Abstract Submitted
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Stochastic shell mixing model for scalars in homogeneous turbulence YANJUN XIA, LANCE COLLINS, Cornell — We present a stochastic shell mixing model (SSMM) based on the eddy damped quasi-normal Markovian (EDQNM) theory to study turbulent mixing of scalars. The formulation combines the strengths of spectral model and the probability density function (PDF) method. The model advances the scalar concentration of notional particles that is distributed across spectral shells using a Monte Carlo algorithm. The variance of the concentration within each shell reproduces the scalar spectrum at the corresponding wavenumber, and the sum of the concentrations over the shell for each particle provides the fine-grained joint PDF. Monte Carlo schemes in general have difficult satisfying the bounds imposed on the scalar by the initial and boundary conditions. We present a special procedure for keeping the particle concentrations within the bounds. Due to the inherent full description of length and time scales, the SSMM model is capable of capturing the dependence of mixing on the molecular diffusivity, and hence the effects of differential diffusion. Results are compared with direct numerical simulations (DNS) and are in good agreement.

Lance Collins
Cornell

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