEGO DONZIS, Texas A&M University — We investigate the effect of compressibility on passive scalar mixing in isotropic turbulence with a focus on the fundamental mechanisms that are responsible for such effects using a large Direct Numerical Simulation (DNS) database. The database includes simulations with Taylor Reynolds number (R_λ) up to 100, turbulent Mach number (M_t) between 0.1 and 0.6 and Schmidt number (Sc) from 0.5 to 1.0. We present several measures of mixing efficiency on different canonical flows to robustly identify compressibility effects. We found that, like shear layers, mixing is reduced as Mach number increases. However, data also reveal a non-monotonic trend with M_t. To assess directly the effect of dilatational motions we also present results with both dilatational and soleniodal forcing. Analysis suggests that a small fraction of dilatational forcing decreases mixing time at higher M_t. Scalar spectra collapse when normalized by Batchelor variables which suggests that a compressive mechanism similar to Batchelor mixing in incompressible flows might be responsible for better mixing at high M_t and with dilatational forcing compared to pure solenoidal mixing. We also present results on scalar budgets, in particular on production and dissipation.

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