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Predicting viscous-range velocity gradient dynamics in large-eddy simulations of turbulence[1] PERRY JOHNSON, CHARLES MENEVEAU, Johns Hopkins University — The details of small-scale turbulence are not directly accessible in large-eddy simulations (LES), posing a modeling challenge because many important micro-physical processes depend strongly on the dynamics of turbulence in the viscous range. Here, we introduce a method for coupling existing stochastic models for the Lagrangian evolution of the velocity gradient tensor with LES to simulate unresolved dynamics. The proposed approach is implemented in LES of turbulent channel flow and detailed comparisons with DNS are carried out. An application to modeling the fate of deformable, small (sub-Kolmogorov) droplets at negligible Stokes number and low volume fraction with one-way coupling is carried out. These results illustrate the ability of the proposed model to predict the influence of small scale turbulence on droplet micro-physics in the context of LES.

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