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A minimum dissipation scalar transport model for large-eddy simulation of turbulent flows MAHDI ABKAR, HYUN J. BAE, PARVIZ MOIN, Center for Turbulence Research, Stanford University, Stanford, California 94305, USA — Minimum-dissipation models are a simple alternative to the Smagorinsky-type approaches to parameterize the sub-filter scale turbulent fluxes in large-eddy simulation. A recently derived minimum-dissipation model for sub-filter stress tensor is the AMD model (Rozema et al., Phys. Fluids, 2015) and has many desirable properties. It is more cost effective than the dynamic Smagorinsky model, it appropriately switches off in laminar and transitional flows, and it is consistent with the theoretic sub-filter stress tensor on both isotropic and anisotropic grids. In this study, an extension of this approach to modeling the sub-filter scalar flux is proposed. The performance of the AMD model is tested in the simulation of a high Reynolds number, rough wall, boundary layer flow with a constant and uniform surface scalar flux. The simulation results obtained from the AMD model show good agreement with well-established empirical correlations and theoretical predictions of the resolved flow statistics. In particular, the AMD model is capable to accurately predict the expected surface-layer similarity profiles and power spectra for both velocity and scalar concentration.

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