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Impact of numerical errors on the turbulent mixing of high Schmidt number passive scalars YUAN XUAN, SIDDHARTHA VERMA, GUILLAUME BLANQUART, California Institute of Technology — Numerical errors associated with scalar transport schemes can affect significantly the mixing of high Schmidt number passive scalars. In this work, we present an analysis of the impact of these errors on the scalar transport characteristics in homogeneous isotropic turbulence and turbulent mixing layers. These two configurations are selected as representatives of different regions of a reacting turbulent jet. We evaluate scalar energy and dissipation spectra, as well as the probability density functions of the scalar and its dissipation rate. This analysis is performed at various grid resolutions, using several different Eulerian and Semi-Lagrangian transport schemes. The results are used to establish the accuracy of these schemes in capturing and preserving the small-scale turbulent structures. It is shown that Eulerian schemes require comparatively higher grid resolution to produce results independent of the mesh size. Conversely, semi-Lagrangian schemes are capable of achieving comparable accuracy at lower grid resolutions, resulting in significant reductions in computational cost. We use the results to propose grid resolution criteria to ensure scheme independent results for high Schmidt number scalar transport in homogeneous isotropic turbulence and turbulent mixing layers.

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