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Effects of numerical dissipation and unphysical excursions on scalar-mixing estimates in large-eddy simulations NEK SHARAN, Graduate Aerospace Laboratories, California Institute of Technology, GEORGIOS MATHEOU, University of Connecticut, PAUL DIMOTAKIS, Graduate Aerospace Laboratories and Applied Physics, California Institute of Technology — Artificial numerical dissipation decreases dispersive oscillations and can play a key role in mitigating unphysical scalar excursions in large eddy simulations (LES). Its influence on scalar mixing can be assessed through the resolved-scale scalar, $\bar{Z}$, its probability density function (PDF), variance, spectra, and the budget of the horizontally averaged equation for $\bar{Z}^2$. LES of incompressible temporally evolving shear flow enabled us to study the influence of numerical dissipation on unphysical scalar excursions and mixing estimates. Flows with different mixing behavior, with both marching and non-marching scalar PDFs, are studied. Scalar fields for each flow are compared for different grid resolutions and numerical scalar-convection term schemes. As expected, increasing numerical dissipation enhances scalar mixing in the development stage of shear flow characterized by organized large-scale pairings with a non-marching PDF, but has little influence in the self-similar stage of flows with marching PDFs. Flow parameters and regimes sensitive to numerical dissipation help identify approaches to mitigate unphysical excursions while minimizing dissipation.

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