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Velocity-Resolved LES (VR-LES) technique for simulating turbulent transport of high Schmidt number passive scalars SIDDHARTHA VERMA, GUILLAUME BLANQUART, California Institute of Technology, P.K. YEUNG COLLABORATION — Accurate simulation of high Schmidt number scalar transport in turbulent flows is essential to studying pollutant dispersion, weather, and several oceanic phenomena. Batchelor's theory governs scalar transport in such flows, but requires further validation at high Schmidt and high Reynolds numbers. To this end, we use a new approach with the velocity field fully resolved, but the scalar field only partially resolved. The grid used is fine enough to resolve scales up to the viscous-convective subrange where the decaying slope of the scalar spectrum becomes constant. This places the cutoff wavenumber between the Kolmogorov scale and the Batchelor scale. The subgrid scale terms, which affect transport at the supergrid scales, are modeled under the assumption that velocity fluctuations are negligible beyond this cutoff wavenumber. To ascertain the validity of this technique, we performed a-priori testing on existing DNS data. This Velocity-Resolved LES (VR-LES) technique significantly reduces the computational cost of turbulent simulations of high Schmidt number scalars, and yet provides valuable information of the scalar spectrum in the viscous-convective subrange.

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