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Exit-time statistics and the inference of Richardson scaling in numerical simulations of turbulent dispersion.[1] J.F. HACKL, Georgia Tech, B.L. SAWFORD, Monash Univ., P.K. YEUNG, Georgia Tech — Unambiguous observation of Richardson inertial-range behavior for particle-pair dispersion and the associated scaling constant (g) in turbulence is often difficult in both experiment and computation, because of limitations in Reynolds number, effects of initial separation, and other factors. The concept of exit-time (time taken for the distance l between two fluid particles to increase by a prescribed factor) has attracted recent interest in dispersion statistics viewed as functions of instantaneous length scale instead of time of travel. We consider both mean-squared dispersion and mean exit time, obtained from direct numerical simulations of forced isotropic turbulence up to Taylor-scale Reynolds numbers of about 650 on a 2048^3 grid. Moments of exit time at fixed thresholds of particle pair separation are computed, and estimates of g are inferred by assuming that the probability density function of l follow self-similar forms such as that predicted by Richardson (1926). Subject to uncertainties due to temporal variability of space-averaged dissipation rate in the simulations, the present analyses suggest a trend towards g in the range 0.4–0.6. However, high-Reynolds-number simulations longer than recently reported in the literature are needed.

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