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Statistical Modeling of Turbulent Dispersion using a Near-Neighbor Implementation of a Local Mixing Model

SHARADHA VISWANATHAN, STEPHEN B. POPE, Cornell University — Probability density function (PDF) calculations are reported for the dispersion from line sources in isotropic turbulence. These flows pose a significant challenge to statistical models, because the scalar length scale (of the initial plume) is much smaller than the turbulence integral scale. The PDF calculations are based on a new near-neighbor implementation of the interaction by exchange with the conditional mean (IECM) mixing model. The calculations are compared to the experimental data of Warhaft (1984) on single and pairs of line sources, and with the previous calculations of Sawford (2004). This establishes the accuracy of the new implementation of IECM. An array of line sources is also considered with comparison to the experimental data of Warhaft & Lumley (1978), which show the dependence of the scalar variance decay rate on the array spacing relative to the turbulence integral scale. The near-neighbor implementation is applicable to other local mixing models, as arise, for example, in multiple mapping conditioning (Klimenko & Pope 2003). In the particle method used to solve the modeled PDF equation, the near-neighbor implementation results in a particle's mixing with just one or two near neighbors (in the relevant space), and hence maximizes the localness of mixing.

[X] Prefer Oral Session
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