



Reduction of mean-square advection in turbulent passive scalar mixing

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Direct numerical simulation data show that the variance of the coupling term in passive scalar advection by a random velocity field is smaller than it would be if the velocity and scalar fields were statistically independent. This effect is analogous to the "depression of nonlinearity" in hydrodynamic turbulence. We show that the trends observed in the numerical data are qualitatively consistent with the predictions of closure theories related to Kraichnan's direct interaction approximation. The phenomenon is demonstrated over a range of Prandtl numbers. In the inertial-convective range the depletion is approximately constant with respect to wavenumber. The effect is weaker in the Batchelor range.

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